COURSE DESCRIPTION CARD - SYLLABUS

Course name
Switching systems

Course

Field of study
Electronics and Telecommunications

Year/Semester
IV/VII

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)

Tutorials
0

Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
prof. dr hab. inż. Wojciech Kabaciński,
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Responsible for the course/lecturer:
dr hab. inż. Remigiusz Rajewski,
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Prerequisites

The student should have a basic knowledge of probability, optimization and graph theories, functions and structures of telecommunication networks. He should be able to use bibliography in English (books, scientific and technical journals, application notes, catalogs, instructions, recommendations, etc.). He should also be able to communicate in English in a professional environment.

Course objective

To get students familiar with the architecture and operation of different kinds of switching nodes used in telecommunication networks (routers, switches, optical cross-connects, optical switches, etc.), and their control and performance evaluation.

Course-related learning outcomes

Knowledge

1. The student knows the switching nodes, their architecture, and their role in communication networks.

2. The student knows methods for switching nodes evaluation and comparison.

3. The student knows the way switching systems are controlled.

Skills

1. The student can evaluate and compare selected performance parameters of switching systems.

2. The student can prepare experiments enabling evaluation of selected parameters.

3. The student can propose and design control algorithms for controlling switching nodes.

Social competences

1. The student has competences to work in a team to realize projects on switching systems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge aquired during the lectures is verified by the final exam. This exam is in the oral or/and written form, depending on the number of students. The oral exam consists of a set of 5 questions, a set of questions is drawn from at least 10 sets; answer to each question is marked in 0-5 points. 50% of points are needed to pass the exam. The written exam consists of 45-60 questions of multiple choice type. Students get 1 point for the correct answer and 0 points for wrong answer or lack of answer. 50% of points are needed to pass the exam. In questionable cases, there is a possiblity to correct the mark by answering for some questions in oral.

The final mark from the laboratory depends on the simulation program and the final report. In the simulation program, there should be implemented all features describing during the round of the subject's laboratories. In the final report, there should be a theoretical description of the topic implemented in the simulation program as well as a discussion of achieved results. The final marks are as follows: 5.0 - in the simulation program there are implemented all features introduced during the round of subject's laboratories, and they are working properly; 4.5 - the simulation program missed the routing feature, and others are working properly; 4.0 - the simulation program has a lack of two features, and others are working properly; 3.5 - the simulation program has the essential future working correctly, and one or two other features are implemented, however, they are not working properly; 3.0 - the simulation program has only the essential feature; 2.0 - the simulation program is not working, or student did not prepare such a simulation program at all

Programme content

Lectures: What are switching systems. Types and functions of switching systems. Switching networks: terminology, characteristics, topologies. Circuit switching networks - crossbar, Clos, Benes. Packet switching networks - functions and router architectures. Buffering in packet switching networks and scheduling algorithms. Multistage switching networks and packet scheduling in such networks. Optical switching elements. Optical cross-connect systems (OXC) and optical add/drop multiplexers (OADM). Optical switching networks. Switching networks in elastic optical networks. Energy efficiency in switching networks.

Laboratory: students do exercises on following subjects: control algorithms, the shortest connecting path algorithms, the cheapest connecting path algorithms, designing of different switching fabrics topologies, capacity dimensioning of switching networks, strict-sense nonblocking conditions for switching systems, wide-sense nonblocking conditions for switching systems, rearrangeable conditions for switching systems, simulation program of switching networks including routing algorithms.

Teaching methods

Lectures: Lectures are conducted in the traditional form, with computer presentations that are available earlier to students. Some lectures, or their parts, are led as interactive or problem lectures, where students participate in solving some problems or examples, especially in proving of some mathematical theorems.

Laboratory: classes are run using exercises and project methodology. Depending on the subject, the lecturer gives students blackboard examples, demonstrates exercises, and present a presentation on multimedia programming. Then students are given some problems which should be solved also by preparing some software (simulation) experiments. The lecturer advises in writing a simulation program being prepared by the students

Bibliography

Basic

1. H. J. Chao and B. Liu, High Performance Switches and Routers. John Wiley & Sons, Inc., 2007

2. W. Kabaciński: Nonblocking Electronic and Photonic Switching Fabrics. Springer, 2005

Additional

1. B. Li and S. J. Chua, Optical switches. Materials and design. Oxford, Cambridge, Philadelphia, New Delhi: Woodhead Publishing Limited, 2010.

2. G. I. Papadimitriou, C. Papazoglou, and A. S. Pomportsis, Optical Switching. John Wiley & Sons, Inc., 2007.

3. T. S. El-Bawab, Optical Switching. Springer, 2006.

4. T. T. Lee and S. C. Liew, Principles of Broadband Switching and Networking. John Wiley & Sons, Inc., 2010.

5. A. Pattavina, Switching Theory. John Wiley & Sons, Inc., 1998.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	31	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam, project preparation) [1]	44	1,0

[1] delete or add other activities as appropriate