COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of virtual measuring devices [S1MNT1>PWPP]

Course

Field of study
Mathematics of Modern Technologies

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Dariusz Prokop
dariusz.prokop@put.poznan.pl

dr inż. Zbigniew Krawiecki
zbigniew.krawiecki@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of mathematics, computer science, electrical engineering, metrology. Ability to effectively self-educate in the field related to the chosen field of study. Awareness of the need to expand their competences, readiness to cooperate within the team.

Course objective

Getting to know the functionality of virtual measuring instruments, comparison to traditional instruments. Program implementation of selected mathematical algorithms for data processing and analysis of electrical signals.

Course-related learning outcomes

Knowledge:
• the student has knowledge of creating applications for measurement tasks in connection with other disciplines, also for the purposes of scientific research [K_W05(P6S_WG), K_W07(P6S_WG)];

• the student has structured knowledge of ergonomics, the operation of systems and devices, knows the principles and techniques of acquiring measurement signals for engineering applications [K_W 09(P 6S_W G),
K_W13(P6S_WK)];
• the student knows how to use the known methods to process the results of measurements and results from computer simulations [K_W08(P6S_WG), K_W11(P6S_WG)].

Skills:
• the student is able to assess the complexity of engineering tasks, acquire knowledge, select a method and apparatus, perform measurements while maintaining safety rules [K_U 08(P 6S_U W), K_U 09(P 6S_U W)];
• the student knows how to work independently and in a team in order to make a virtual instrument for a measuring task [K_U04(P6S_UW), K_U13(P6S_UW), K_U16(P6S_UO)];
• thestudentisabletocreativelyusethepossibilitiesofferedbynewtechnologiesinthefieldofobtaining and processing as well as analyzing the results of measurements [K_U 06(P 6S_U W), K_U 07(P 6S_U W)].

Social competences:
• the student is aware of the limitations of his knowledge and the need to constantly improve it resulting from the social role of a technical university graduate [K_K05(P6S_KR)];
• the student is aware of the need to think and act in an entrepreneurial and critical manner, objectively assessing the results of measurements and data analysis [K_K01(P6S_KK)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: assessment of the knowledge shown in the final test (test, accounting and problem questions, 50% pass threshold), rewarding activity in the classroom;
Laboratory classes: assessment of knowledge and skills related to the implementation of a laboratory task, assessment of the report made in class or at home. Rewarding insights regarding the improvement of the content of teaching materials.

Programme content

Lectures: functionality and open architecture of a virtual measuring instrument, comparison with a traditional instrument, virtual instrument in scientific research, signal generators, determination of signal parameters, data processing and analysis, elements of statistics, sound card in a computer as an element of a virtual instrument, DAQ card;
Laboratories: planning and implementation of tasks related to the construction of a virtual measuring device, data processing, use of the Mathematics library (LabVIEW), principles of creating the front panel and graphic code of a virtual device, controlling the sound card in a computer for measurement and signal generation, recording, reading and analysis data.

Course topics

Lectures: functionality and open architecture of a virtual measuring instrument, comparison with a traditional instrument, use of a virtual instrument in scientific research and in industry and in an engineer's workshop, examples of practical solutions for signal acquisition, creating applications for measurement tasks, algorithms for generating signals and determining signal parameters , interpretation, processing and analysis of data, elements of statistics, description of results, use of a sound card in a computer as an element of a virtual device, comparison with a DAQ card;
Laboratories: planning and implementation of tasks related to the construction of a virtual measuring instrument with elements of mathematical structures, mathematical data processing algorithms for determining the basic parameters of signals, use of the Mathematics library (LabVIEW), principles of creating the front panel and graphic code of a virtual instrument, programmatic implementation of functions of generation devices signals and measurement of electrical quantities, simulation of selected elements of the measurement path for data acquisition and processing, integration, signal differentiation, control of a sound card in a computer for the purpose of measuring and generating signals, recording, reading and analyzing data, comparison with a DAQ card.

Teaching methods

Lectures: lecture with a multimedia presentation supplemented with examples given on the blackboard, initiating discussions related to issues, referring to the curriculum content of other subjects;
Laboratory classes: individual or team work, discussion of various methods and aspects of problem solving. Detailed review of the documentation from the laboratory by the teacher.

Bibliography

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

Additional:
• Rak R., Wirtualny przyrząd pomiarowy. Realne narzędzie współczesnej metrologii, Oficyna Wydawnicza Politechniki Warszawskiej, 2003;
• TłaczałaW., Środowisko LabViewTM w eksperymencie wspomaganym komputerowo, Wydawnictwo WNT, 2014;
• Bishop H. R., LabVIEW student edition, Wydawca Pearson, 2015;
• Otomański P., Krawiecki Z., Wykorzystanie środowiska LabVIEW do oceny niedokładności pomiarów rezystancji, PAK, 2011, vol. 57, nr 12, s. 1561-1563;
• Odon A., Krawiecki Z., LabVIEW application for computer simulation of the conversion technique of dual-slope analog-to-digital converter, Elsevier Ltd. Measurement, 2011, vol. 44, No. 8, s. 1406-1411.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00