COURSE DESCRIPTION CARD - SYLLABUS

Course name
Switching Systems [S2EiT2E-TIT>SK]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/4

Area of study (specialization)
Information and Communication Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

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

4,00

Coordinators

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Lecturers

Prerequisites

Has basic knowledge of probability optimization, graph theory, basic telecommunication network devices, network topologies, operation of telecommunication networks. Is able to use bibliography in English (books, scientific and technical journals, application notes, catalogs, instructions, recommendations, etc.). Can write a research report and prepare a presentation on solving problems in the field of telecommunication networks, can conduct a discussion on the presented problem.

Course objective

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

Course-related learning outcomes

Knowledge:
1. Has detailed knowladge about the switching nodes role and architecture in communication networks.
2. Knows methods for switching nodes evaluation and comparison.
3. Knows the way switching systems are controlled.

Skills:
1. Can evaluate and compare selected performance parameters of switching systems.
2. Can prepare experiments enabling to evaluated selected parameters.
3. Can propose and design control algorithms for controling switching nodes.

Social competences:
1. 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:

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Knowledge acquired during the lectures is verified by the final written test. This test consists of 45-60 questions of multi-choice type. Each question has four answers, one of them is correct. The student gets 1 point per each correct answer and 0 points in the case of no answer or a wrong answer. The student must get at least 50% of the total number of points to pass the test. In questionable cases, students can correct the mark by answering 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

Discussion of the structure, functions and principles of operation of various switching systems in modern telecommunications networks (routers, switches, optical cross connects, optical add/drop multiplexers. Parameters for the evaluation of switching systems.

Course topics

Lectures: What are switching systems. Types and functions of switching systems. Switching networks ? terminology, characteristics, topologies. Circuit switching networks - crossbar, Clos, Benes. Circuit switching networks - control algorithms. Packet switching networks - router architectures. Buffering in packet switching networks. Buffering in packet switching networks - scheduling algorithms. Multistage switching networks and packet scheduling algorithms. Contention resolutions in optical switches. Optical switching elements. Optical crossconnect systems (OXC) and optical add/drop multiplexers (OADM). Elastic optical switches. Evaluation of switching networks.
Laboratory: students do exercises of following subjects: designing of switching fabric topologies (crossbar, Benes, Clos), optical switching fabrics desing and programming, designig of routing algorithms in selected switching fabrics, packet scheduling algorithms in packet switches with different buffering arrangements.

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	100	4,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00