



Subject card

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|---|--|---|-------------------------------------|------------|--|---------|-----|
| Subject name and code | Basics of Electronics and Metrology, PG_00047648 | | | | | | |
| Field of study | Informatics | | | | | | |
| Date of commencement of studies | October 2021 | Academic year of realisation of subject | | | 2021/2022 | | |
| Education level | first-cycle studies | Subject group | | | Obligatory subject group in the field of study | | |
| Mode of study | Full-time studies | Mode of delivery | | | at the university | | |
| Year of study | 1 | Language of instruction | | | Polish | | |
| Semester of study | 2 | ECTS credits | | | 3.0 | | |
| Learning profile | general academic profile | Assessment form | | | assessment | | |
| Conducting unit | Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Sylwia Babicz-Kiewlicz | | | | | |
| | Teachers | dr hab. inż. Wiesław Kordalski mgr inż. Tomasz Chłudziński dr inż. Maciej Wróbel dr inż. Michał Ryciewicz dr inż. Stanisław Galla dr inż. Sylwia Babicz-Kiewlicz | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 30.0 | 0.0 | 30.0 | 0.0 | 0.0 | 60 |
| | E-learning hours included: 0.0 | | | | | | |
| | Adresy na platformie eNauczanie: Podstawy Elektroniki i Metrologii 2022 - Moodle ID: 20088 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=20088 | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | | Self-study | SUM | |
| | Number of study hours | 60 | 2.0 | | 13.0 | 75 | |
| Subject objectives | Acquirement of basic knowledge and skills in the field of electronics and metrology | | | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
|-------------------|--|---|---|
| | [K6_W42] Knows and understands, to an advanced extent, architecture, design principles and methods of hardware and software support for local and distributed information systems, including computing systems, databases, computer networks and information applications, as well as the principles of human cooperation with computers and computer-aided teamwork | Student understands the concept of the measurement system. Performs experiments using dedicated programs and computer-assisted measurement equipment. | [SW3] Assessment of knowledge contained in written work and projects |
| | [K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions | Student performing experiments on a analyzes their course and effect in real time. Is able to predict the expected result of the measurement and react in case of the wrong course of the experiment. Understands the basic electrical phenomena occurring in electronic systems and can use this knowledge during the experiment. | [SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools |
| | [K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions | Student calibrates analog and digital electrical meters. Performs measurements of basic electrical parameters: voltage, current, resistance, power and energy. Explores measurement functions of analog and digital oscilloscope. Measures signal parameters: time, frequency, phase shift. Student organizes measurement system and measures parameters of selected A/D converters. Analyzes measurement results and evaluate measurement accuracy. Student defines signal types and timings. Recognizes basic properties of periodic and non-periodic signals spectrum. Classifies signal sources and RC circuits. Describes operational amplifiers and RC and relaxation oscillators. Explains digital measurement methods of time, frequency and phase shift. Describes rules of voltage to digital code conversion. Student recognizes architecture and operation modes of analog and digital oscilloscope. Classifies measurement systems and interfaces. Performs measurements of basic electrical parameters. Student organizes measurement system and measures parameters of selected A/D converters. Explores basic układy pracy tranzystora. Performs measurement of frequency characteristic of operational, resonant and audio frequency amplifiers. | [SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools |
| | [K6_W05] Knows and understands, to an advanced extent, methods of supporting processes and functions, specific to the field of study | Student understands the concept of the measurement system. Knows the simplified construction and tasks of the measuring system. Recognizes the need to properly build the system in the context of performed tasks. Kows alternative programming environments used in building a measurement system. | [SW1] Assessment of factual knowledge |

| | Course outcome | Subject outcome | Method of verification |
|--|--|--|---------------------------------------|
| | [K6_W06] Knows and understands the basic processes occurring in the life cycle of devices, facilities and systems specific to a given field of study. | Student knows and understands the processes that cause the uncalibration of measuring instruments. Is able to determine and qualify the reasons for the change of the boundary error value of the device. Understands the need to operate the device under certain conditions and the risk associated with working outside the rated conditions. | [SW1] Assessment of factual knowledge |
| Subject contents | <p>1. Introduction to basic of electronics. 2. Electronic signals: kind and their cours time, into it : detailed description of harmonical signal, AM, FM, PM signals. 3. Spectrum of periodic signals: Fourier sequence, examples of signals abouy different spectra, into it spectrum of rec-tangular wave and AM signal. 4. Distortions of periodic signals: unlinear distortions (intermodulation) and linear distortions, influence of freguency characteristic of road on form of signal, typical distortions of rectangular wave. 5. Spectrum of periodic signal: Fourier integral, spectrum of rectangular pulse, spectrum of acoustic and video signals. 6. Noises, digital signals and principles of convection of analog signals to didital signals, into it Nyquist condition. 7. Sources of signals, electric sources and measures of signals, into it: a statement about supplementary source, electronic circuits as sources of signals, absolute and relative signals. 8. RC circuits and their influence on electronic signals: switching of circuit, integral and compensate circuits, elementary low-pass and high-pass filters. 9. Voltage and current resonance, resonance LC circuits, quartz resonator. 10. Detection, demodulation and decoding of sugnals. 11. Amplification of signals transistors. 12. Amplifier with negative feedback, differential amplifier, push-pull and operational amplifier. 13. Harmonic generators. 14. Relaxetion oscillators. 15. Signal synchronisation. 16. Introduction. Basic metrological terms: measurement, converter, measuring instrument and system, measurement errors, standard and extended uncertainty. 17. Analog oscilloscope: Block diagram, principles of operation. 18. Time base generator, triggering methods. 19. Oscilloscope measurement methods: phase, pulse parameters, observation of device characteristics. 20. Digital method of time-interval measurement, +/-1 count error. 21. Digital methods of low and high frequency measurements. 22. Phase measurements. 23. Classification and characterization of digital voltage measurements methods. 24. Dual-slope integration ADC. 25. Voltage to frequency integration ADC. 26. DACs with binary weighted resistors and R-2R ladder. 27. Compensation ADC with successive-approximation. 28. Flash ADC. 29. Measurements of AC voltage, AC/DC converters of true RMS value. 30. Digital multimeters: 2 & 4-wire resistance to voltage converters. 31. Digital storage oscilloscope, architecture, sampling techniques, modes of operations, applications. 32. Digital measurement methods of impedance parameters R, L, C, Z . 33. Classification and characterization of measuring systems. 34. Measuring systems based on general purpose interface bus (GPIB), signals and lines, three wire handshake process. 35. Creating of virtual instruments.</p> | | |
| Prerequisites and co-requisites | | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Colloquiums | 50.0% | 50.0% |
| | Practical exercises | 50.0% | 50.0% |
| Recommended reading | Basic literature | <ol style="list-style-type: none"> Taylor J. R., Wstep do analizy błędu pomiarowego, PWN, Tumański S., Technika pomiarowa, WNT, Chwaleba A., Poniński M., Siedlecki A., Metrologia elektryczna, WNT, Stabrowski M., Cyfrowe przyrządy pomiarowe. PWN, Nawrocki W., Komputerowe systemy pomiarowe, WKiŁ, Dusza J. i inni, Podstawy miernictwa. Wyd. Politechniki Warszawskiej Guide to the Expression of Uncertainty in Measurement. Wydanie polskie: Wyrażenie niepewności pomiaru, Przewodnik, Główny Urząd Miar Sedra A., Microelectronic circuits, HRW, New York, Osiowski J., Szabatin J., Podstawy teorii obwodów, t.2, WNT, Stabrowki M., Cyfrowe przyrządy pomiarowe, PWN, Instrukcje i materiały pomocnicze do laboratorium | |
| | Supplementary literature | A. Filipkowski: Układy elektroniczne analogowe i cyfrowe, WNT | |
| | eResources addresses | Podstawy Elektroniki i Metrologii 2022 - Moodle ID: 20088 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=20088 | |
| Example issues/ example questions/ tasks being completed | | | |
| Work placement | Not applicable | | |