## STUDY MODULE DESCRIPTION FORM

| Name of the module/subject | Code |
|---|---|
| **Exploitation and maintenance of telecommunication systems** | **1010821171010833610** |

| Field of study | Profile of study (general academic, practical) | Year /Semester |
|---|---|---|
| **Electronics and Telecommunications** | **general academic** | **4 / 7** |

| Elective path/specialty | Subject offered in: | Course (compulsory, elective) |
|---|---|---|
| **Computer Networks and Internet** | **Polish** | **elective** |

| Cycle of study: | Form of study (full-time,part-time) |
|---|---|
| **First-cycle studies** | **full-time** |

| No. of hours | | | | No. of credits |
|---|---|---|---|---|
| Lecture: **2**  Classes: **1**  Laboratory: **-**  Project/seminars: **-** | | | | **3** |

| Status of the course in the study program (Basic, major, other) | (university-wide, from another field) |
|---|---|
| **major** | **from field** |

| Education areas and fields of science and art | ECTS distribution (number and %**)** |
|---|---|
| **technical sciences**<br>    **Technical sciences** | **3   100%**<br>   **3    100%** |

### Responsible for subject / lecturer:

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### Prerequisites  in terms of knowledge, skills and social competencies:

| 1 | **Knowledge** | Has a knowledge of the fundamentals of circuit theory, together with necessary mathematical background (K1_W05) |
|---|---|---|
| | | Knows the principle of operation of digital transmission systems (K1_W15) |
| | | Has a detailed, systematic knowledge of the fundamentals of the telecommunication theory, which is necessary to understand, analyze and evaluate the operation of analogue and digital telecommunications systems (K1_W17) |
| 2 | **Skills** | 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_U01) |
| | | Is able to use known mathematical analysis, algebra and theory of probability concepts to solve basic problems in electronics and telecommunication (K1_U07) |
| | | Demonstrates the ability to solve typical tasks and problems related to analysis of electrical circuits (K1_U09) |
| | | Demonstrates the ability to solve problems related to signal analysis in time domain and frequency (K1_U10) |
| 3 | **Social competencies** | Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study (K1_K01) |
| | | Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects (K1_K02) |

### Assumptions and objectives of the course:

Prezentation of the basic aspects related to maintainance and exploitation of the telecommunication systems

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

**Knowledge:**

1. Has knowledge of devices and systems exploitation - [K1_W20]

2. Has knowledge of analysis procedures of PDH and SDH systems - [-]

3. Has knowledge of power supply systems in telecommunication network and systems - [-]

**Skills:**

1. Is able to determine basic parameters and properties of signals and telecommunication systems , under predefined constraints.  - [K1_U15]

2. Is able to measure typical parameters of signals, systems and devices,  in particular those used in telecommunication. Is able to choose  appropriate methods to measure given electrical quantities  and parameters of  signals and devices.   Is able to plan and perform measurements and analyze the results.  - [K1_U17]

3. Is able to evaluate the parameters describing digital signals transmission quality in various communication channels. Is able to match digital signal reception methods to transmission parameters and distortions introduced by the channel.  - [K1_U19]

4. Is able to select the construction of devices according to technical requirements and service conditions.  - [K1_U21]

5. Is able to solve some problems related to analysis of component signals for different hierarchies  - [-]

6. Is able to make measurement of jitter, wonder, clocks frequency, and matching impedance; BER test, battery test   - [-]

**Social competencies:**

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study - [K1_K02]

2. Demonstrates  responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced - [K1_K03]

### Assessment  methods of study outcomes

Written exam

Assessment of realized projects

### Course description

Lectures:

Features of the telecommunication system. The structure of the telecommunication network. PCM frame. The idea of ??using polynomial codes. The implementation of frame alignment. Line codes, signal regeneration. Phase fluctuations, jitter and wonder. Jitter measurement, BER measurement. Stuffing and interleaving. Higher order PDH systems. Power systems of telecommunications equipment. Scope of service and maintainance activities. Measurement of selected parameters. Introduction to SDH hierarchy, the basic concept of SDH. Multiplexing in the SDH. Multiplexers ADM, DXC-n. STM-n transport module. Clock synchronization in SDH network. Selected service and maintainance activities in the SDH network. Analysis of PDH/SDH and SDH/PDH interfaces. Standards for quality of SDH network connections. Parameters of synchronization signals and their measurement in the SDH network.


Classes

Projects of some elementary parts of telecommunication systems

Model of multiplexer for 64kb/s binary rate. Encoders and decoders of line codes. AD and DA converters with A-law compression and decompression. Jitter detectors for E1, E2, and E3 signals. Model of 2048 kHz SEC. BER measurement for E1, E2, and E3 signals. Regenator for E1 signal with HDB3 coding. Stand for attenuation analysis of E1 devices. Phase detector for wander analysis. Jitter generators for E1, E2, and E3 signals. Frame symulator with display for E1, E2, and E3 signals. Measurement stand for VRLA test. Frame aligment detector. PRBS generator for E1, E2, and E3 signals. Sample and hold device. Interleaver model for E1/E2. Overhead generator for STM-1. Model of CRC-4.

### Basic bibliography:

1. S. Kula, Systemy teletransmisyjne, WKiŁ, Warszawa 2000

2. S. Haykin, Systemy telekomunikacyjne, WKiŁ, Warszawa, 1998

3. S. Bregni, Synchronization of Digital Telecommunications Networks, Wiley, 2002

### Additional bibliography:

1. J. Kazimierczak, Eksploatacja systemów technicznych, Wydawnictwo Politechniki Śląskiej, Gliwice, 2000

2. S. Niziński, Elementy eksploatacji obiektów technicznych, UWM, Olsztyn, 2000

### Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. Participation in lectures | 30 |
| 2. Participation in classes | 15 |
| 3. Realization of projects | 15 |
| 4. Individual work | 15 |

### Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 75 | 3 |
| Contact hours | 50 | 2 |

| Practical activities | 30 | 1 |
|---|---|---|