STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Measurements and analysis of biological signals		**1010321261010324819**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electrical Engineering	**(brak)**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Measurement Systems in Industry and	**polish**	**obligatory**

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

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

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

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge in the scope of algebra, mathematical analysis, electronic analog circuits, digital technique, and digital processing of signals
2	**Skills**	Ability of the efficient self-education in the area concerned with the chosen field and speciality of studies
3	**Social competencies**	Awareness of the necessity of broadening of the competence in the field of electrical engineering and willingness to cooperate in a team

Assumptions and objectives of the course:

Knowledge of modern methods of the measurements, processing and analysis of biological signals

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

Knowledge:

1. Ability to explain the principles and techniques of measuring signals acquisition for biomesurements - [K_W05+, K_W14 +]

Skills:

1. Ability to work independently and as a team in laboratories, research centres, and medical facilities - [K_U05 ++, K_U09 +, K_U23 +]

Social competencies:

1. Ability to think and act enterprisingly in the area of biomedical engineering - [K_K04 +, K_K05 +]

Assessment methods of study outcomes

- Tests and awarding the increase in knowledge necessary to realize the laboratory tasks,
- Continuous estimation during all classes and awarding the increase in skills of using the get principles and methods,
- The evaluation of knowledge and skills connected with the measuring tasks and prepared reports

Course description

- Analog conditioners of signals.
- Cooperation of operational amplifiers with measuring sensors.
- Kinds and specificity of biological signals.
- Examples of noninvasive techiques of biomedical signals acquisition.
- Sampling of measuring signals.
- Aliasing and choice of the proper filter.
- Comparison of analog and digital filters properties.
- Basic mathematical operations using the collected samples of biosignals.
- Digital Fourier Transform and fundamentals of spectrum analysis.
- Selected problems concerned with Laplace?a transform and introduction to NOI digital filters.
- Selected questions of the statistical methods of measuring data analysis.

Basic bibliography:

1. J.T. Białasiewicz, Falki i aproksymacje, WNT, Warszawa 2000
2. Biocybernetyka i inżynieria biomedyczna, red. M. Nałęcz, Akademicka Oficyna Wyd. EXIT, Warszawa 2001-2002
3. U. Tietze, Ch. Schenk, Układy półprzewodnikowe, WNT, Warszawa 2001
4. T. Zieliński, Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2007

Additional bibliography:

1. J. Jakubiec, J. Roj , Pomiarowe przetwarzanie próbkujące, Wyd. Politechniki Śląskiej, Gliwice 2000
2. J. Moczko, L. Kramer, Cyfrowe metody przetwarzania sygnałów biomedycznych, Wyd. UAM, Poznań 2001
3. J. Szabatin, Teoria sygnałów, WKŁ, Warszawa 2000

Result of average student's workload

Activity	Time (working hours)
1. Participation in laboratory exercises	30
2. Participation in consulting with the lecturer	9
3. Preparation to laboratory exercises and preparation of the reports	20

Student's workload

Source of workload	hours	ECTS
Total workload	59	2
Contact hours	39	1
Practical activities	50	2