FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE - LUBLIN UNIVERSITY OF TECHNOLOGY - PL LUBLIN03

Courses available at the Faculty of Electrical Engineering and Computer Science

2024/2025

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REMARKS:

1. In square brackets, the course code and availability are given. ❄ – available in winter, ☼ – available in spring
2. Duration of all courses is 1 semester.
3. Semester: winter and/or summer means that the same course repeats in the winter and summer semester. Otherwise in the indicated semester ONLY.
4. The applying student can select up to 32 ECTS (1 semester mobility) or up to 62 ECTS (whole year mobility).
5. Up to 30% of courses specified in the Learning Agreement (LA) can be subjects offered by the other faculties of the Lublin University of Technology.
6. Upon arrival, the student is entitled to change up to 30% of courses listed in his/her Learning Agreement (LA). The “During the mobility” form must be delivered to the Coordinator no later than 21 days after the organizational meeting.
7. When the number of students applying for a course is less than specified in the catalogue, the faculty will have the right to cancel the course. In this case, the student should amend his/her Learning Agreement.
8. Please pay attention to the preliminary requirements.

Last update: 2024-09-17

Advanced Energy Sources [E001 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 10

PRELIMINARY REQUIREMENTS: basics of chemistry and physics
CONTENTS: Introduction of the laboratory and subject. Energy resources- general evaluation, Energy from non-renewable resources: coal, petroleum, natural gas, methane hydrates. Nuclear Energy: fusion, fission. Energy from renewables: geothermal energy. Hydropower. Solar energy. Wind energy. Solar and wind architecture.
Energy from biomass, biofuels. Hydrogen fuel cells, batteries, energy efficient devices, electrical grid.
EFFECTS OF EDUCATION PROCESS: Students will gain basic knowledge about generation of energy from variety of resources. Simple problems related to availability of resources, efficiency, economical, societal and ecological aspects of energy generation will be analysed.
LITERATURE: 1. . Ghosh, M. Prelas “Energy Resources and Systems: Volume 2: Renewable Resources”, [ED:] R. Rugescu “Solar power”
TEACHING METHODS: Lecture
ASSESSMENT METHODS: Activity in the class, oral presentation, panel presentation, report and attendance.
TEACHER: Joanna Pawłat, j.pawlat@pollub.pl

Algebra [E003 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and discussion
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Essentials of high school algebra and trigonometry

CONTENTS:

Complex numbers. Definition and properties of complex numbers, geometric interpretation, polar representation, exponential form, DeMoivre theorem, roots of complex numbers.

Polynomials. Definition and properties, divisibility, roots of polynomials, the fundamental theorem of algebra, partial fraction decomposition.

Matrices and determinants. Definition of a matrix, addition and multiplication of matrices, determinants and its properties, Laplace expansion, inverse matrix.

Systems of linear equations. Definitions, Cramer's theorem, method of matrix inversion, the rank of a matrix, fundamental theorem for systems of linear equations, Gaussian –Jordan elimination.

Analytical geometry. The algebra of vectors, products of vectors, equations of straight lines and planes in Euclidean space.

Eigenvalues and eigenvectors. Similar matrices, the characteristic polynomial, Cayley –Hamilton theorem, diagonalization theorem

Conic sections. Definition and properties of a circle, ellipse, parabola and hyperbola.

EFFECTS OF EDUCATION PROCESS: The purpose of this course is to introduce students to ideas and techniques from linear algebra. This course teaches students understanding basic concepts of algebra, which are used to solving engineering and computer science problems.

LITERATURE:

1. Anthony M and Harvey M. – Linear Algebra: Concept and Methods, Cambridge University Press, 2012,
2. Vaisman I. – Analytical Geometry, World Scientific, 1997.

TEACHING METHODS: lecture, class discussion

ASSESSMENT METHODS: 40% - Final Exam, 60% - Homework

TEACHER: Ph.D. Iwona Malinowska, i.malinowska@pollub.pl

Applications of photonics and optoelectronics [E091 ❄ ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: lecture, laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Fundamentals of optoelectronics, Fundamentals of metrology.
CONTENTS: Waveguide transducers and sensors. Definitions. Classification of waveguide sensors. Light modulators for waveguide sensors. Bulk modulators. Planar modulators. Fiber optic modulators. Fiber optic sensors. Intensity based sensors. Reflective sensors. Transmission loss sensors. Bending loss sensors. Interferometric sensors. Modal interferometric sensors. Methods of detecting signals from interferometric sensors. Homodyne detection. Heterodyne detection. White light interferometric sensors. Fiber Bragg grating sensors. Types of fiber Bragg gratings. Fiber Bragg gratings as measurement transducers. Optical wavelengths demodulators for fiber Bragg grating sensors. Fiber Bragg grating laser sensors. Multipoint and distributed sensors. Distributed sensors using Rayleigh scattering. Raman and Brillouin based distributed sensors. Measuring systems for distributed sensors. Optical time-domain reflectometers. Coherent optical time-domain reflectometers. Optical frequency domain reflectometers. Multipexing fiber optic sensors. Time division multiplexing. Wavelength division multiplexing. Code division multiplexing. Coherence multiplexed sensors
EFFECTS OF EDUCATION PROCESS: knowledge of the principle of operation, metrological parameters, application and methods of designing the most widely used fiber optic and integrated optic sensors and measuring systems
LITERATURE
TEACHING METHODS: lecture, laboratory experiments
ASSESSMENT METHODS: reports from laboratory experiments, oral exam.
TEACHER: Cezary Kaczmarek, c.kaczmarek@pollub.pl

Artificial intelligence [E084 ❄ ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: lecture
NUMBER OF HOURS: 45 = 30(lecture)+15(project)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basics of programming
CONTENTS: Artificial intelligence introduction, basic terms and solutions. Present models of artificial intelligence. Neural networks. Genetic algorithms. Decision trees. Artificial intelligence in computer games. Fuzzy logic. Optimisation.
EFFECTS OF EDUCATION PROCESS: Competence to adjust proper AI technique to chosen application. The knowledge about AI solutions and their applications.
LITERATURE: (optional) 1. .
TEACHING METHODS: *Lecture, discussion*
ASSESSMENT METHODS: Final coursework assessment - test
TEACHER: Ph.D. Grzegorz Kozieł g.koziel@pollub.pl

Automatics and Automatic Control 1 [E004 ❄]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: lecture/laboratory
NUMBER OF HOURS: 30+30 (lecture + laboratory)	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Linear algebra
CONTENTS: Introduction to automatics – short history, control system and related nations, classification of control systems, System models – differential equations, state equations, Linearization of models, Laplace transform, transfer function, Time responses – impulse and step response, Frequency responses – Nyquist plot, Bode plots, Basic dynamics elements – first order system, integrator, differentiator, second order systems, systems with delay, Structure of control system – examples of control systems, description of closed-loop systems, Closed loop system stability – Hurwitz criterion, Nyquist criterion, Quality of control – analyses of steady state, method based on roots placement, method based on integral indices, Compensators and regulators - PID controller, PID controller parameters tuning – Ziegler-Nichols methods, Chien, Hrones and Reswick methods.
EFFECTS OF EDUCATION PROCESS: Students will gain knowledge about structure and functionality of open- and closed-loop control systems. Students will have ability to analyse and design of simple control systems.
LITERATURE: 2. . Gessing R., Control fundamentals, Wyd. Politechniki Śląskiej, Gliwice 2004
TEACHING METHODS: *Lecture + laboratory exercises*
ASSESSMENT METHODS: Oral/written examination
TEACHER: Adam Kurnicki, a.kurnicki@pollub.pl

Automatics and Automatic Control 2 [E005 ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: Lecture/Laboratory
NUMBER OF HOURS: 30+30 (lecture + laboratory)	ECTS: 5
SEMESTER: summer	CLASS LEVEL: I,II
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Automatics and Automatic Control I
CONTENTS: *Discrete-time functions and Z transform – properties of Z-transform, Inverse Z-transform, Systems with sampling, Discrete-time transfer function, Closed-loop system description using discrete-time transfer function, Closed-loop discrete-time systems stability analyses, Design of discrete-time regulators - digital realization of PID controllers, Analysis and construction of binary circuits – boolean algebra, logic gates, Combinational Circuit design – simplification of Boolean expressions, function minimization methods, Sequential system design – Huffman method, flip-flop circuits.*
EFFECTS OF EDUCATION PROCESS: Students will gain knowledge about structure and functionality of digital control systems. Students will have ability to analyse and design of simple digital control systems.
LITERATURE: 1. . Gessing R., Control fundamentals, Wyd. Politechniki Śląskiej, Gliwice 2004
TEACHING METHODS: *Lecture + laboratory exercises*
ASSESSMENT METHODS: Oral/written examination
TEACHER: Adam Kurnicki, a.kurnicki@pollub.pl

Biomechatronics [E082 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30+20	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	Minimum number of students required to start: 5

PRELIMINARY REQUIREMENTS: None
CONTENTS: Fundamentals of mechatronics. Blood pressure measurement, types of blood pressure monitors, pulse wave measurement. Biomechatronics in nephrology, kidney dialysis, artificial kidney. Cardiostimulators, valve prostheses, angioplasty. Artificial lung ventilation, types of ventilators. Neonatology and incubators. Musculoskeletal prostheses. Bionic prostheses and exoskeletons. Hearing and speech prostheses. Biomechatronics in rehabilitation, rehabilitation robots. Endoscopes – rigid, flexible and video. Laparoscopy. Ultrasonography (classic, doppler, elasto, etc.), transducers, graphic post-processing. Thermography. Cardiovascular support, counterpulsation methods, peristaltic pumps, artificial hearts. Medical robots. MEMS, NEMS, MOEMS in biomechatronics. Lasers in medicine.
EFFECTS OF EDUCATION PROCESS: Acquaintance in applications of mechatronics in medicine.
LITERATURE: 1. . 2. .
TEACHING METHODS: theory – lecture, practice - laboratory
ASSESSMENT METHODS: Oral/written examination + project
TEACHER: Andrzej Smolarz, prof, a.smolarz@pollub.pl, Róża Dzierżak, r.dzierzak@pollub.pl

C programming [E008 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	Minimum number of students required to start: 5

PRELIMINARY REQUIREMENTS: Knowledge of any other programming language
CONTENTS: Presentation of the laboratory curriculum and principles of the coursework assessment. Material consolidation on C programming: variable types, control statements, arrays, structures, pointers, functions, dynamic memory allocation, files and input output operations. Final coursework assessment.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of C programming language. Learning the skills of using C capabilities.
LITERATURE: 3. Kernighan Brian W., Ritchie Dennis M., The C Programming Language, Second Edition, Prentice Hall, Inc., 1988. 4. Steve Oualline, Practical C Programming, 3rd Edition, O'Reilly 1997
TEACHING METHODS: theory – lecture, practice - laboratory
ASSESSMENT METHODS: Final coursework assessment (40% - test, 60% - final project)
TEACHER: Jerzy Montusiewicz, prof, *j.montusiewicz@pollub.pl*

Calculus 1 [E009 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and discussion
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Essentials of high school mathematics
CONTENTS: Basic notions about sequences and functions. Elementary functions and their properties. Calculating limits of functions. Derivatives and differentiation formulas. Mean-value theorems. Tests for local extrema. Taylor's formula and Taylor's series. Convexity, points of inflection. Evaluation of indeterminate forms and the l'Hôspital's rule. Asymptotes, sketching the graph of a function. Implicit differentiation. Indefinite integrals, integration methods. Definite integrals and their applications to geometry and physics.
EFFECTS OF EDUCATION PROCESS: Acquainting students with notions of calculus like derivatives and integrals and applying them to solving problems in geometry and physics.
LITERATURE: 1. Marsden J., Weinstein A., Calculus I, II, Springer, 1985.
TEACHING METHODS: lecture-discussion format
ASSESSMENT METHODS: homework assignments , final exam
TEACHER: PhD. Ernest Nieznaj, e.nieznaj@pollub.pl

Calculus 2 [E010 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and discussion
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Essentials of Calculus 1
CONTENTS: Functions of several variables: limits and continuity. Calculating partial derivatives, chain formula, curvilinear coordinates. Especially polar, spherical and cylindrical coordinates. Geometric notions: tangent plane, gradient, local extrema and saddle points. Lagrange multipliers. Double, triple and line integrals and their applications to geometry and physics problems. Elements of vector field theory, divergence, curl, Green's formula, Gauss-Ostrogradsky theorem and its applications.
EFFECTS OF EDUCATION PROCESS: Learning and understanding main concepts of advanced calculus.
LITERATURE: 1. Ghordape S. R., Limaye B.V. – A course in multivariable calculus and analysis, Springer, 2010. 2. Apostol T.M. – Calculus, Vol. 2, Wiley, 1969.
TEACHING METHODS: lecture-discussion format
ASSESSMENT METHODS: homework assignments , final exam
TEACHER: Ph.D. Ernest Nieznaj, e.nieznaj@pollub.pl

Circuit Theory part 1 [E011 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of mathematics and physics
CONTENTS: Units associated with basic electrical quantities. An introduction to electric circuits. Resistance variation. Series circuits. Potential divider. Parallel networks. Current division. Resistive Circuits. Capacitors and capacitance. Magnetic circuits. Electromagnetic induction. Inductance. DC circuit theory: Kirchhoff's laws, the superposition theorem. Thevenin's theorem. Norton's theorem. Maximum power transfer theorem. Alternating voltages and currents. Single-phase series and parallel AC circuits. DC transients (RC circuit, RL circuit).
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of Electric Circuits Theory. Learning the methods of the solution basic examples of electric circuits.
LITERATURE: 1. John Bird, Electrical Circuit Theory and Technology, Newnes, Oxford, 2003. 2. Charles K. Alexander, Matthew N.O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Companies, New York 2009
TEACHING METHODS: multimedia lectures with computational examples
ASSESSMENT METHODS: Two coursework assessment tests.
TEACHER: Paweł Surdacki, Ph.D. (Eng.), D.Sc., Associate Professor, p.surdacki@pollub.pl

Computational bioelectromagnetics [E085 ❄ ☼]]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture, laboratory
NUMBER OF HOURS: 15 lectures, 30 laboratory	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Electromagnetic field theory, Partial differential equations.

CONTENTS:

Basic concepts of electric and magnetic field:

Electric and magnetic field conceptcs. Maxwell's equations. Boundary conditions for lossless and lossy materials. Energy absorption. Pennes bio-heat transfer equation.

Low-frequency approximations.

Bioelectromagnetic dosimetry:

Electric properties of the human body. Human models. Specific Absorption Rate (SAR).

Numerical models for bioelectromagnetic simulations.

Electromagnetics in medicine:

Hyperthermia. Magnetic hyperthermia. Transcranial magnetic stimulation (TMS).

Radiofrequency ablation.

EFFECTS OF EDUCATION PROCESS:

knowledge of the basic concepts, fundamental principles and characteristics behavior of electromagnetic field interaction with biological systems.

LITERATURE:

1. C. Furse, D. A., Christensen, C. H. Durney, Basic Introduction to bioelectromagnetic, CRC Press 2008.

TEACHING METHODS: lecture, laboratory

ASSESSMENT METHODS: reports from laboratory experiments.

TEACHER: Arkadiusz Miaskowski,, Ph.D. (Eng.), D.Sc., Associate Professor, a.miaskowski@pollub.pl

Circuit Theory part 2 [E012 ☼]]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of mathematics and physics
CONTENTS: Revision of complex numbers. Application of complex numbers to analysis of series and parallel AC circuits. Power in AC circuits. Series and parallel resonance and Q-factor. Network analysis. Mesh-current and nodal analysis. The superposition, Thevenin's and Norton's theorems. Delta-star and star-delta transformations. Maximum power theorems and impedance matching. Three-phase systems. Transformers.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of Electric Circuits Theory. Learning the methods of the solution basic examples of electric circuits.
LITERATURE: 1. John Bird, Electrical Circuit Theory and Technology, Newnes, Oxford, 2003. 2. Charles K. Alexander, Matthew N.O. Sadiku, Fundamentals of Electric Circuits, McGraw-Hill Companies,New York 2009..
TEACHING METHODS: multimedia lectures with computational examples
ASSESSMENT METHODS: Final coursework assessment (100% - test)
TEACHER: Paweł Surdacki, Ph.D. (Eng.), D.Sc., Associate Professor, p.surdacki@pollub.pl

Computer architecture and organisation [E013 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 10

PRELIMINARY REQUIREMENTS: None
CONTENTS: Basic computer system components, basic interactions between computer system components, hardware aspects of programming, interconnection, bus standards, memory basics, cache memory, system memory, mass storage, input/output system, programming I/O, CPU basics, microprogramming, instruction set architectures, pipelining, superscalar architecture, application specific architectures, multiprocessor/multicore architectures.
EFFECTS OF EDUCATION PROCESS: Knowledge in hardware aspects of computer system performance. .
LITERATURE: 1. William Stallings, Computer Organization and Architecture,6th Ed, Pearson Education Inc. (Prentice Hall), 2003,
TEACHING METHODS: lecture
ASSESSMENT METHODS: final exam
TEACHER: Andrzej Smolarz, prof, a.smolarz@pollub.pl

Computer graphics fundamentals [E014 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basic computer knowledge

CONTENTS:

The course covers: principles of 2D graphics (color, raster, image type, image transformations, geometry transformations, curves, tools), principles of 3D graphics (basic notions, 3D objects, transformations and geometry, projection, basics of lighting, models and shading, texturing of 3D objects - simple and UV coordinates), introduction to 2D animations, motion and shape animation, morphing, introduction to 3D animation - animation of position, shape, lighting, simple effects.

EFFECTS OF EDUCATION PROCESS:

Student will get acquainted with basic principles of computer graphics, starting from the definitions of color, resolution etc, digital 2D and 3D image construction, followed by explanation of simple image transformation methods and the principles of animation.

LITERATURE:

1. James D. Foley, John F. Hughes, Andries van Dam, Steven Feiner, Computer Graphics: Principles and Practice (third edition), Addison-Wesley Professional, 2013

TEACHING METHODS: theory – lecture, practice - laboratory

ASSESSMENT METHODS: Final coursework assessment (40% - test, 60% - final project)

TEACHER: Jacek Kęsik, j.kesik@pollub.pl

Computer networks [E015 ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture+ laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: None
CONTENTS: Packet-switched data transmission. Computer networks standards and devices. Reference models. Network types, topologies. Structured cabling basics and standards. Physical layer. Media Access mechanisms. IEEE802 standards: Ethernet, Token Ring and FDDI networks. Wireless Networks (IEEE 802.11 and Bluetooth). The Network Layer design issues. IP protocol. Routing. Internetworking. ARP & RARP protocols. ICMP protocol. Ping program. Broadcasting & multicasting. The transport layer. The internet transport protocols TCP, UDP. Performance issues. Application layer. Dynamic Name System. DNS Resource Records; BOOTP & DHCP. Remote logon. Telnet. File Transfer Protocol. Electronic mail protocols SMTP, POP, IMAP. HTTP protocol features. Network security. The basis of SSH, SLL and IPSec. VPNs.
EFFECTS OF EDUCATION PROCESS: Knowledge in structure and protocols of computer networks on various layers. Basics of network management.
LITERATURE: 1.
TEACHING METHODS: lecture, project, laboratory
ASSESSMENT METHODS: Final coursework assessment
TEACHER: Konrad Gromaszek, k.gromaszek@pollub.pl

Computer systems security [E016 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 45 = 30(lecture)+15(project)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basics of operating systems, basics of networking
CONTENTS: Virtualization, cryptography and steganography basics, encryption, threats in information systems, hash functions, digital signature, malware and protection against it, hacking and a defence against it, penetration tests, threats in the Internet – how to recognize and protect against them.
EFFECTS OF EDUCATION PROCESS: Competence to adjust proper security technique to chosen apply. The knowledge about IT systems protections.
LITERATURE: (optional) 1.
TEACHING METHODS: lecture, discussion
ASSESSMENT METHODS: Final coursework assessment - test
TEACHER: Ph.D. Grzegorz Kozieł, g.koziel@pollub.pl

Data warehousing and business intelligence [E017 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 20lecture+20lab	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basic knowledge of issues related to the relational databases
CONTENTS: The role and the place of the data warehouse in the information system of the contemporary enterprise. Differences between data marts and data warehouses and areas of its implementation. Designing the conceptual model of the data warehouse. Data models used in data warehouses. Designing the structure of the database of data warehouse according to the analytical needs of the end-user. Implementing the database of the data warehouse using MySQL or Oracle platform. The role of business intelligence (BI) in decision making. The contemporary business intelligence tools and their functionalities. Designing the analytical reports and dashboards using BI tool (Tableau Desktop).
EFFECTS OF EDUCATION PROCESS: The student has the knowledge and skills to design and implement the database for a data warehouse that supports decision making in a chosen area of reality and satisfies the information needs of the end-user. The student also knows business intelligence tool and is able to use it to prepare analytical reports and dashboards.
LITERATURE: 1. Alejandro Vaisman, Esteban Zimányi, *Data Warehouse Systems: Design and Implementation*, Springer-Verlag Berlin Heidelberg, 2014 2. Ralph Kimball, Margy Ross, *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling,* Wiley, 2013 3. Alexander Loth, *Visual Analytics with Tableau*, Wiley, 2019
TEACHING METHODS: lecture, laboratory
ASSESSMENT METHODS: The final project of the database in the data warehouse (50%), Final test with the use of Tableau Desktop (50%)
TEACHER: Piotr Muryjas, p.muryjas@pollub.pl

Databases fundamentals [E018 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 20lecture+20lab	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basic knowledge of issues related to software engineering
CONTENTS: The role and the place of the databases in the information system of the contemporary enterprise. Types of contemporary databases and areas of its implementation. Designing the structure of the relational database according to the information requirements of the end-user and predefined specification of the functionalities of IT system (MySQL Workbench, Oracle SQL Developer Data Modeler). Implementing the structure of the relational database using SQL commands in MySQL and Oracle environments. Management of the relational database and its objects using SQL statements in MySQL and Oracle environments. Inserting data into the database (MySQL, Oracle), updating and deleting data. Defining the queries to the relational database (MySQL, Oracle) using SELECT statement. Data processing using the procedural extension of the SQL on the MySQL and Oracle platform.
EFFECTS OF EDUCATION PROCESS: he student has the knowledge and skills to design and implement the relational database that supports the chosen area of reality and satisfies the information needs of the end-user. The student also knows and is able to realize the basic operations performed by the administrator of the relational database. The student is able to explore the relational database using SQL commands and process data using a procedural approach.
LITERATURE: 1. David M. Kroenke, David J. Auer, Scott L. Vandenberg, Robert C. Yoder, Database Processing Fundamentals, Design, And Implementation, Pearson, 2018 2. Ben Brumm, *Beginning Oracle SQL for Oracle Database 18c: From Novice to Professional*, Apress, 2019 3. Vinicius M. Grippa and Sergey Kuzmichev, Learning MySQL. Get a Handle on Your Data, O'Reilly Media, Inc., 2021
TEACHING METHODS: lecture, laboratory
ASSESSMENT METHODS: Final project of the database (60%), Final SQL test (40%)
TEACHER: Piotr Muryjas, p.muryjas@pollub.pl

Digital signal processing [E019 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Linear algebra
CONTENTS: Signals - classification, basic 1D signals. Discrete systems –examples. Properties of LTI systems (also in frequency domain). Expansion of continuous function in a series of the orthogonal function Fourier Transform (continuous) - properties. Examples of FT calculation, Sampling Theorem. Short-Time Fourier Transform, Time-frequency resolution. Heisenberg Uncertainty principle, Wavelet transformation – continuous and discrete, Multiresolution analysis. Wavelet properties, Z- transform – properties, examples, Region of Convergence. Properties of the Z- Transform. FFT algorithms – DIT (Decimation in Time) and DIF (Decimation in Frequency). Digital Filters.
EFFECTS OF EDUCATION PROCESS: Students will gain knowledge about basic properties of both digital signals and systems. Special attention is paid to signal transformations and their practical use by doing projects that would provide better understanding of lecture topics.
LITERATURE: 2. Oppenheim, Alan V.; Schafer, R. W.; and Buck, J. R. Discrete-time signal processing. Upper Saddle River, N.J.: Prentice Hall, 1999.
TEACHING METHODS: Lecture, project
ASSESSMENT METHODS: Oral/written examination + project
TEACHER: Andrzej Kotyra, a.kotyra@pollub.pl

Discrete mathematics [E020 ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture,
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: I/II
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Essentials of high school calculus and algebra.
CONTENTS: Tautology or fallacy. Basic rules of reasoning. Quantifiers. Naive set theory. Operations on sets. Cartesian product. Relation and functions. Equivalence relation. Order relation. Multiplication and Addition Principles. The law of inclusion-exclusion. Division and factorization. Greatest common divisor. Euclid's algorithm. Homogeneous and non-homogeneous linear recurrence relations. Basic notions of graph theory. Matrix graphs representations. Complexivity. Acyclic graphs and trees. Eulerian and Hamiltonian graphs.
EFFECTS OF EDUCATION PROCESS The goal of this course is to introduce students to ideas and techniques from discrete mathematics that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving engineering and computer science problems.
LITERATURE: 1. K. A. Ross, C. R. B. Wright, Discrete Mathematics, Pearson Education, Inc. 2003 2. E. Lehman, T. Leighton, A. R. Meyer, Mathematics for Computer Science, Samurai Media Limited, 2017
TEACHING METHODS: lecture, class discussion
ASSESSMENT METHODS: written final exam
TEACHER: Ph.D. Adam Gregosiewicz a.gregosiewicz@pollub.pl

Electromagnetic Field Theory 1 [E025 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of mathematics and physics
CONTENTS: Vector analysis: gradient, divergence, rotation, Nabla and Laplace operators. Electrostatic field: electric charge, field intensity, flux density, Coulomb's and Gauss' laws. Work in electrostatic field, electric potential, equipotential surfaces, relationship between E and V, energy in static electric fields. Electrostatic field in matter: electrical properties of matter, dielectrics and polarization, the relative permittivity, conductor in an electrostatic field, the electrostatic induction, dielectric strength, interface conditions, capacitance. Methods of solving electrostatic problems. Currents and conductors: charges in electric field, conduction current density, current distributions, continuity of current, static electro-conductive field, resistance and Ohm's law, power losses, interface conditions.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of Field Theory in Electrical Engineering. Learning the solution methods of the basic examples in electrostatic and conductive fields in 2D and 3D space.
LITERATURE: 1. Paweł Jabłoński: Engineering Physics –Electromagnetism. Handbook (EFE, sem. 2), Czestochowa University of Technology, 2009. (also in an electronic version)
TEACHING METHODS: multimedia lectures with practical examples
ASSESSMENT METHODS: Two coursework assessment tests.
TEACHER: Paweł Surdacki, Ph.D. (Eng.), D.Sc., Associate Professor, p.surdacki@pollub.pl

Electromagnetic Field Theory 2 [E026 ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of mathematics and physics
CONTENTS: Magnetostatics: Biot-Savart and Ampere's laws. Magnetic field intensity and flux density distributions in a cylindrical wire and cylindrical coil with current. Divergence and curl of magnetic field intensity and flux density in different coordinate systems. Relationship of current density and magnetic field intensity. Magnetic flux. Equations of magnetostatic field. Magnetic scalar and vector potentials. Poisson's and Laplace's equations. Interface conditions on the boundary of two media. Magnetic lines refraction. Magnetic screening. Self-inductance and mutual inductance. Coupling coefficient. Reluctance in a magnetic circuit. Energy of magnetic field. Density of magnetic field energy. Maxwell's equations.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of Field Theory in Electrical Engineering. Learning the solution methods of the basic examples in magnetostatic field in 2D and 3D space.
LITERATURE: 1. Paweł Jabłoński: Engineering Physics –Electromagnetism. Handbook (EFE, sem. 2), Czestochowa University of Technology, 2009. (also in an electronic version)
TEACHING METHODS: multimedia lectures with practical examples
ASSESSMENT METHODS: Two coursework assessment tests.
TEACHER: Paweł Surdacki, Ph.D. (Eng.), D.Sc., Associate Professor, p.surdacki@pollub.pl

Electronic circuits (Electronics 2) [E027 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture + laboratory/project
NUMBER OF HOURS: 60 (30 lecture, 30 practise)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I/II
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 10

PRELIMINARY REQUIREMENTS: Advanced knowledge in electronics, e.g. Electronics 1
CONTENTS: Analog Circuits: Transistor amplifiers, Operational amplifiers and their applications, analogue filters, nonlinear circuits - limiters, rectifiers, analogue to digital interface; Digital circuits: combinatory logic, latches, registers, counters, automats. Design and laboratory tests of chosen circuits
EFFECTS OF EDUCATION PROCESS: Knowledge in operation principles of analogue and digital electronic circuits. Knowledge in basics of electronic circuit design.
LITERATURE: 1.
TEACHING METHODS: lecture, project
ASSESSMENT METHODS: exam, project
TEACHER: Andrzej Smolarz, professor, a.smolarz@pollub.pl

Electronics fundamentals (Electronics 1) [E028 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture+laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Knowledge in electrical circuits, basic knowledge in solid-state physics
CONTENTS: Semiconductors; Diodes: model, applications, Zener; Transistors - bipolar: polarization, large-signal model, graphical analysis, small-signal model; Operational amplifiers: differential amplifier, properties of ideal op.amp. and real op amp, linear and non-linear applications; Digital electronics fundamentals (arithmetic, coding, gates, registers, counters, automats, memory, technologies.
EFFECTS OF EDUCATION PROCESS: Knowledge in basic electronic components and circuits operation.
LITERATURE:
TEACHING METHODS: lecture, Laboratory, project
ASSESSMENT METHODS: Final coursework assessment
TEACHER: Tomasz Zyska, t.zyska@pollub.pl

Fundamentals of algorithms [E073 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture/laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 7

PRELIMINARY REQUIREMENTS: Basic skills in programming
CONTENTS: Presentation of the laboratory curriculum and principles of the coursework assessment. Data structures in Python. Algorithms design techniques. Coding algorithms. Searching algorithms: binary search, interpolation search. Sorting algorithms: bubble sort, insertion sort, selection sort, quick sort, merge sort, heap sort, bucket sort. String–serach algorithms: Boyer-Moore, Knuth–Morris–Prat, Karp– Rabin. Partition problem.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of algorithms. The knowledge and skills to implement and solve algorithmic problems using mentioned algorithms
LITERATURE: 1. Introduction to algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press; 3rd edition (2009) 2. Algorithms + Data Structures = Programs, N. Wirth, Prentice Hall (November 1985); eBook (2017)
TEACHING METHODS: lecture, laboratory
ASSESSMENT METHODS: Final coursework assessment – 20% activity during classes, 30% programs, 50% final test
TEACHER: Małgorzata Charytanowicz, Ph.D., D.Sc., m.charytanowicz@pollub.pl

Fundamentals of electric machines [E024 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Fundamentals of electrical engineering
CONTENTS: Introduction to electromechanical energy conversion – electromagnetic induction phenomena, principles of electric machines operation. Introduction to transformers, construction and principle of operation, emf equation, transformation ratio. Equivalent circuit and its parameters, open circuit and short circuit tests, power losses and efficiency. Three phase transformer connections. Introduction to AC machines, generation of rotating magnetic field, emf equations. Construction details of AC induction machines, types of stator and rotor windings, winding coefficient. Principle of operation of AC induction motor, torque production, equivalent circuit, power balance. Slip ring and squirrel cage induction motors characteristics, starting and speed control methods. Principle of operation of synchronous machines, constructional features of round rotor and salient pole machines. Characteristics of synchronous generator, synchronization with the grid, active and reactive power regulation. Constructional details of DC machines, emf and torque equations, methods of excitation. Characteristics of separately excited, shunt and compound generators, output voltage control. Principle of operation of DC motors, characteristics of series, shunt and compound motors, methods of starting and speed control of DC motors.
EFECTS OF EDUCATION PROCESS: Student is able to explain the principles of operation of basic types of electrical machines and describe its main construction features. Student can identify main characteristics and parameters of transformers, three-phase induction machines, synchronous machines and DC machines.
LITERATURE: 1. Edwards J.D.: Electrical machines. An Introduction to principles and characteristics, Macmillan Publishing Comp., New York 2001; 2. Witczak P.: An Introductory Course on Electric Machines and Transformers, Lodz University of Technology Press, Lodz 2015; 3. Chapman S.: Electric Machinery and Power System Fundamentals, McGraw-Hill, 2001.
TEACHING METHODS: multimedia lecture, demonstrations of laboratory stands
ASSESSMENT METHODS: Written examination
TEACHER: Radosław Machlarz, PhD, r.machlarz@pollub.pl

Fundamentals of photonics and optoelectronics [E090 ❄ ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: lecture, laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Calculus of vector fields in curvilinear coordinates, Partial differential equations, Fundamentals of Electronics.
CONTENTS: Properties of light. Light as an electromagnetic wave. Geometrical and wave optics. Total internal reflection. Quantum optics. Propagation of light in anisotropic media. Electrooptic effects. Magnetooptic effects. Polarization of light. States of polarization. Description using the Jones matrix and the Poincare sphere. Retarders. Polarizers. Rotators. Optical waveguides. The concept of an optical waveguide. Intuitive model of beam propagation in a waveguide. Waveguide modes. Outline of the Beam Propagation Method. Planar waveguide. Analysis using geometrical optics. Discrete nature of propagation angles. The concept of waveguide modes. Maxwell's equations for a dielectric waveguide. Wave equation of planar waveguide. Definition of a mode. TE and TM modes. Two dimensional waveguides. Cylindrical waveguides. Optical fibers. Single mode fibers. Birefringent single mode fibers. Transmission properties of optical fibers. Attenuation. Dispersion. Nonlinear effects. Microstructred fibers. Light sources. Electroluminescent diodes. Gas lasers. Solid-state lasers. Semiconductor lasers. Single mode lasers. Tunable lasers. Semiconductor laser noise. Fiber amplifiers. Fiber amplifier noise. Amplified spontaneous emission sources. Fiber lasers. Photodetectors. Photovoltaic detectors. PN junction photodiode. PIN photodiode. Avalanche photodiode. Photodetector preamplifiers. Photodetector noise, sensitivity, signal to noise ratio. Integrated optics. Overview of fiber optic communication systems.
EFFECTS OF EDUCATION PROCESS: knowledge of the principle of operation, parameters, application and methods of designing the most widely used optoelectronic devices and systems.
LITERATURE
TEACHING METHODS: theory – lecture, programming laboratory
ASSESSMENT METHODS: reports from laboratory experiments, oral exam.
TEACHER: Cezary Kaczmarek, c.kaczmarek@pollub.pl

Fundamentals of physics [E032 ❄ ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: lecture, laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basic knowledge of mechanics, electromagnetism and optics at the secondary school level.
CONTENTS: Methods for determining the measurement uncertainty. Mechanics: mass density, uniform motion and uniformly variable motion, harmonic motion – spring and simple pendulum, acoustic waves, mechanical resonance, viscosity of fluids, thermal expansion of bodies. Optics: refractive index, microscopes, lenses - measurements of focal length, diffraction and interference of laser light, polarization of electromagnetic waves, Faraday effect. Electromagnetism: voltage, current, electrical resistance, Ohm's law, Kirchhoff's circuit laws, voltaic cells - electromotive force measurements, series RLC circuits, properties of semiconductors, Hall effect – measuring of magnetic field induction.
EFFECTS OF EDUCATION PROCESS: Students will have ability to set up simple experimental systems, to measure values of basic physical quantities and to estimate measuring uncertainties.
LITERATURE: Jearl Walker, Halliday & Resnick Fundamentals of Physics, John Wiley & Sons Inc. 2011
TEACHING METHODS: theory – lecture, laboratory experiments.
ASSESSMENT METHODS: Oral/written examination
TEACHER: Tomasz Pikula, t.pikula@pollub.pl

Geometry for computer graphics [E079 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture, project
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: knowledge of vectors, matrices, and calculus
CONTENTS: I. Transformations of the plane: translations, scaling, reflections, rotation, shears, applications. II Homogeneous Coordinates and Transformations of the Plane. III Homogeneous Coordinates: visualization of the projective, transformations in homogeneous coordinates, concatenation of transformations, applications. IV. Projections and the Viewing Pipeline: projections of the plane, projections of three-dimensional space, view-plane coordinate mapping.
EFFECTS OF EDUCATION PROCESS: Students completing this course will be able to: learn the framework and tools for solving problems in two and three dimensions geometry, which are the cornerstone of computer graphics and computer animation.
LITERATURE: 1. Duncan Marsh, Applied Geometry for Computer Graphics and CAD, Springer, 2005. 2. John Vince, Geometric Algebra: An Algebraic System for Computer Games and Animation, Springer, 2009.
TEACHING METHODS: lecture, class discussion
ASSESSMENT METHODS: 40% – final exam, 60% – homework
TEACHER: Zbigniew A. Łagodowski, professor, z.lagodowski@pollub.pl

Internet of things [E060 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture, project
NUMBER OF HOURS: 30+30 (Lecture + project)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 9

PRELIMINARY REQUIREMENTS: basic knowledge in microprocessor systems, basic C programming

CONTENTS:

What is the Internet of Things, origins, basic concepts, components, interaction with Man. Software technologies in IoT. Network technologies in IoT. Hardware technologies in IoT. Internet of things at home - television, home appliances, intelligent building. Urban centre in the IoT. Intelligent clothing. Internet of things in vehicles – cars, flying machines. IoT applications in military technology. Security and other problems to be solved in IoT.
Project consisting in setting-up small IoT system using IoT development platforms

EFFECTS OF EDUCATION PROCESS:

After the course the participant has knowledge of the concepts and components of the Internet of Things in various areas of human activity.

LITERATURE:

1. http://www.millerwriter.com/book/the-internet-of-things/

TEACHING METHODS: lecture, project

ASSESSMENT METHODS:

Final coursework assessment

TEACHER: Andrzej Smolarz, a.smolarz@pollub.pl

Introduction to electric drives [E086 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basic knowledge of electrical engineering
CONTENTS: Introduction: definitions, significance of electric drives, basic applications. Construction and operation principles of DC motors, characteristics of operation, methods of speed and torque control, applications and limitations. Alternating current motors: induction motors, synchronous motors, methods of speed and torque control. Electric motor control: methods of speed control, torque regulation, speed control systems. Variable frequency drives: construction and operation principles, applications of variable frequency drives, advantages and limitations. Selection of electric motors: criteria for selecting the appropriate motor, comparison of different types of motors for specific applications. Energy efficiency in electric drives: energy-saving strategies in electric drives, technologies for efficient energy management. Electric drives in vehicles: application of electric drives in automotive industry, electric motors in passenger vehicles, trends and future prospects. Electric drives in industry: applications of electric drives in various branches of industry, automation of production processes.
EFECTS OF EDUCATION PROCESS: Deep understanding of different types of electric motors, their principles of operation. Knowledge of various methods of speed and torque control of electric motors and understanding the principles of operation of speed control systems. Knowledge of selecting methods of electric drives for different applications in industry and transportation.
LITERATURE: 1. Crowder R.: Electric drives and electromechanical systems., Elsevier 2006; 2. Hughes, Austin; Drury, Bill: Electric motors and drives: fundamentals, types and applications, Elsevier 2013; 3. André Veltman, Duco W.J. Pulle, Rik W. De Doncker: Fundamentals of Electrical Drives, Springer, 2006.
TEACHING METHODS: multimedia lecture, demonstrations at laboratory stands
ASSESSMENT METHODS: Written examination
TEACHER: Radosław Machlarz, PhD, r.machlarz@pollub.pl

Introduction to field theory (mathematical foundation) [E080 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and seminar
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: knowledge of multivariable function, partial derivative, integral and multiple integrals

CONTENTS:

I. Vector analysis: Derivative of vector functions; Different coordinates; Laplace operator; Directional derivative and gradient; Divergence and curl; Field operators in cylindrical and spherical coordinates.

II. Fundamental vector field theorems: Multiple integrals, connection with line and surface integrals; Flux through the surface, divergence theorem; Curl, Stokes' theorem; Scalar and vector potentials.

III. Examples: Electrostatic field - flux, curl, electric potential; Magnetostatic field - curl, magnetic flux, scalar and vector magnetic potentials; Electromagnetic field - Maxwell equation, scalar and vector potentials.

EFFECTS OF EDUCATION PROCESS:

Students completing this course will be able to: calculate directional derivative and gradient, field divergence and curl, use field operator in different coordinates, calculate line and surface integrals, ununderstand divergence and Stokes' theorems and use them to electrostatic, magnetostatic and electromagnetic fields.

LITERATURE:

1. Jeffrey R. Chasnov, Vector Calculus for Engineers, Lecture Notes, The Hong Kong University of Science and Technology, 2019, https://www.math.hkust.edu.hk/~machas/vector-calculus-for-engineers.pdf
2. Larry Oliver, Calculus for the Electrical and Electronic Technologies, 2009.

TEACHING METHODS: lecture, class discussion

ASSESSMENT METHODS: 40% - final exam, 60% - homework

TEACHER: Zbigniew A. Łagodowski, professor, z.lagodowski@pollub.pl

Introduction to image processing and analysis [E081 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and seminar
NUMBER OF HOURS: 20+10	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: knowledge of multivariable function, partial derivative, integral and multiple integrals
CONTENTS: Image representation; Imaging techniques; Pre-processing methods; Image de-noising; Object edge detection; Segmentation; Feature analysis; Texture analysis; classification of images in medical diagnostics.
EFFECTS OF EDUCATION PROCESS: Knowledge of pre-processing algorithms and medical image analysis methods.
LITERATURE: 1. Jiri Jan, Medical Image Processing, Reconstruction and Analysis. Concepts and Methods, Second Edition, CRC Press, 2020. 2. Klaus D. Toennies, Guide to Medical Image Analysis Methods and Algorithms, Springer London, 2012.
TEACHING METHODS: theory – lecture, practice – laboratory
ASSESSMENT METHODS: Lecture: exam/oral presentation, laboratory: project
TEACHER: Róża Dzierżak, r.dzierzak@pollub.pl

Introduction to Operating Systems [E089 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Completed C programming course. Basic knowledge of data structures, algorithms and computer architecture. Assignments will require a Linux environment. You should setup anticipate setting up a virtual machine if you don't run Linux natively.
CONTENTS: The lectures include information about the tasks of operating systems, their structure and the operation of basic elements such as processes, threads, memory, file system, mass storage and I/O system. The laboratories are based on Linux operating system and cover topics such as file system, permissions, processes, streams, pipes, programming in the shell environment, administration elements and the use of Makefiles. The laboratories are performed in the bash shell environment and the C language. Students can also participate in related Red Hat Academy courses: RH104 Getting Started with Linux Fundamentals, RH124 - Red Hat System Administration I and RH134 - Red Hat System Administration II.
EFFECTS OF EDUCATION PROCESS: At the end of the course, students should be able to describe the general structure and purpose of the operating system and practically implement individual tasks of the operating system at the user, administrator and programmer level.
LITERATURE: 3. Abraham Silberschatz, Peter Galvin, and Greg Gagne Operating System Concepts, 10th edition. Wiley Publishing, Inc. 2018. 4. Stones Richard, Matthew Neil, Beginning Linux Programming, 4th edition, Wrox Press, Ltd. 2007.
TEACHING METHODS: theory – lecture, practice – laboratory
ASSESSMENT METHODS: Final coursework assessment (30% - in-class quizzes and activities, 70% - final test)
TEACHER: Maciej Pańczyk,Ph.D. Eng., m.panczyk@pollub.pl

Introduction to telecommunications [E034 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: good knowledge of circuits theory, electronics, mathematics (Fourier series and Fourier transform)

CONTENTS:

Basic concepts, telecom messages and signals, description of telecom signals, physical transmission channels, telecom channel analog and digital, modulation analog and digital, demodulation analog and digital, signal and data multiplexing, forward error correction, teletransmission systems, commutation, data networks, mobile systems, principles of digital TV broadcasting. Final coursework assessment.

EFFECTS OF EDUCATION PROCESS:

After the course the participant:

1. Recognizes fundamental concepts in telecommunications, recognizes and describes technical characteristics of telecom systems.
2. Describes modulation and demodulation methods, error protection, multiplexing and commutation, and architectures of telecom systems.
3. Matches telecom services and technical means of communication with typical telecom applications.
4. Can express assessment on the role of telecommunications in industry and society

LITERATURE:

3. Simon Haykin, Communication Systems, 5th ed., John Willey&Sons, 2009

TEACHING METHODS: theory – lecture

ASSESSMENT METHODS:

Midterm and final coursework assessment (100% - test)

TEACHER: Zbigniew Lach, PhD, z.lach@pollub.pl

IP networks [E035 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture+ laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Knowledge in computer networks
CONTENTS: IPv4 Protocol Addressing. Variable Length Subnet Mask (VLSM) addressing. CIDR (Classless Inter-Domain Routing). Autonomus Systems. Network Address Translation (NAT). IPv6 Network Protocol VLAN. Cisco Discovery Protocol (CDP), IPSec Protocol. IP protocols tunneling. Mobile IP. Static and dynamic routing protocols. RIP, IGRP, EIGRP. OSPF, BGP. Virtual Private Networks
EFFECTS OF EDUCATION PROCESS: Knowledge in structure and protocols of computer IP networks.
LITERATURE: 1.
TEACHING METHODS: lecture, project, laboratory
ASSESSMENT METHODS: Final coursework assessment
TEACHER: Konrad Gromaszek, professor, k.gromaszek@pollub.pl

Java programming [E083 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture+ laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter and summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Fundamentals of algorithmics and operating systems.
CONTENTS: **Lecture** – Introduction to Java technology. Data types and operators. Control instructions. Basics of object-oriented programming. Classes and objects. Access and property modifiers. Encapsulation. Types and scope of variables. Exception handling. Standard input and output streams. Selected methods of the Math, String and StringBuffer classes. Arrays. Inheritance and method overriding. Early binding and late binding. Polymorphism. The JFrame class. The Graphics class. Fonts and colors in Java. Event handling. Building a graphical user interface. Creating menus and dialog windows. Layout managers. Displaying images and playing sounds. Creating threads. Graphical context and texture painting. Application of threads in animations. Delegation model of event handling. Mouse and keyboard events. Adaptive and internal classes. Anonymous and nested classes. Java archives and documentation programming. **Laboratory** – Java technology basics. Control instructions. Classes and objects. Methods and constructors overloading. Input-output streams. Mathematical operations. String operations. File handling. Arrays. Inheritance. Methods overriding. Building applications with a graphical user interface. The use of popular controls. Creating menus and dialog boxes. Displaying images. Playing sounds. The use of keyboard and mouse events.
EFFECTS OF EDUCATION PROCESS: knowledge of Java basics, object-oriented programming principles, and the ability to build Java applications.
LITERATURE: (OPTIONAL)
TEACHING METHODS: lecture, project, laboratory
ASSESSMENT METHODS: 50% – lecture exam, 50% – lab reports.
TEACHER: Zbigniew Omiotek, professor, z.omiotek@pollub.pl

Linux daemon programming [E036 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of C and C++ programming languages and Linux operating system environment (confirmed by finished C programming, C++ programming and Operating System – courses/subject).

CONTENTS:
Step by step practical explanation how to create client-daemon programs in C/C++ under Linux: process creation (fork, exec, system, wait), inter process communications (shared memory, semaphores, pipes, FIFOs, message queues), sockets, blocking files, daemon creation. Final coursework assessment.

EFFECTS OF EDUCATION PROCESS:
Acquainting students with daemon and client programs creation and usage under Linux operation system.
Learning the skills of writing own C/C++ daemon-client software.

LITERATURE:

1. Stevens W. Richard, UNIX Network Programming Volumes 1 and 2, Second edition, Prentice Hall, Inc., 1997.
2. Stones Richard, Matthew Neil, Beginning Linux Programming, 4th Edition, Wrox Press, Ltd 2007

TEACHING METHODS: lecture, laboratory

ASSESSMENT METHODS: Final coursework assessment (20% - activity during classes, 80% - test)

TEACHER: Maciej Pańczyk, PhD, *m.panczyk@pollub.pl*

Machine learning fundamentals [E070 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: l lecture and discussion
NUMBER OF HOURS: 60 (30 lecture, 30 laboratory)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basics of statistics and structured programming.
CONTENTS: **Lecture** – Python basics. Artificial intelligence areas. Machine learning categories. Frameworks for building machine learning systems. Scales of measurement. Feature engineering. Exploratory data analysis. Supervised learning – regression. Supervised learning – classification. Unsupervised learning. Model diagnosis and tuning. Ensemble methods. Hyperparameter tuning. Artificial neural network. Perceptron. Multilayer perceptron. Restricted Boltzman machine. Autoencoder. Convolution neural network. Recurrent neural network. Transfer learning. Reinforcement learning. **Laboratory** – Machine learning Python packages. Univariate and multivariate analysis. Correlation matrix and pair plots. Linear regression and polynomial regression. Logistic regression. Multiclass logistic regression. Decision tree. Support vector machine. K-nearest neighbors. Autoregressive integrated moving average. K-means. Hierarchical clustering. Principal component analysis. Ensemble methods. Multilayer perceptron. Autoencoder. Convolution neural network. Transfer Learning.
EFFECTS OF EDUCATION PROCESS: fundamental knowledge on key machine learning concepts and practical skills in machine learnig models development.
LITERATURE: 1.
TEACHING METHODS: lecture, laboratory
ASSESSMENT METHODS: 50% – final exam, 50% – practical test.
TEACHER: Zbigniew Omiotek, professor, z.omiotek@pollub.pl

Mathematical methods in engineering [E075 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and practical excercises
NUMBER OF HOURS: 30+20	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: the knowledge of complex numbers, operations with matrices, determinant of a matrix, convergence of series, continuous functions, differentiation, integration

CONTENTS:

Reminder of operations with matrices, determinant of a matrix. Systems of linear equations: Existence of solution, Cramer and Gauss rules of solving the linear systems. Vector space: Basis and dimension, the eigenvalues and the eigenvectors of the matrix. First and higher order differential equations: Existence of solution, rules of solving. Linear systems of differential equations: Definition, rules of solving. Laplace transform and applications: Solving the linear equations, and systems linear differential equations.

EFFECTS OF EDUCATION PROCESS:

Students completing this course will be able to: solve the systems of linear equations, classify differential equations, solve first order linear equations and some nonlinear differential equations, solve higher order linear differential equations with constant coefficients, understand the conditions for the existence and uniqueness of solutions, calculate Laplace transform and inverse Laplace transform, solve systems of linear differential equations using the Laplace transform.

LITERATURE:

1. Henry C. Edwards, David E. Penney, Differential Equations & Linear Algebra (3rd Edition), Pearson, 2011
2. Thomas B.A. Senior – Mathematical Methods in Electrical Engineering, Cambridge University Press, 2008,
3. Robert A. Adams - Calculus: A Complete Course, Addison Wesley Publishing Company 2010.

TEACHING METHODS: lecture, class discussion

ASSESSMENT METHODS: 40% - final exam, 60% - homework

TEACHER: Zbigniew A. Łagodowski, professor, z.lagodowski@pollub.pl

Medical electronic equipment [E087 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture+laboratory/project
NUMBER OF HOURS: 30+30 (lecture + practise)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basic knowledge in physics, electronics
CONTENTS: Basics of electrical safety in medical electronic equipment. Medical diagnostic techniques. Medical electric diagnostic techniques: bioelectrical measurements, electrocardiography, electroencephalography, electromyography. Bioimpedance analysis (BIA). Spirometry. Pulse oximetry. Medical imaging techniques. Ultrasound imaging technique. X-ray computed tomography (CT). Magnetic resonance imaging (MRI). Positron emission tomography (PET). Single-photon emission computed tomography (SPECT). Thermography. Therapeutic medical techniques.
EFFECTS OF EDUCATION PROCESS: Knowledge in operation principles of medical electronic equipment. Knowledge in basics of medical electronic equipment design.
LITERATURE: 1. .
TEACHING METHODS: lecture, laboratory, project
ASSESSMENT METHODS: final coursework assessment
TEACHER: Oleksandra Hotra, professor, o.hotra@pollub.pl

Metrology fundamentals [E029 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture/laboratory
NUMBER OF HOURS: 30+30 (lecture + laboratory)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 7

PRELIMINARY REQUIREMENTS: Basics of Physics, Basics of Electrical Circuits, Basics of Mathematics
CONTENTS: Metrology: its subject, history, and basic terms. Measurement process. Systems of units. Measurement standards. Measurement error and uncertainty. Measurement transducers. Measurement methods. Analog and digital measuring instruments. Oscilloscopes. Measurements of electrical quantities.
EFFECTS OF EDUCATION PROCESS: Knowledge about: basics of metrology, methods of measurement, estimation of measurement accuracy, features of measuring instruments, basic operating of measurement equipment, performing of laboratory measurements
LITERATURE: 1. .
TEACHING METHODS: Lecture, laboratory experiments
ASSESSMENT METHODS: Writing report, oral/written examination
TEACHER: Jacek Majewski, j.majewski@pollub.pl

Microprocessor technology fundamentals [E037 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture, laboratory/project
NUMBER OF HOURS: 30(lecture)+30(lab/project)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: C programming
CONTENTS: Introduction – basic concepts and terms. The standard structure of microprocessor systems. Structure of the microprocessor and microcontroller. Von Neumann and Harvard architecture. Types of processors, data processing rules. Addressing modes, instruction categories, rules of instruction decoding and executing. Architecture of selected microcontrollers. Computer Memory: ROM, RAM features. Hardware and software stack, stack access rules, use of a stack. Interrupts, types of interrupts, interrupt controller, interrupt priorities. Counter – timer circuits (CTC). The structure and programming of timers in selected microcomputer. Serial transmission - principles, serial port structure. Analog converters ADC and DAC, operating principles, typical implementations. DMA - transmission rules, typical structure. Reduction of microcontrollers' power consumption. Electromagnetic compatibility. The reliability of the software. Future development of microprocessors and microcontrollers.
EFFECTS OF EDUCATION PROCESS: The student knows the principles of architecture and logic of microprocessors and microcontrollers. knows peripheral devices and arrangements for their cooperation with the microprocessors and microcontrollers knows the rules of creating algorithms and applications of microprocessor systems in selected programming environments..
LITERATURE:
TEACHING METHODS: lecture, lab/project
ASSESSMENT METHODS: Final coursework assessment
TEACHER: Andrzej Smolarz, prof, a.smolarz@pollub.pl

Mobile operating systems fundamentals [E030 ❄ ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: lecture, laboratory
NUMBER OF HOURS: 60 (30lecture, 30laboratory)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basics of operating systems and object-oriented programming.
CONTENTS: **Lecture** – Hardware for mobile platforms. Challenges in mobile computing. Issues in designing mobile computing systems. Mobile operating system. Wireless networks and sensors for mobile platforms. Popularity and comparison of mobile operating systems. Android version history and characteristics. Android platform architecture and file system. Boot process and application components. Application development, compiling and packaging. Android runtime and Google Play service. Android process management and out-of-memory killer. Android device configurations. Screen density and defining the size of UI components in layout files. Interface design principles and graphics designing. Providing responsive and fast Android applications. Android security and permissions. **Laboratory** – Android Studio and introduction into development of Android applications. Anatomy of Android application. The use of virtual and physical devices for testing. Popular control items and event handling. Intents and data transfer between activities. Building charts. **Toolbar and n**avigation drawer. Drawables and playing sound. Drag and drop gesture. **Lists and fragments.** Text to speech conversion. Geolocation, Google Maps and the use of sensors. Sending and receiving SMS. SQLite database and using threads. Individual work on the programming project (mobile app) that will be assessed.
EFFECTS OF EDUCATION PROCESS: General knowledge on mobile systems and practical skills in Android applications development.
LITERATURE
TEACHING METHODS: lecture, laboratory.
ASSESSMENT METHODS: 40% – final exam, 60% – practical test and programming project.
TEACHER: Zbigniew Omiotek, PhD (Eng.), z.omiotek@pollub.pl

Numerical methods [E039 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30 (15 lecture+ 15 laboratory)	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Linear algebra
CONTENTS: Presentation of the laboratory curriculum and principles of the coursework assessment. The course covers: the theory of interpolation and approximation; direct methods for solving systems of linear equations: Gauss, LU and Cholesky factorization; solving an scalar nonlinear equation: Newton, regula falsi and bisection method; numerical integration: Newton-Cotes and Gauss methods; Runge-Kutta methods for ordinary differential equations; the characteristic polynomial and eigenvalues.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics numerical methods. The knowledge and skills to solve numerical problems using learned methods.
LITERATURE: 1. J. Stoer, R. Bulirsch, Introduction to numerical analysis, Springer, 2002 2. W. Press, S. Teukolsky, W. Vetterling, B. Flannery, Numerical Recipes in C++, Cambridge University Press, 2002
TEACHING METHODS: theory – lecture, practice – laboratory
ASSESSMENT METHODS: Final coursework assessment (100% - final project)
TEACHER: Edyta Łukasik, e.lukasik@pollub.pl

Object-oriented analysis and design in UML [E088 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture + laboratory/project
NUMBER OF HOURS: 60 (30 lecture, 30 practise)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basic knowledge of object-oriented design and modeling
CONTENTS: Basic definitions, structures and elements in the UML language. Object-oriented analysis and design. Assumptions in UML modeling, analysis, and design. Model organization in UML: Basic structures; Packages; Classifiers; Instance specification; Values; Event types, Executable, control and object nodes. Analysis of object-oriented modeling with a case example. Modelling using sequence diagrams and state machines. System architecture design. Application Design. Constructing UML diagrams.
EFFECTS OF EDUCATION PROCESS: Knowledge of object-oriented modeling and practical skills in developing projects in UML.
LITERATURE: 1. optional
TEACHING METHODS: theory – lecture, practice – laboratory/project
ASSESSMENT METHODS: Final coursework assessment (exam)
TEACHER: Żaklin Grądz, Ph.D. , z.gradz@pollub.pl

Object programming in C++ [E040 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture / laboratory
NUMBER OF HOURS: 40 (20 lecture+ 20 laboratory)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Basic skills of programming
CONTENTS: Material consolidation on C++ programming: variable types, manipulators, control statements, arrays and structures, pointers and references, dynamic memory allocation, functions, namespaces, streams. Object Oriented Programming in C++: classes and objects, data members and member functions, access modifiers, constructors and destructors, encapsulation, constant and static members, inheritance, operator overloading, virtual functions, polymorphism, abstract classes.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basics of C++ programming. Learning the skills of using object oriented C++ capabilities.
LITERATURE: 2. Richard L. Halterman, Fundamentals of Programming C++, http://python.cs.southern.edu/cppbook/progcpp.pdf 3. C++ Language, https://cplusplus.com/doc/tutorial/ 4. Wikibooks.org, C++ Programming, https://upload.wikimedia.org/wikipedia/commons/e/e9/CPlusPlusProgramming.pdf
TEACHING METHODS: theory – lecture, practice – laboratory
ASSESSMENT METHODS: Final coursework assessment (exam)
TEACHER: Ph.D. Mariusz Dzieńkowski, m.dzienkowski@pollub.pl

Parallel and distributed programming [E042 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of C and C++ programming languages and Linux operating system environment (confirmed by finished C programming, C++ programming and Operating System – courses/subject).

CONTENTS:

Introductory course for C++ multithread programming (using boost library or C++ v.11 threads) and two main standards of parallel and distributed programming: OpenMP and MPI.Basics of parallel computing (calculation efficiency, Amdahl's law for parallel computing). Shared memory multiprocessing programming in C/C++ (mutexes, conditional variables, monitors and semaphores) and OpenMP (#pragma statements, parallel construction, parallel for loop, constructions - sections, barrier, critical, atomic, flush, reduction operations). Message Passing Interface (MPI) standard basics (communicators, groups of processes, MPI functions, point–to-point communication, collective communication). Final coursework assessment.

EFFECTS OF EDUCATION PROCESS:

Acquainting students with C++ multithread programming including boost library and two main standards of parallel and distributed programming: OpenMP and MPI. Learning how to speedup a program using multiple processors or hosts with OpenMP and MPI programming skills.

LITERATURE:

1. C++ Concurrency in Action: Practical Multithreading, Anthony Williams, Manning Publications, 2017
2. Mastering C++ Multithreading, Maya Posch, Packt Publishing, 2017
3. Boost Library Documentation -Concurrent Programming http://www.boost.org/doc/libs/?view=category_Concurrent
4. The OpenMP API specification for parallel programming, http://openmp.org/wp/
5. A users' guide to MPI, ftp://math.usfca.edu/pub/MPI/mpi.guide.ps

TEACHING METHODS: lecture, laboratory

ASSESSMENT METHODS: 20% - activity during classes, 80% - final test)

TEACHER: Maciej Pańczyk, PhD, m.panczyk@pollub.pl

PLC Controllers [E043 ❄ ☼]

FACULTY: ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	CLASS TYPE: Lecture/Laboratory
NUMBER OF HOURS: 30+30 (lecture + laboratory)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I,II
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Bool algebra
CONTENTS: **PLC concept and components**, **PLC configuration** – I/O modules, **PLC data and addressing**, **PLC programming –** text and graphical methods, **PLC logic functions** – bit, shift and rotate functions, **PLC timer and counter functions**, **PLC math functions**, **Sequential Function Chart**, **PLC interrupts, PID alghotitms**
EFFECTS OF EDUCATION PROCESS: Students will gain knowledge about structure and functionality of PLC Controllers. Students will have ability to design and analyse of PLC control systems used in industry.
LITERATURE: 1. William Bolton, Programmable Logic Controllers, Newnes, 2015.
TEACHING METHODS: Lecture + laboratory exercises
ASSESSMENT METHODS: Oral/written examination
TEACHER: Adam Kurnicki, a.kurnicki@pollub.pl

Power electronics [E044 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture+laboratory
NUMBER OF HOURS: 60 (30 lecture, 30 practise)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Knowledge in electrical circuits, Knowledge in fundamentals of electronics
CONTENTS: Power electronic components (diodes, BJT, power MOSFET, IGBT, thyristors, GTO); Power rectifiers, AC/DC, DC/DC-up and down conversion, Inverters, AC/AC converters Safety and EMC
EFFECTS OF EDUCATION PROCESS: Knowledge in industrial and power applications of electronics.
LITERATURE:
TEACHING METHODS: lecture, Laboratory, project
ASSESSMENT METHODS: Final coursework assessment
TEACHER: Tomasz Zyska, Ph.D., t.zyska@pollub.pl

Power System Analysis [E046 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture, laboratory
NUMBER OF HOURS: 20+20 (lecture + computer laboratory	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Essentials of Power Generation and Electrical Circuits
CONTENTS: Power Systems, Energy Distribution, Electric Grids, Electric Lines, Transformers, Load Flow Analysis.
EFFECTS OF EDUCATION PROCESS: Knowledge about structure of Power Systems, Power Transmission and Distribution, modelling of lines, transformers, generators and load for load flow analysis, load flow analysis.
LITERATURE: 1. Embedded Generation, Nick Jenkins, Ron Allan, Peter Crossley, Daniel Kirschen, Goran Strbac, The Institution of Engineering and Technology; Volume 31 edition (June 30, 2000) 2. AC Power Systems Handbook. Second Edition Jerry C. Whitaker, CRC Press (1697) 3. THE ELECTRIC POWER ENGINEERING HANDBOOK Richard C. Dorf University of California, Davis, CRC Press 4. Power System Dynamics: Stability and Control 2nd Edition, Jan Machowski, Janusz W. Bialek, Dr Jim Bumby:Wiley ISBN: 978-0-470-72558-0 Oct. 2008.
TEACHING METHODS: lecture, project
ASSESSMENT METHODS: 20% - Final Exam, 80% - Projec
TEACHER: Sylwester Adamek, PhD, s.adamek@pollub.pl

Probability and statistics [E048 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture, project
NUMBER OF HOURS: 30 (lecture) + 20 (project)	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I/II
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of Calculus and Set Theory
CONTENTS: Sample spaces and events. Definition of probability. Conditional probability. Independence. Discrete and continuous random variables. Expectation, variance and other moments. Families of discrete distributions. Families of continuous distributions. Regression. Descriptive statistics. Graphical statistics. Point estimation. Confidence intervals. Hypothesis testing. Introduction to practical applied statistics with R. Programming with R. Interacting with data using R and RStudio. Creating reproducible reports with RMarkdown to communicate results.
EFFECTS OF EDUCATION PROCESS: This course is designed to introduce students to various topics in probability and uncertainty that they will encounter in engineering. Projects are designed to encourage the student to begin thinking about probability and uncertainty within engineering and computer science problems. Students is learnt to use R for data analysis and simulation.
LITERATURE: 1. M. Arkitas, Probability & Statistics with R for Engineers and Scientists, Pearson Education, 2014 2. D. Dalpiaz, Applied Statistics with R, GitHUb, 2021
TEACHING METHODS: lecture, project
ASSESSMENT METHODS: written project reports, written final exam
TEACHER: TEACHER: Zbigniew A. Łagodowski, professor, z.lagodowski@pollub.pl

Python Programming [E061 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture/laboratory
NUMBER OF HOURS: 15+15 (lecture + laboratory)	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I and II
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basic skills of programming

CONTENTS:

Python programming fundamentals: variable and data types, control structures, strings, lists, collections, functions, modules, input/output, exception handling.

Advanced Python: object oriented programming concept, database interaction, turtle graphics, GUI programming, string manipulation, data processing techniques, data visualisation.

EFFECTS OF EDUCATION PROCESS:

Developing proficiency in creating applications using the Python programming language.

Understanding various data structures available in the Python and applying them for solving problems from different fields of science.

LITERATURE:

1. Allen Downey, How to Think Like a Computer Scientist, https://runestone.academy/ns/books/published/thinkcspy/index.html
2. The Python Tutorial, https://docs.python.org/3/tutorial/index.html
3. Brad Miller and David Ranum, Problem Solving with Algorithms and Data Structures using Python, https://runestone.academy/ns/books/published/pythonds/index.html

TEACHING METHODS: theory - lecture, practice - laboratory

ASSESSMENT METHODS: Final coursework assessment (exam)

TEACHER: Dr. Mariusz Dzieńkowski, m.dzienkowski@pollub.pl

Software engineering [E051 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: basic knowledge of software applications designing
CONTENTS: Presentation of the laboratory curriculum and principles of the coursework assessment. Material consolidation on software engineering: gathering and analyzing of system requirements, Entity Relationship Diagram (ERD), Business Process Modeling Notation (BPMN), UML models, Design Patterns, Model Driven Engineering basics. Final coursework assessment.
EFFECTS OF EDUCATION PROCESS: Acquainting students with standards and methods of software designing. Learning the skills of applications design in practice.
LITERATURE: 1. Ian Sommerville. Software Engineering, 2010. 2. Norman Daoust. UML Requirements Modeling For Business Analysts. 2012. 3. Alan Dennis, Barbara Haley Wixom, David Tegarden: Systems Analysis and Design with UML.
TEACHING METHODS: theory – lecture, practice - laboratory
ASSESSMENT METHODS: Final coursework assessment (40% - test, 60% - final project)
TEACHER: Małgorzata Plechawska-Wójcik m.plechawska@pollub.pl

Superconducting Devices [E077 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of physics and electrical engineering
CONTENTS: Low and High Temperature Superconductors. Cooling and thermal insulation systems. Superconducting rotating AC and DC machines. Superconducting transformers. Superconducting fault current limiters. Superconducting power cables. Magnetic levitation transport systems. Superconducting magnets and their applications. Applications of superconductors in thermonuclear power projects. Superconducting electronics and metrology.
EFFECTS OF EDUCATION PROCESS: Acquainting students with applications of superconductors in power electrical engineering, electronics and metrology.
LITERATURE: 1. S.S. Kalsi, Applications of high temperature superconductors to electric power equipment, John Wiley & Sons, Inc., Publication of IEEE, 2011
TEACHING METHODS: multimedia lectures with practical examples
ASSESSMENT METHODS: Two coursework assessment tests
TEACHER: Paweł Surdacki, Ph.D. (Eng.), D.Sc., Associate Professor, p.surdacki@pollub.pl

Sustainability and Environment [E055 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 10

PRELIMINARY REQUIREMENTS: basics of biology, chemistry and physics
CONTENTS: Fundamentals of ecology, basic definitions, sustainability. Biological communities and relations between organisms. Population, biodiversity. Ecological succession, flow of energy through an ecosystem. Cycles of nutrients. Earth's atmosphere, gas laws. Indoor air pollution. Outdoor air pollution. Photogenic smog, acid rain. Ozone depletion, global warming. Measurement of pollutants' concentrations. Chosen examples of pollution control technologies.
EFFECTS OF EDUCATION PROCESS: Students will gain basic knowledge in a multidisciplinary academic field that integrates physical, chemical and biological sciences applied for study of environmental problems.
LITERATURE: 1. . D. Chiras "Environmental Science", M. McKinney, R. Schoch, L. Yonavjak "Environmental Science: Systems and Solutions"
TEACHING METHODS: Lecture
ASSESSMENT METHODS: Activity in the class, oral presentation, panel presentation, report and attendance.
TEACHER: Joanna Pawłat, j.pawlat@pollub.pl

Web application development [E058 ❄]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Good knowledge of the basics of programming
CONTENTS: Presentation of the laboratory curriculum and principles of the coursework assessment. Web application architecture. Basic standards in the creation of web applications: HTML5 mark-up language, CSS style sheet rules. The concept of accessibility and flexibility of web pages. Responsive web design. Document Object Model. Interaction elements on web pages – CSS3, JavaScript, jQuery. Final coursework assessment.
EFFECTS OF EDUCATION PROCESS: Acquainting students with basic tools for web application development. Ability to create a simple web application.
LITERATURE: 1. http://www.w3schools.com/
TEACHING METHODS: theory – lecture, practice - laboratory
ASSESSMENT METHODS: Final project assessment
TEACHER: Marcin Badurowicz, M.Sc., m.badurowicz@pollub.pl

Web programming in PHP [E059 ❄ ☼]

FACULTY: Electrical Engineering and Computer Science	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: I
LANGUAGE OF INSTRUCTION: English	MINIMAL NUMBER OF STUDENTS: 5

PRELIMINARY REQUIREMENTS: Knowledge of creating Web applications in HTML and CSS, basic knowledge of databases
CONTENTS: Building Web pages, Creating Web applications, MySQL database integration in Web applications, Implementing social tools in Web pages
EFFECTS OF EDUCATION PROCESS: Competence to develop usable and accessible web applications with PHP and MySQL
LITERATURE: 5. K. Tatroe, P. Maclntyre, R. Lerdorf, Programming PHP, O'Reily 2013 6. L. Welling, L. Thompson, PHP and MySQL Web Development (5th Edition), Addison-Wesley Professional, 2013
TEACHING METHODS: theory – lecture, practice - laboratory
ASSESSMENT METHODS: Final coursework assessment (40% - test, 60% - final project)
TEACHER: Tomasz Szymczyk, M.Sc., Eng. t.szymczyk@pollub.pl

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