STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Switching Systems		**1010822131010822961**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **2 / 3**
Elective path/specialty **Computer Networks and Internet**	Subject offered in: **Polish**	Course (compulsory, elective) **elective**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **2** Classes: **-** Laboratory: **1** Project/seminars: **-**		No. of credits **2**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **from field**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **2 100%** **2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a basic knowledge in mathematics required to formulate and solve task in the area of electronics and telecommunications. K2_W01
2	**Skills**	Is able to use bibliography in English (books, scientific and technical journals, application notes, catalogs, instructions, recommendations etc.) [K2_U01]. Can write research report and prepare presentation (in Polish or/and English) on solving problems in the field of electronics and/or telecommunications, can conduct discussion on the presented problem.[K_U02] Can use optimization methods to solve problems in electronics and telecommunications. [K_U05]
3	**Social competencies**	Knows the limitations of their own knowledge and skills, he understands the need for further education. [K2_K04].

Assumptions and objectives of the course:

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.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has knowladge about the switching nodes role and architecture in communication networks - [K2_W11]
2. Knows methods for switching nodes evaluation and comparison - [K2_W03]
3. Knows the way switching systems are controlled - [-]

Skills:

1. Can evaluate and compare selected performance parameters of switching systems - [K2_U05]
2. Can prepare experiments enabling to evaluated selected parameters - [K2_U09]
3. Can propose and design control algorithms for controling switching nodes - [K2_U16]

Social competencies:

1. Has competences to work in a team to realize projects on switching systemsi - [K2_K01]

Assessment methods of study outcomes

Forming assessment:

In the laboratory: on the basis on activity during projects and the report from the final project

Summary assessment:

Lectures: the multiple choice test; points for each question: -0,25 p. (wrong answer), 0 p. (no answer), 1 p. (correct answer); test is passed when student receives at least 50% points.

Course description

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. Optical switching elements. Optical crossconnect systems (OXC) and optical add/drop multiplexers (OADM). Optical switching networks. Energy efficiency in switching networks.

Practical exercises:

Designing of switching fabric topologies (crossbar, Benes, Clos).

Capacity dimensioning of switching networks.

Control algorithms ? the shortest connecting path - exercises.

Control algorithms ? the cheapest connecting path- exercises.

Control algorithms ? the shortest connecting path - programming.

Control algorithms ? the cheapest connecting path- programming.

Control algorithms ? rearrangements and repacking - exercises.

Control algorithms ? rearrangements and repacking - programming.

Configuration of switching nodes ? IP routers, software routers, routing.

Optical switching fabrics ? designing and programming.

Basic bibliography:

1. A. Pattavina, Switching Theory. John Wiley & Sons, Inc., 1998.
2. H. J. Chao and B. Liu, High Performance Switches and Routers. John Wiley & Sons, Inc., 2007
3. W. Kabaciński: Nonblocking Electronic and Photonic Switching Fabrics. Springer, 2005

Additional bibliography:

1. A. Jajszczyk, Wstęp do telekomutacji, WNT, 2000
2. W. Kabaciński, M. Żal: Sieci Telekomunikacyjne, WKŁ, 2008

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Laboratory exercises	15
3. Preparation for laboratory ecercises	15

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	45	2
Practical activities	30	1