POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name

PO 2.6.1 Energooszczędne sieci programowalne - EC 2.6.1 Energy-efficient programmable networks

Course

Field of study
Teleinformatics

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)

Tutorials
0

Projects/seminars
15/0

Number of credit points
4

Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

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Prerequisites

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Students know the structure of data communications networks. Student knows types of telecommunication devices and what their functions are. Students learn basic terms in electronics and electrotechnics. Students will learn to determine the type of network in which a given data communications device can be used. Students will learn to convert basic voltage, power and energy units. Students will be able to work in a group.

Course objective

The objective of the module is to provide students with knowledge of programmable networks and methods for reducing electricity consumption in these networks. Published standards and recommendations for reducing electrical power consumption will be discussed. Methods of reducing electrical power consumption in the data and control plane in various types of programmable networks will be discussed.

Course-related learning outcomes

Knowledge

1. Students have extended knowledge of the need to create communication systems with reduced energy consumption and greenhouse gas emissions.
2. Students have extended knowledge on construction and principles of operation of measurement and control systems and communication interfaces. He knows control algorithms of automatic regulation systems.
3. Students have extended vocabulary in English in the field of data communications and technology.

Skills

1. Students are able to think critically and argue their position.
2. Students are able to obtain data from literature, databases and other sources in Polish or English, analyze standardization recommendations, integrate obtained information, make interpretations, as well as draw conclusions and formulate and justify opinions.
3. Students are able to predict the consequences of negligence in the field of ICT network security, data processing and storage.
4. Students are able to propose improvements of the existing IT and telecommunications solutions in the field of ICT systems, including mobile ones
5. Students are able to use reports on the state of the ICT market, is able to interpret market trends, is able to prepare financial projections, is able to develop a business plan.
6. Students are able to work in a group to solve a technical problem, is able to plan his/her own tasks as well as those of other group members, is able to direct the work of a team and to react to deviations from planned actions.

Social competences

1. Students know the limits of his knowledge and understands the necessity of its updating. He/she is open to constant learning and constant improvement of professional, personal and social competences.

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2. Student understand the influence of own work on the team results and the necessity of submission to rules of work in a team as well as bearing responsibility for jointly performed tasks, also perceives the benefits of experience exchange also in multicultural environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge gained in the lecture is verified by an exam in written or oral form. In the written form, students must provide answers to 50-90 questions (test and open) differently scored. There are three or four point groups. However, in the oral examination, the student draws one question from each scoring group. In an oral format, for each question drawn, the student may be asked an additional question (related to the question drawn). The evaluation of the question (includes the answer to both the drawn question and the supplementary question) includes the breadth of the answer and the depth of understanding of the question. There are 50-60 questions prepared for each exam. Successful completion of the examination requires a minimum score of 50%.
The skills acquired as part of the projects will be assessed on the basis of partial marks received from the projects. The pass mark is 50%.

Examination and passing grade criteria:
number of points grade
< 50 %	2,0
50% - 60%	3,0
61% - 70%	3,5
71% - 80%	4,0
81% - 90%	4,5
91% - 100%	5,0

Programme content

Lectures
1. Influence of civilization development on environment and tendencies of climate changes.
2. Characteristics of electrical energy sources and trends in energy consumption in ICT
3. Methods of measuring electricity consumption and energy efficiency assessment in the data and control layer of ICT equipment
4. Methods for reducing electricity consumption.
5. Standards and recommendations for reducing electricity consumption and measuring electricity consumption.
6. Structure and functions of programmable networks
7. Mechanisms for reduction of power consumption in programmable networks
8. Function virtualization mechanisms
9. Traffic flow control in energy-aware networks
10. OpenFlow - mechanisms for reduction of power consumption.
11. Using programmable network elements to reduce electricity consumption in access and backbone networks.
12. Reduction of electricity consumption in electronic components.
13. Optimization of control algorithms for electricity demand reduction.
14. Reduction of electricity consumption in various industries through the use of ICT.

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15. Summary - trends in ways to reduce electricity consumption.

Project activities.
Students in the occupation will prepare papers on energy reduction techniques in programmable networks:
Example projects:
Project 1. Using renewable energy sources to power access network equipment.
Project 2. how much electricity does a computer consume to execute a program written in C++?
Project 3: How to cool a computer efficiently?
Project 4. How to use thermal energy from data centers?

Teaching methods

1. Lecture: multimedia presentations illustrated with examples given on the blackboard.
2. Project: presentations prepared by students, projects in P4 language of simple functionalities of network devices

Bibliography

Basic

1. Kabaciński W., Żal M., Sieci Telekomunikacyjne. WKŁ, Warszawa 2008.
2. ITU-T Recomendation: L. 1300, L. 1310, L. 1420, G.992.5.
3. Standard IEEE 802.3az.

Additional

1. Shafiullah Khan, Jaime Lloret Mauri, Green Networking and Communications: ICT for Sustainability, CRC Press, 2013
2. Daniel Minoli, Designing Green Networks and Network Operations: Saving Run-the-Engine Costs, CRC Press, 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	86	4.0
Classes requiring direct contact with the teacher	45	2.0
Student's own work (preparation for tests, project preparation, literature studies)	41	2.0