



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Smart Buildings Systems [S1Eltech2>PO6-SSB]

### Course

Field of study

Electrical Engineering

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

elective

### Number of hours

Lecture

15

Laboratory classes

30

Other

0

Tutorials

0

Projects/seminars

0

### Number of credit points

3,00

### Coordinators

dr inż. Grzegorz Dombek

grzegorz.dombek@put.poznan.pl

dr inż. Sławomir Sowa

slawomir.sowa@put.poznan.pl

### Lecturers

### Prerequisites

Basic knowledge of electrical equipment, as well as ergonomics and safety of their use, electrical engineering, automation, and computer science. Ability to perform mathematical analysis of simple electrical circuits and read electrical schematics. Awareness of the need to expand one's competencies and readiness to collaborate within a team.

### Course objective

Understanding the principles and possibilities of controlling building installations, aimed at energy savings and achieving user comfort. Acquisition of skills in designing simple installations controlled by PLCs and dedicated building automation systems. Acquisition of skills in programming and testing simple building installations.

### Course-related learning outcomes

Knowledge:

Has knowledge of the principles of operation and implementation of building automation systems, as well as basic phenomena occurring in low-voltage installations. Is familiar with the principles of selecting installation and control devices for selected control algorithms for lighting, heating, and blinds.

#### Skills:

Able to critically analyze available data to select devices and carry out technical and non-technical evaluation of the designed building automation system.

#### Social competences:

Is aware of the need for continuous learning and professional development. Understands that in technology, knowledge and skills become obsolete very quickly.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

#### Lecture:

- knowledge gained during the lecture is assessed through a written final test, consisting of open-ended or multiple-choice questions with varying point values. Passing threshold: 50% of points,
- ongoing assessment during each class (with bonus points for active participation).

#### Laboratories:

- continuous evaluation and rewarding of the knowledge necessary to solve the tasks assigned in the laboratory exercises,
- assessment of reports from completed exercises,
- rewarding activity related to the execution of laboratory exercises.

### Programme content

The module program covers the following topics:

1. Quality requirements for smart buildings.
2. Communication protocols used in smart buildings.
3. Wired building automation systems.
4. Wireless building automation systems.

### Course topics

#### Lecture:

1. User needs versus smart building standards.
2. Smart building - quality requirements (definitions, smart building standards, requirements, impact of functional diversity on the building's automation systems).
3. Classification of building automation systems in modern construction.
4. Basic communication protocols used in building automation systems. Differences in the application of specific protocols.
5. KNX system - origin, operating principles, bus system.
6. KNX system - device classification, topology, addressing, and communication within the KNX system.
7. PLC controllers in building automation.

#### Laboratory:

1. Introduction to software dedicated to the applied building automation systems.
2. Basic lighting control using selected building automation systems.
3. Smooth lighting control using selected building automation systems.
4. Control of blinds/shutters/awnings using selected building automation systems.
5. Heating control using selected building automation systems.
6. Use of peripheral devices for controlling building installations.

### Teaching methods

#### Lecture:

- multimedia or object-based presentations supported by illustrated examples shown on the board,
- lecture conducted interactively, with questions posed and discussions initiated.

#### Laboratories:

- object-based presentations supported by illustrated examples shown on the board,
- presentation of selected experiments,

- initiation of teamwork activities.

## Bibliography

Basic:

1. A. Kamińska A, L. Muszyński, Z. Boruta, R. Radajewski, Nowoczesne techniki w projektowaniu energooszczędnych instalacji budynkowych w systemie KNX, Warszawa, 2011.
2. E. Niezabitowska, J. Sowa, Z. Staniszewski, D. Winnicka-Jasłowska, W. Badroń, A. Niezabitowski. Budynek inteligentny. Potrzeby użytkownika a standard budynku inteligentnego. Wydawnictwo Politechniki Śląskiej, Gliwice, 2000.
3. J. Kasprzyk, Programowanie sterowników przemysłowych WNT, Warszawa, 2012.
4. A. Ruda, R. Olesiński, Sterowniki programowalne PLC, COSiW SEP, Warszawa, 2008.
5. M. Parol, Ł. Rokicki. Instalacje i systemy w inteligentnych budynkach. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2017.
6. K. Duszczak, A. Dubrawski, A. Dubrawski, M. Pawlik, M. Szafranski. Inteligentny budynek. Poradnik projektanta, instalatora i użytkownika. Polskie Wydawnictwo Naukowe, Warszawa, 2019.

Additional:

1. Norma IEC 61131-3: Standardy programowania sterowników PLC.
2. H. Merz, T. Hansemann, C. Hubner. Building Automation - communication system with EIB/KNX, LON, and BACnet, Springer, 2009 r.
3. R. A. Carlson, R.A. Di Giandomenico. Understanding Building Automation Systems. Construction Consultants & Publishers, 1991 r.
4. PN-EN 15193-1:2017-08. Efektywność energetyczna budynków. Wymagania energetyczne dotyczące oświetlenia. Część 1.
5. Code of practice. Building Automation and Control Systems. The Institution of Engineering of Technology. 2020.

## Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00