



Course title: Electrical measurement and thermovision II

ECTS credit allocation (and other scores): 3

Semester: spring

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Engineering and technology

Language: English

Number of hours per semester: 15+15

Course coordinator/ Department and e-mail: Maciej Neugebauer, Department of Electrical, Power, Electronic and Control Engineering, mak@uwm.edu.pl

Type of classes: classes and lectures

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#### Substantive content

**CLASSES:** Measurements of basic electrical quantities: current, voltage, power, resistance in AC and DC circuits. Calculation of absolute and relative errors of measurement. Transfer of measurement uncertainties. Mathematical analysis of the obtained results: interpolation, extrapolation and approximation. Analysis of systematic and random errors. Analysis of the taken infrared photos. Temperature measurements with thermocouples, liquid and resistance thermometers. Measurements with a pyrometer, determination of the emissivity coefficient of various materials.

**LECTURES:** Basic concepts of measurement theory and metrology. Measurement errors. Measurement uncertainty and measurement error. Absolute and relative errors of measurement with analog and electronic meters. Analysis of uncertainties type A and B.. Physical basics, principles of operation and construction of analog meters. Construction and operation of electronic (digital) meters. Temperature measurements - liquid, resistance and thermocouple thermometers. Physical basics of thermal imaging - the principle of operation of a pyrometer and a thermal imaging camera.

**Learning purpose:** Ability to: calculus of measurement uncertainties, measurements and thermal imaging analysis.

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On completion of the study programme the graduate will gain:

**Knowledge:** Know basic concepts, mathematical description used in measurements and in measurement uncertainty.

**Skills:** Able to design and connect simple measuring system for various physical parameters.

**Social Competencies:** Understands the need to learn and improve throughout their professional career.

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**Basic literature:** J. Bentley, Principles of Measurement Systems, Pearson 2005; W. Nawrocki, Measurement Systems and Sensors, ArtechHouse 2005; BROCK, Fred V., et al. Meteorological measurement systems. Oxford University Press, USA, 2001.

**Supplementary literature:**

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The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 79

Student's independent work: 73