STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Synchronous Digital Hierarchy**		Code **1010832121010800995**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty **Telecommunication Systems**	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				No. of credits **4**
Lecture: **2**	Classes: **-**	Laboratory: **-**	Project/seminars: **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 %**)**
	
	4 100%
	          4 100%

Responsible for subject / lecturer:

dr hab. inż. Mieczysław Jessa
email: mjessa@et.put.poznan.pl
tel. +48 61 665 38 54
Faculty of Electronics and Telecommunications
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	K1_W09-Knows the principles of construction of computer programs ; has knowledge from the area of computing science; knows the syntax of C, C++, C#, MatLab. K1_W15-Knows the principle of operation of digital transmission systems, digital modulations, forming the spectral properties of signals, countering channel distortions. K1_W18-Has a systematic knowledge, together with necessary mathematical background, of the fundamentals of metrology, which is necessary to measure the signal properties and the parameters of electronic and telecommunication systems components.
2	**Skills**	K1_U01-Is able to extract information from Polish or English language literature, databases and other sources. Is able to synthesize gathered information, draw conclusions, and justify opinions. K1_U13-Is able to write software for basic computational algorithms, using popular programming languages (e.g. Matlab, C). Is able to conduct simulation experiments to evaluate parameters of circuits, systems and networks. K1_U24-Is able to analyze and design logic circuits. Is able to build complex digital circuits from commercially available ICs. Is able to analyze and build typical microcontroller and microprocessor systems.
3	**Social competencies**	K1_K01-Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. K1_K02-Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects. K1_K04-Is aware of the main challenges facing electronics and telecommunication in the 21st century. Is aware of the impact electronics and ICT systems and networks will have on the development of the information society.

Assumptions and objectives of the course:

The presentation of properties of the basic transmission system exploited in modern communication networks. The basic structures of the SDH: line, chain, ring, mesh. SDH hierarchy levels. An exemplary structure of the SDH network. Methods of designing the SDH networks.

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

Knowledge:

1. Has a wide, systematic knowledge, with necessary mathematical background, of ICT networks and signal transmission methods. - [K2_W13]

Skills:

1. Is able to select adequate numerical methods and simulation methods to solve typical tasks related to analysis, design and optimization of systems and computational tasks in telecommunication.   - [K2_U09]

Social competencies:

1. Is aware of the limitations of his/her current knowledge and skills; is committed to lifelong learning. - [K2_K04]

2. Is aware of the necessity to approach solving technical problems with responsibility and professionalism. - [K2_K05]

Assessment methods of study outcomes

Written exam.

Reports from an individual project.

Activity during studies.

Course description

History of the SDH. Introduction to SDH: the layer concept, SDH network model, synchronous transport module, overheads structure, synchronous multiplexing, pointer justifications, virtual containers, tributary signals, mapping of tributary signals. SDH multiplexers: Terminal Multiplexer, Line Multiplexer, Add and Drop Multiplexer, Digital Crossconnect, Regenerator. SDH networks: partitioning concept, layering model, uni- and bi-directional rings, mesh network, protection in SDH, connections of ring subnetworks.

Basic bibliography:

1. Systemy Teletransmisyjne, Sławomir Kula, WKŁ, Warszawa, 2004.

2. Principles of Synchronous Digital Hierarchy, R. K. Jain, CRC Press, Boca Raton, 2012.

3. SDH/SONET Explained in Functional Models, Huub van Helvoort , Wiley, New York, 2005.

Additional bibliography:

1. Broadband Telecommunications Technology, B.G. Lee, M. Kang, J. Lee, Artech House, 2nd. Edn. , Boston, 1996.

2. Broadband Networking, ATM, SDH, and SONET, M. Sexton, A. Reid, , Artech House, Boston, 1997.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in laboratories/projects	15
3. Individual literature studies	30
4. Prepparation for the exam	10
5. Individual work on preparing excercises	15

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	65	2
Practical activities	55	2