STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Fundamentals of advanced measurement techniques**		Code **1010341761010329414**
Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **general academic**	Year /Semester **3 / 6**
Elective path/specialty **Device diagnostics**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies (Polish Qualifications Framework level six)**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **Technical sciences** **Technical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

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 mathematics, electrotechnics, computer science [K_W03(P6S_WG)], [K_W04(P6S_WG)]
2	**Skills**	Ability of the efficient self-education in the area concerned with a chosen field of studies [K_U06(P6S_UW)]
3	**Social competencies**	Awareness of the necessity of competence broadening and ability to show a readiness to work as a team [K_K02(P6S_KK)]

Assumptions and objectives of the course:

- Knowledge of the modern techniques of acquisition, processing and presentation of measuring data.
- Selected examples of the realization of virtual measuring devices.

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

Knowledge:

1. Ability to explain the principles and techniques of measuring signal acquisition [K_W04(P6S_WG)]
2. Ability to characterize the importance and application possibilities of the modern measuring systems [K_W07(P6S_WG)]

Skills:

1. Ability to work independently and as a team in the design and construction companies, research laboratories, industrial centers, and medical facilities [K_U10(P6S_UW)], [K_U14(P6S_UO)]
2. Ability to design the measuring systems creatively, using possibilities offered by new technologies [K_U07(P6S_UW)], [K_U09(P6S_UW)], [K_U11(P6S_UW)]

Social competencies:

1. Ability to think and act enterprisingly in the area of the measuring systems to be used in industry [K_K03(P6S_KO)]

Assessment methods of study outcomes

Lectures:

- evaluation of the knowledge with tests related to the content of lectures (test, computational and problem questions), awarding marks in laboratory exercises)
- continuous estimation in all classes (awarding attendance in lectures, activity and quality of perception).

Laboratories:

- continuous estimating with the tests,
- awarding the skill increase,
- evaluation of the knowledge and skills concerning the realization of an individual project, evaluation of the made project.

Course description

General characteristics of the selected environments to program and control the measuring equipment. Software implementation of measuring instruments, use of mathematical functions. Simulation software to generate signals using mathematical formulas. Metrological properties of the DAQ cards. Functional structure of a virtual measuring device. Realization of a device with the multi-functional DAQ card. Principles of preparation of an user interface and program code by the use of LabVIEW environment. Acquisition and processing of data using the DAQ card. The use of advanced mathematical algorithms for the analysis of measurement results.

Updating 2017 and 2018:

Methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports.

Applied methods of education:

Lectures:

Lecture with multimedia presentation supplemented by examples on the board, initiation of discussions in relation to the subject, presentation of a new topic preceded by a reminder of the previous lecture (main issues).

Projects:

Groups of students work as teams. Discussion on different methods and aspects of problem solutions. Detailed reviewing of particular projects documentation.

Basic bibliography:

1. D. Świsulski, Komputerowa technika pomiarowa, oprogramowanie wirtualnych przyrządów pomiarowych w LabVIEW, Agenda Wydawnicza PAK, 2005.
2. M. Chruściel, LabVIEW w praktyce, Wydawnictwo BTC, 2008.
3. P. Maj, Wirtualne systemy kontrolno-pomiarowe, Wydawnictwo AGH, 2011.

Additional bibliography:

1. R. Rak, Wirtualny przyrząd pomiarowy. Realne narzędzie współczesnej metrologii, Oficyna Wydawnicza Politechniki Warszawskiej, 2003.
2. W. Tłaczała, Środowisko LabViewTM w eksperymencie wspomaganym komputerowo, Wydawnictwo WNT, 2014.

Result of average student's workload

Activity	Time (working hours)
1. participation in lecture classes	30
2. participation in laboratory classes	30
3. consultations	10
4. preparation of laboratory classes reports and presentation problematic tasks	10
5. preparation for laboratory exercises	10
6. familiarization with the indicated literature / teaching materials (10 pages of scientific text = 1 hr.)	8
7. exam preparation and exam	10

Student's workload

Source of workload	hours	ECTS
Total workload	108	4
Contact hours	72	3
Practical activities	50	2