COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metrology [S1AiR1E>Metr]

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge in the scope of mathematics including algebra, geometry, analysis. Basic knowledge in the scope of physics, especially electricity, magnetism, physics of solid body in necessary scope to understand physical phenomena occurring in electronic circuits. Basic knowledge in the scope of the theory of electrical circuits and electrical engineering of direct and alternating current. Ability to acquire information from the literature, data and other sources; ability to the self-education in order to increase and update the professional competences. Ability to construct, start and test a simple electronic circuit. Awareness of the importance of the out-of-technical aspects and effects of the engineer activity, including its influence on the environment and relating responsibility for the decisions.

Course objective

Knowledge of the measurement methodology, attributes of the modern measuring equipment, the principles of application of analog and digital devices, and the principles of the evaluation of measurement results.

Course-related learning outcomes

Knowledge:
Has a basic knowledge of metrology, knows and understands the methods of measurement of electrical and non-electrical quantities; knows the computational methods and computer tools necessary to analyse experimental results [K1_W11 (P6S_WG)].
Skills:
Be able to use appropriately selected methods and measuring instruments and measure relevant signals and, on the basis of these, determine the static and dynamic characteristics of automation components and obtain information on their basic properties [K1_U14 (P6S_UW)].
Social competences:
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures:
Evaluation of the knowledge and skills shown during a written test (a test sheet includes information necessary to solve computational tasks). Passing threshold of test equals 50%.
Laboratory exercises:
Evaluation of the knowledge and skills connected with realization of a given task, evaluation of the report;
Bonus knowledge necessary to implement the problems posed in a given area of laboratory tasks;
Continuous assessment in every class (rewarding activity and quality of perception).
Final test in written (passing threshold 50%)
Getting the additional points related to activity during classes such as:
Preparation and presentation of a lecture on the subject according to a module or task made by students;
Efficiency of application of the obtained knowledge during solving a given problem;
The aesthetic qualities of the reports.

Programme content

Selected issues of measurement theory. Planning and implementation of the measurement task. Elements of the theory of errors and uncertainty of measurement results.
Basic properties of measuring transducers. Principles of carrying out oscilloscope measurements. Analog and digital measurements of electrical quantities. Balanced and tilting bridges. Measurements of selected non-electric quantities. Measuring systems.

Course topics

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Lectures:
Measurement methodology: definition and basic terms. Planning and realization of a measurement task. Elements of errors theory and uncertainty of measurement results. Measuring transducer: processing characteristics, static and dynamic properties, linearity, supply. Cooperation between measuring transducers and devices - signal transmission, interaction. Measurements with oscilloscopes. Methods of measurements. Measuring bridges. Analog and digital measurements of electrical quantities. Measurement sensors and measurements of nonelectrical quantities. Introduction to structure and organization of measurement systems. Knowledge of safety principles during measurements. Planning and realization of measurements of the basic electrical quantities with widely available analog and digital equipment. Measurements of electrical signals with analog oscilloscopes. Preparation of the documentation based on the obtained results of measurements.
Laboratory:
Planning and realization of a measurement task. Calculating of errors and uncertainty of measurement results. Investigating of static and dynamic properties of measuring transducers. Measurements of

electrical signals with analog and digital oscilloscopes. Analog and digital measurements of electrical quantities. Using of measuring bridges. Selected examples of measurements of nonelectrical quantities (eg. force, preeure, distance, angle of rotary, temerature). Using of simple measurement systems. Knowledge of safety principles during measurements. Preparation of the documentation based on the obtained results of measurements.

Teaching methods

Methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports.
Lectures:
Multimedia presentations expanded by examples shown on a board. Theoretical questions are presented in the exact reference to the practice. Activity of students is taken into consideration in final students evaluation.
Laboratory:
Realization of laboratory tasks in teams, making of computatinal tasks and measurement experiments. Making of reports.

Bibliography

Basic
1. Layer E., Tomczyk K. Measurement, Modelling and Simulation of Dynamic Systems. Berlin, London, Springer. 2010.
2. Nawrocki W. Measurement Systems and Sensors. Boston, London, Artech House, 2016.
3. Sidor T., Żegleń T.. Laboratory Manual For Basic Metrology Course, AGH Krakow, 2010.
Additional
1 Gupta S.V. Units of Measurement., Springer Berlin Heidelberg, 2010,
2. www.bipm.org
3. www.electropedia.org

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00