

ECTS Erasmus+ Course Catalog  
for the academic year 2026/2027  
offered in English

Faculty of Mathematics and Information Technology  
PL LUBLIN03



### **ADDITIONAL PROVISIONS:**

- The applying student can select courses corresponding to no more than 33 ECTS credits per semester.
- The student is allowed to choose courses offered by the other faculties of the Lublin University of Technology, provided that the number of ECTS credits assigned to these courses is no more than 20% of the total number of ECTS credits specified in his/her Learning Agreement (LA).
- Upon arrival the student may alter some of the courses originally listed in his/her Learning Agreement (LA) within the limits of up to 30% of the total number of ECTS credits specified in the original Learning Agreement.
- The "During the mobility" form must be delivered to the Coordinator no later than 7 days after the organizational meeting held at the faculty.
- When the number of students applying for a given course is less than 12, the faculty will have the right to cancel the course. In this case the student should amend his/her Learning Agreement.

### **IMPORTANT NOTICE:**

- The students have to check carefully **PRELIMINARY REQUIREMENTS** in order to make sure they are eligible for a desired course.
- The students are required to check in which semester the course will be delivered. The courses will be delivered exclusively in semesters specified in this offer.

### **International Exchange Coordinator**

Faculty of Mathematics and Information Technology

Eng. Jarosław Zubrzycki Ph. D.

[j.zubrzycki@pollub.pl](mailto:j.zubrzycki@pollub.pl)

Ox. 127

<http://zubrzycki.net.pl/>



### ECTS Erasmus+ Course Catalog for the academic year 2026/2027

Course code	Course name	Semester	Number of hours	Teacher	ECTS
WI01	C++ programming – WI01	W	15L; 15Lab	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	3
WI02	Calculus – WI02	W,S	15L; 15C	dr inż. Magdalena Jastrzębska	3
WI03	Cloud Computing – WI03	S	15L; 15Lab	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	3
WI04	Complex Analysis – WI04	W,S	15L; 15Lab	dr inż. Anna Futa	3
WI05	Econometrics – WI05	S	15L	dr Anna Makarewicz-Trzeźniewska	2
WI06	Electronics – WI06	W,S	15L; 15Lab	dr inż. Michał Charlak	3
WI07	Full-Stack Development in Cloud Computing – WI07	S	15L; 15Lab	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	3
WI08	Fundamentals of Control Theory – WI08	W,S	30L; 30Lab	dr inż. Radosław Cechowicz	5
WI09	Graph Theory – WI09	W	30L	dr Izolda Gorgol	3
WI10	Introduction to Data Analysis – WI10	W	15L	dr Dariusz Majerek	2
WI11	Introduction to Functional Analysis – WI11	W,S	15L+C	dr Renata Buczko	2
WI12	Introduction to Industrial Robotics – WI12	W,S	30L; 30Lab	dr inż. Radosław Cechowicz	5
WI13	Introduction to Machine Learning – WI13	W,S	30L	mgr inż. Michał Błaszczkowski	3
WI14	Pneumatics and hydraulics drives – WI14	W,S	15L; 30Lab	Dr inż. Jarosław Zubrzycki	4



WI15	Industrial Microcontrollers – WI15	W,S	15L; 30Lab	Dr inż Jarosław Zubrzycki	4
WI16	Linear Algebra – WI16	W,S	15L; 15C	dr Ewa Łazuka, prof. uczelni	3
WI17	Mathematical Foundations of Life Insurance – WI17	W,S	15L; 15E	dr Paweł Właż	3
WI18	Probability Theory – WI18	W,S	15L; 15C	mgr inż. Dagmara Dudek	3
WI19	Reliability Theory and Predictive Maintenance – WI19	W,S	15L; 15Lab.	dr inż. Bartłomiej Ambrożkiewicz	3
WI20	Introduction to deep learning in Python – WI2	W,S	15L; 15Lab.	dr Maciej Czarnacki	3
WI21	Introduction to Logic and Formal Languages – WI2	W,S	15L; 30Lab.	dr inż. Radosław Cechowicz	4
WI22	Diploma Seminar – WI2	S	30S	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	3
WI23	Web technologies – WI2	W,S	30P	dr inż. Barbara Buraczyńska	3
WI24	E-commerce and social media WI24	W,S	30P	dr inż. Barbara Buraczyńska	3

Semester: W – winter (Oct.-Feb.); S – summer (Feb. – Jun.)

Number of hours: L – lecture, Lab. – laboratory, C – class, P – project, E – exercise, S - seminar

There is no possibility to apply for the whole academic year, only applications for one semester can be approved.

A course will be opened if at least 5 students apply. In case of fewer students interested in a course an individual work may be proposed.

A student can prepare his/her Learning Agreement with at most 33 ECTS.



FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

**C++ programming – WI01**

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture and laboratory
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter	<b>CLASS LEVEL:</b> undergraduate
<b>NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:** basic skills of programming

**CONTENTS:** C++ language – overview of basic paradigms, inheritance, Operator overloading, this pointer, references, Virtual functions and classes, Input-output system, formatting mechanisms, Dynamic memory allocation, static class elements, Function and class templates, namespaces, Exceptions and their handling, String class – C++-style strings, standard template library

**EFFECTS OF EDUCATION PROCESS:** Basic knowledge of object-oriented programming and C++ language elements used to create object-oriented applications. Students know inheritance techniques, operator overloading, references and virtualization of functions and classes, the I/O library, formatting methods, the iOS class and manipulators, the exception mechanism and the technique of using it.

**LITERATURE (OPTIONAL):** Mark Reed. C++: 2 books in 1 - The Ultimate Beginners Guide to Master C++ Programming Quickly with No Prior Experience. 2022  
Malik, D. S. "C++ Programming: From problem analysis to program design." Cengage Learning 2017

**TEACHING METHODS:** theory – lecture, practice – laboratory

**ASSESSMENT METHODS:** Final coursework assessment (exam)

**TEACHER (NAME, EMAIL CONTACT):** prof. Dariusz Czerwiński, university professor, d.czerwinski@pollub.pl

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**Calculus – WI02**

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture + class
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> basic mathematical knowledge
<b>CONTENTS:</b> concepts of functions, limits and continuity, differentiation rules, applications of derivatives, techniques of integration
<b>EFFECTS OF EDUCATION PROCESS:</b> acquiring basic concepts, facts and methods in the field of the differential and integral calculus, developing skills in the mathematical reasoning, solving problems related to the mathematical analysis
<b>LITERATURE (OPTIONAL):</b> C. L. Mett, J. C. Smith, Calculus with applications, New York [etc.] : McGraw-Hill Book Company, 1985 A. Howard, Calculus with analytic geometry, New York : John Wiley & Sons, 1989 O. Hijab, Introduction to Calculus and Classical Analysis, Springer-Verlag, New York, 1966
<b>TEACHING METHODS:</b> lecture, solving exercises
<b>ASSESSMENT METHODS:</b> homework, written exam
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Magdalena Jastrzębska, m.jastrzebska@pollub.pl



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Cloud Computing – WI03

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture and laboratory
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> summer	<b>CLASS LEVEL:</b> undergraduate
<b>NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> basic skills of programming, Java programming
<b>CONTENTS:</b> The concept of cloud, types of clouds, the concept of cloud services, computer clouds and virtualization, Cloud storage support, mass storage virtualization, Cloud solutions on Linux systems, MapReduce parallel programming paradigm, Hadoop system as an example of cloud programming, Elements of a cloud computing task, Using Java for programming in the cloud
<b>EFFECTS OF EDUCATION PROCESS:</b> Understands the role and importance of cloud technology and knows its applications in business. Knows the principles of operation of clouds in various operating systems. Knows the techniques of creating a cloud application.
<b>LITERATURE (OPTIONAL):</b> Rafaels, Ray J. Cloud computing: From beginning to end. CreateSpace Independent Publishing Platform, 2015. Erl, Thomas, Ricardo Puttini, and Zaigham Mahmood. Cloud computing: concepts, technology & architecture. Pearson Education, 2013.
<b>TEACHING METHODS:</b> theory – lecture, practice – laboratory
<b>ASSESSMENT METHODS:</b> Final coursework assessment (exam)
<b>TEACHER (NAME, EMAIL CONTACT):</b> prof. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl



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Complex Analysis – WI04

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture + class
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:** calculus

**CONTENTS:** complex sequences and series, analytic functions, Cauchy’s Theorem, residue calculus, harmonic functions

**EFFECTS OF EDUCATION PROCESS:** acquiring basic concepts, facts and methods in the field of the complex analysis, developing skills in the mathematical reasoning, solving problems related to the complex analysis

**LITERATURE (OPTIONAL):** L.V.Ahlfors, Complex Analysis, 3rd edition, McGraw Hill, 2000

**TEACHING METHODS:** lecture, solving exercises

**ASSESSMENT METHODS:** homework, written exam

**TEACHER (NAME, EMAIL CONTACT):** Ph. D. eng. Anna Futa, a.futa@pollub.pl



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**Econometrics – WI05**

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> laboratories
<b>NUMBER OF HOURS:</b> 15	<b>ECTS:</b> 2
<b>SEMESTER:</b> summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> Computer skills, including using a spreadsheet. Knowledge of the basics of linear algebra, mathematical analysis and probability theory.
<b>CONTENTS:</b> Choosing independent variables. Matrix of correlation coefficients. Simple regression model. Ordinary Least Squares Method. Nonlinear models reducible to linear models.
<b>EFFECTS OF EDUCATION PROCESS:</b> Knowledge of basic types of econometric models, constructs econometric models of selected phenomena by selecting appropriate variables for the model.
<b>LITERATURE (OPTIONAL):</b> Damodar N. Gujarati, Dawn C. Porter, Basic Econometrics, Published by McGraw-Hill/Irwin <a href="https://www.cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf">https://www.cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf</a>
<b>TEACHING METHODS:</b> Working with learning materials, laboratory classes.
<b>ASSESSMENT METHODS:</b> Active participation in laboratories, doing homework on time.
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Eng. Anna Makarewicz – Trzeźniewska <a href="mailto:a.makarewicz@pollub.pl">a.makarewicz@pollub.pl</a>

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Electronics – WI06

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture + laboratory
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b>
<b>CONTENTS:</b> Semiconductors: diode, bipolar transistor, operational amplifier. Rectifier. AC/DC Power Adapter. Power amplifier. Function generator. Logic gates, flip-flops. Microprocessor architecture.
<b>EFFECTS OF EDUCATION PROCESS:</b> Students can apply fundamental electrical circuit's laws to design and measure simply electronic device
<b>LITERATURE (OPTIONAL):</b> Kuphaldt T.R., 2009 Lessons In Electric Circuits. Volume III - Semiconductors. full text access <a href="http://openbookproject.net/electricCircuits/">http://openbookproject.net/electricCircuits/</a>
<b>TEACHING METHODS:</b> tutorial in lab
<b>ASSESSMENT METHODS:</b> exercise evaluation, class test
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. eng. Michał Charlak, <a href="mailto:m.charlak@pollub.pl">m.charlak@pollub.pl</a>



**Full-Stack Development in Cloud Computing – WI07**

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture and laboratory
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> summer	<b>CLASS LEVEL:</b> master
<b>NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> Knowledge of the following languages and tools: JavaScript, HTML, CSS, PHP, SQL, Java, basic programming in algorithmic languages
<b>CONTENTS:</b> Levels of computer clouds used in application programming, Full-stack programming, Full-stack programming in the computer cloud, Computer cloud services available to full-stack developers, Kubernetes as a full-stack tool, microservices in Kubernetes, pods and their settings, deployments in Kubernetes
<b>EFFECTS OF EDUCATION PROCESS:</b> Student understands the role and importance of full-stack programming in cloud computing. Student knows how to configure an environment for designing and implementing full-stack applications for cloud computing.
<b>LITERATURE (OPTIONAL):</b> Northwood, Chris. The full stack developer: your essential guide to the everyday skills expected of a modern full stack web developer. Apress, 2018. Zammetti, Frank. Modern Full-Stack Development: Using TypeScript, React, Node. js, Webpack, and Docker. Apress, 2020.
<b>TEACHING METHODS:</b> theory - lecture, practice - laboratory
<b>ASSESSMENT METHODS:</b> Final coursework assessment (exam)
<b>TEACHER (NAME, EMAIL CONTACT):</b> prof. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

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**Fundamentals of Control Theory – WI08**

<b>FACULTY: Faculty of Mathematics and Information Technology</b>	<b>CLASS TYPE: Lecture + Laboratory</b>
<b>NUMBER OF HOURS: 60 (30 lecture + 30 laboratory)</b>	<b>ECTS: 5</b>
<b>SEMESTER: winter/summer</b>	<b>CLASS LEVEL: undergraduate</b>
<b>MINIMAL NUMBER OF STUDENTS: 5</b>	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> Basic skills in numerical software (like Matlab/Scilab), fundamentals of calculus
<b>CONTENTS:</b> Mathematical models of real systems, differential equations, state-space equations, dynamic properties, standard signals, typical responses, system identification. Laplace's transform, Laplace's transfer function. System analysis – zeros, poles, dynamic response, stability, root locus. Frequency domain analysis, frequency response, Nyquist and Bode plots. Closed-loop control, compensation, pure time delay, PID Control. Quality of control process, performance of the system, dynamic and static errors. Robust control, IMC. Examples of control systems in industry.
<b>EFFECTS OF EDUCATION PROCESS:</b> Students will get acquainted with fundamentals of formal knowledge and methods in the area of control theory and its applications. Students will learn to design simple control systems.
<b>LITERATURE (OPTIONAL):</b> K. J. Åström, R. M. Murray: Feedback Systems: An Introduction for Scientists and Engineers <a href="http://www.cds.caltech.edu/~murray/amwiki/Main_Page">http://www.cds.caltech.edu/~murray/amwiki/Main_Page</a> P. Dawkins,; Paul's Online Notes, <a href="http://tutorial.math.lamar.edu/">http://tutorial.math.lamar.edu/</a>
<b>TEACHING METHODS:</b> lecture, laboratory exercises
<b>ASSESSMENT METHODS:</b> lecture: exam, laboratory: assessment of reports,
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Eng. Radosław Cechowicz r.cechowicz@pollub.pl

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Graph Theory – WI09

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:**

**CONTENTS:** fundamentals of graph theory: connectivity, trees, minimal spanning trees, shortest paths, Euler and Hamilton cycles, planarity, colorings

**EFFECTS OF EDUCATION PROCESS:** recognizing basic properties of graphs, constructing minimal spanning trees and shortest paths, recognizing planar graphs, ability of applying vertex and edge colorings of graphs

**LITERATURE (OPTIONAL):** G. Chartrand, L. Lesniak, P. Zhang, Graphs and digraphs, CRC, 2011

**TEACHING METHODS:** lecture, solving exercises

**ASSESSMENT METHODS:** written exam

**TEACHER (NAME, EMAIL CONTACT):** Ph. D. Izolda Gorgol, i.gorgol@pollub.pl



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Introduction to Data Analysis – WI10

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> Lecture
<b>NUMBER OF HOURS:</b> 15	<b>ECTS:</b> 2
<b>SEMESTER:</b> winter	<b>CLASS LEVEL:</b> bachelor/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:** base knowledge of R or Python

**CONTENTS:** data science methods

**EFFECTS OF EDUCATION PROCESS:** point estimation, testing parametric and nonparametric hypotheses, sampling designs, linear and nonlinear models, feature selection, multidimensional scaling, cluster analysis, regression and classification models

**LITERATURE (OPTIONAL):** M.Khun, K. Johnson, Applied predictive modeling, Springer, 2013, S.J. Sheather, A modern approach to regression with R, Springer, 2009, T. Raykov, G. A. Marcoulides, Basic statistics, An introduction with R, Rowman & Littlefield, 2013

**TEACHING METHODS:** lectures with examples

**ASSESSMENT METHODS:** project

**TEACHER (NAME, EMAIL CONTACT):** Ph. D. Dariusz Majerek, d.majerek@pollub.pl



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Introduction to Functional Analysis – WI11

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture+class+discussion
<b>NUMBER OF HOURS:</b> 15	<b>ECTS:</b> 2
<b>SEMESTER:</b> winter	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> basis mathematical analysis
<b>CONTENTS:</b> inner product, norm, metric, Hilbert space, Banach space, bounded and linear operator on normed spaces
<b>EFFECTS OF EDUCATION PROCESS:</b> the students can apply the concepts and method described in syllabus
<b>LITERATURE (OPTIONAL):</b>
<b>TEACHING METHODS:</b> lecture, solving exercises
<b>ASSESSMENT METHODS:</b> homework, written exam
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Renata Buczko, r.buczko@pollub.pl

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Introduction to Industrial Robotics – WI12

<b>FACULTY: Faculty of Mathematics and Information Technology</b>	<b>CLASS TYPE: Lecture + Laboratory</b>
<b>NUMBER OF HOURS: 60 (30+30)</b>	<b>ECTS: 5</b>
<b>SEMESTER: winter/summer</b>	<b>CLASS LEVEL: undergraduate</b>
<b>MINIMAL NUMBER OF STUDENTS: 5</b>	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> none
<b>CONTENTS:</b> Basic concepts in industrial robotics: terminology, classification of robots, coordinate systems, workspace, tools, equipment, applications. Planning of motion trajectories. Applied robotics: programming languages, presentation of the selected programming environments, offline modeling, offline simulation and programming, load assessment, component wear planning, tool selection, auxiliary equipment, data exchange, planning of safety procedures, scheduling of tasks in robotic systems, process optimization.
<b>EFFECTS OF EDUCATION PROCESS:</b> Students acquire knowledge on: the use of robotized manufacturing cells, the general rules of design of automated manufacturing cells with industrial robots. Skills: Students will be able to select an appropriate robot for a task (palletizing, welding, assembly), select robot tools and program robot movements.
<b>LITERATURE (OPTIONAL):</b> Craig JJ (2005) Introduction to Robotics - Mechanics and Control. Pearson Education International, Upper Saddle River, NJ 07458 Murray RM et al. (1994) A Mathematical Introduction to Robotic Manipulation. CRC Press;
<b>TEACHING METHODS:</b> lecture, laboratory exercises
<b>ASSESSMENT METHODS:</b> lecture: exam, laboratory: assessment of reports,
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Eng Radosław Cechowicz, r.cechowicz@pollub.pl

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Introduction to Machine Learning – WI13

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> laboratory
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> logical thinking, basic computer skills, basic knowledge in probability
<b>CONTENTS:</b> machine learning fundamentals, regression analysis, classification techniques, clustering algorithms, dimensionality reduction methods, data preprocessing
<b>EFFECTS OF EDUCATION PROCESS:</b> The course will provide students with a thorough understanding of traditional machine learning algorithms and their practical application in solving real-world predictive problems. Additionally, the course will cover data clustering methods and dimensionality reduction techniques. Students will also acquire skills in data preprocessing and identifying dependencies essential for conducting effective analyses. Furthermore, participants will be introduced to tools for reporting and visualizing results. During the laboratory sessions, key data analysis libraries from Python and R will be utilized.
<b>LITERATURE (OPTIONAL):</b> C.M. Bishop, „Pattern Recognition and Machine Learning”, Springer, 2006
<b>TEACHING METHODS:</b> laboratory
<b>ASSESSMENT METHODS:</b> project
<b>TEACHER (NAME, EMAIL CONTACT):</b> M. Sc. Eng. Michał Błaszczkowski, <a href="mailto:m.blaszczkowski@pollub.pl">m.blaszczkowski@pollub.pl</a>

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Pneumatics and hydraulics drives – WI14

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> Lecture + Laboratory
<b>NUMBER OF HOURS:</b> 45 (15+30)	<b>ECTS:</b> 4
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> Knowledge of the basics of physics in the field of mechanics and thermodynamics. Ability to use engineering graphics
<b>CONTENTS:</b> Basic knowledge of fluid and gas mechanics - Pascal's law, Bernoulli's equation, equation of continuity of motion, types of fluid flows in a pipe. Working fluids - compressed air, working fluids, basic properties of working fluids, density, compressibility, viscosity, emulsions, anhydrous liquids. Energy converters - pumps and compressors, actuators, engines. Control elements - flow direction control valves, distributors, check valves, flow rate control valves. Monostable and bistable valves with electropneumatic control - automatic control system of a double-acting actuator using road distributors. Pneumatic and hydraulic actuators - single-acting and double-acting. Throttle control on the inlet, throttle control on the outlet. Control of the speed of extension and retraction of the piston rod of a double-acting actuator with a bistable valve.
<b>EFFECTS OF EDUCATION PROCESS:</b> the student is able to build a pneumatic and hydraulic drive system with control, is able to build an electropneumatic and electrohydraulic drive system with control, knows the principles of building pneumatic and hydraulic drives and their control
<b>LITERATURE (OPTIONAL):</b> Parr A.A.: Hydraulics and pneumatics. Elsevier Science & Technology Books, 2011
<b>TEACHING METHODS:</b> lecture, laboratory exercises
<b>ASSESSMENT METHODS:</b> lecture: exam, laboratory: assessment of reports
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Eng. Jarosław Zubrzycki, j.zubrzycki@pollub.pl

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Industrial Microcontrollers – WI15

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> Lecture + Laboratory
<b>NUMBER OF HOURS:</b> 45 (15+30)	<b>ECTS:</b> 4
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> basic knowledge of electronics, electrical engineering and programming
<b>CONTENTS:</b> Basic concepts: processor, microprocessor, microcontroller, interface, computer. History and development of microprocessors. Typical microprocessor architectures, their advantages and disadvantages. Overview of the most popular microprocessor and microcontroller models. Basic elements of a single-chip computer: control unit, ALU, registers, program memory, RAM, buses, clock signal and its sources, reset and watchdog circuits, integrated interfaces. Methods of programming non-volatile memory. Programming the microcontroller with demonstration programs and testing their operation. Sequential control of LED numeric display. BCD code. Number display. Communication with a computer via a serial port. Communication with measuring transducers via I2C interface. Alphanumeric LCD display support
<b>EFFECTS OF EDUCATION PROCESS:</b> students have the knowledge to describe the architecture of a typical microprocessor system and explain the functions of its basic components. Students can correctly read a schematic diagram and design a simple embedded system based on a microcontroller and typical peripheral devices
<b>LITERATURE (OPTIONAL):</b> 1. Banzi M., Shiloh M.: Getting started with Arduino. 4th Edition. O'Reilly Media 2024; 2. Monk S. : Programming Arduino. Getting started with sketches. McGraw Hill Book Co, 2023
<b>TEACHING METHODS:</b> lecture, laboratory exercises
<b>ASSESSMENT METHODS:</b> lecture: exam, laboratory: assessment of reports
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Eng. Jarosław Zubrzycki, <a href="mailto:j.zubrzycki@pollub.pl">j.zubrzycki@pollub.pl</a>

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FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Linear Algebra – WI16

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture + class + discussion
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> basic mathematical concepts and notations
<b>CONTENTS:</b> complex numbers; matrix algebra; determinants; systems of linear equations; vector spaces, linear independence, basis and dimension; linear transformations; eigenvectors and eigenvalues; diagonalization
<b>EFFECTS OF EDUCATION PROCESS:</b> the students will be able to apply the concepts and methods described in the syllabus and will be able to solve different mathematical problems using linear algebra
<b>LITERATURE (OPTIONAL):</b> S. J. Axler, Linear Algebra Done Right, Springer-Verlag., D. H. Griffel, Linear Algebra and Its Applications, Chichester: Ellis Horwood Limited., D. C. Lay, Linear Algebra and Its Applications, Addison Wesley., S. J. Leon, Linear Algebra with Applications, Pearson Prentice Hall., D. Poole, Linear Algebra: A Modern Introduction, Brooks/Cole.
<b>TEACHING METHODS:</b> lecture, solving exercises, discussion
<b>ASSESSMENT METHODS:</b> homework, written exam
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. Ewa Łazuka, e.lazuka@pollub.pl

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FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Mathematical Foundations of Life Insurance – WI17

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lectures and exercises
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> differential and integral calculus, probability theory (discrete and continuous random variables)
<b>CONTENTS:</b> demographic models, life tables, typical life insurance policies and their actuarial values, life annuities, premiums, losses and reserves
<b>EFFECTS OF EDUCATION PROCESS:</b> student knows the concept of future lifetime as a random variable, student knows analytical laws of mortality, student knows life tables based model of mortality, student is able to apply methods of calculating actuarial values (also with commutation function), student is able to calculate premium and reserves
<b>LITERATURE (OPTIONAL):</b> N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones, C.J. Nesbitt, Actuarial Mathematics, The Society of Actuaries 1997
<b>TEACHING METHODS:</b> lectures by teacher, textbook assignments, problem solving
<b>ASSESSMENT METHODS:</b> recognition of course work, written and oral examinations
<b>TEACHER (NAME, EMAIL CONTACT):</b> Ph. D. PAWEŁ WLAŻ, p.wlaz@pollub.pl



FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Probability Theory – WI18

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture+class
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> Basic knowledge and skills in the field of calculus, set theory and algebra
<b>CONTENTS:</b> 1. Basic combinatorial schemes. 2. Geometric probability, conditional probability, law of total probability, Bayes's theorem. 3. Independent events, Borel–Cantelli lemma. 4. Random variables, discrete and continuous random variables. 5. Parameters of a distribution, well-known probability distributions. 6. Characteristic functions, central limit theorem.
<b>EFFECTS OF EDUCATION PROCESS:</b> 1. Knows and understands the basic concepts of the probability theory. 2. Knows the basic methods and computational techniques used in the theory of probability.
<b>LITERATURE (OPTIONAL):</b>
<b>TEACHING METHODS:</b> Lecture and practical classes
<b>ASSESSMENT METHODS:</b> Written exam
<b>TEACHER (NAME, EMAIL CONTACT):</b> M. Sc. Eng. Dagmara Dudek <a href="mailto:dagmara.dudek@pollub.pl">dagmara.dudek@pollub.pl</a>

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FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Reliability Theory and Predictive Maintenance – WI19

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> Lecture and Laboratory
<b>NUMBER OF HOURS:</b> 15 Lecture + 15 Laboratory	<b>ECTS:</b> 3
<b>SEMESTER:</b> Winter/Summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

<b>LANGUAGE OF INSTRUCTION:</b> English
<b>PRELIMINARY REQUIREMENTS:</b> none
<b>CONTENTS:</b> This course covers the fundamentals of Reliability Theory, including failure modeling, reliability assessment, and risk analysis, as well as their applications in maintenance strategies. Emphasis is placed on Predictive Maintenance, utilizing data-driven techniques, condition monitoring, and machine learning to optimize system performance and prevent failures.
<b>EFFECTS OF EDUCATION PROCESS:</b> Students will gain the ability to analyze system reliability, apply predictive maintenance techniques, and utilize data-driven methods to optimize performance and prevent failures.
<b>LITERATURE (OPTIONAL):</b>
<b>TEACHING METHODS:</b> Multimedia lectures, laboratory exercises
<b>ASSESSMENT METHODS:</b> Lecture: final exam, Laboratory: submission of final report
<b>TEACHER (NAME, EMAIL CONTACT):</b> PhD Eng. Bartłomiej Ambrozkiewicz, <a href="mailto:b.ambrozkiwicz@pollub.pl">b.ambrozkiwicz@pollub.pl</a>

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FACULTY OF MATHEMATICS and INFORMATION of ECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Introduction to deep learning in Python - WI20

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: Lecture + Laboratory
NUMBER OF HOURS: 30 (15 hours of lectures and 15 hours of laboratories)	ECTS: 3
SEMESTER: Winter/Summer	CLASS LEVEL: undergraduate/master
MINIMAL NUMBER OF STUDENTS: 5	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Mathematics at an academic level, basics of programming in Python, including knowledge of object-oriented programming

CONTENTS: Learning the principles of construction and operation of neural networks from scratch, construction of deep neural networks, i.e. dense networks, CNN, RNN, LSTM using deep learning libraries such as Tensorflow or Pytorch.

EFFECTS OF EDUCATION PROCESS: After completing the course, students will be able to prepare training data, construct neural networks and select deep learning algorithms appropriate to specific problems (regression, binary and multiclass classification, object detection, image recognition, time series prediction).

LITERATURE (OPTIONAL): Deep learning from Scratch: Building with Python from First Principles - Seth Weidman, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensorflow: Concepts, Tools, and Techniques to build Intelligent Systems, 2nd Edition or higher - Aurelien Geron

TEACHING METHODS: Lectures and laboratories

ASSESSMENT METHODS: Final test and assessment of the final project from the laboratory classes

TEACHER (NAME, EMAIL CONTACT): Ph. D. Maciej Czarnacki, m.czarnacki@pollub.pl

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FACULTY OF MATHEMATICS and INFORMATION of ECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Introduction to Logic and Formal Languages - WI21

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> Lecture + Laboratory
<b>NUMBER OF HOURS:</b> 45 (15 Lecture + 30 Laboratory)	<b>ECTS:</b> 4
<b>SEMESTER:</b> Winter/Summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:** None

**CONTENTS:** The course focuses on essential elements of logic and formal languages that can be used to develop efficient programs for logic controllers used in many industrial applications, machine controllers, IoT devices, and smart things. You will learn how to efficiently use formal laws to analyse a problem and produce a minimal switching function suitable for specific hardware (eg. discrete logic gates), programmable logic device (eg. smart switch) or a computer program. Using formal languages will make the process of designing and programming of any sequence (or discrete event controller) easy and straightforward, plus your programs will be easy to debug and upgrade.

**EFFECTS OF EDUCATION PROCESS:** Student will acquire basic formal knowledge on logic and systems of logic and on the basic concepts of formal languages useful for designing and analysing of deterministic finite automata (DFA). Skills: Student will learn to use formal problem analysis to develop control programs for simple logic controllers (like smart switches) and popular industrial control devices (I/O modules, PLC controllers)

**LITERATURE (OPTIONAL):**

**TEACHING METHODS:** Lecture, Laboratory exercises, Work in groups

**ASSESSMENT METHODS:** Lecture: test of knowledge; Laboratory: assessment of reports

**TEACHER (NAME, EMAIL CONTACT):** Ph. D. Eng. Radosław Cechowicz; r.cechowicz@pollub.pl



FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Diploma Seminar – WI22

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> lecture and seminar
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> summer	<b>CLASS LEVEL:</b> master
<b>NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:** knowledge of literature searching, ability to think logically, knowledge regarding the topic of the diploma thesis

**CONTENTS:** Presentation of the principles of writing diploma theses, discussion. Methods of acquiring knowledge for scientific work. Collecting materials from literature and the Internet. Critical analysis of the collected materials. Preparing and conducting research. Rules for the correct presentation of scientific works. Case studies. Students will independently develop issues related, directly or indirectly, to the subject of their diploma theses - according to the schedule established at the beginning of the classes. Discussion with the participation of students and the lecturer regarding both the content and the form of presentation of the presented studies.

**EFFECTS OF EDUCATION PROCESS:** Has knowledge of scientific work, formulating questions, theses and research hypotheses, organizing experiments and using literature. Is able to present the topic and results of the diploma thesis. Is able to edit and write scientific texts.

**LITERATURE (OPTIONAL):** Murray, Rowena. How to write a thesis. McGraw-Hill Education (UK), 2017.  
Evans, David, Paul Gruba, and Justin Zobel. How to write a better thesis. Melbourne Univ. Publishing, 2011.

**TEACHING METHODS:** theory – lecture, practice – seminar

**ASSESSMENT METHODS:** Final coursework assessment (exam)

**TEACHER (NAME, EMAIL CONTACT):** prof. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl



FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Web technologies – WI23

<b>FACULTY:</b> Faculty of Mathematics and Information Technology	<b>CLASS TYPE:</b> Project
<b>NUMBER OF HOURS:</b> 30	<b>ECTS:</b> 3
<b>SEMESTER:</b> winter/summer	<b>CLASS LEVEL:</b> undergraduate/master
<b>MINIMAL NUMBER OF STUDENTS:</b> 5	

**LANGUAGE OF INSTRUCTION:** English

**PRELIMINARY REQUIREMENTS:**  
Knowledge of basic concepts in the field of information technology  
All students willing to participate in the class are required to contact the teacher, personally or via email, before first lecture.

**CONTENTS:**  
Web application design. Basic development tools and frameworks. jWebsite skeleton and organization of basic information on the page using HTML and cascading style sheets CSS. Website layout, navigation, positioning of elements on the page. jBasics of JavaScript programming language and application of ready-made JavaScript and jQuery scripts on websites to increase the functionality of the page. jCode optimization and functionality tests of web applications. Content management systems (CMS). Implementation of a web application according to the assigned project and its publication on the server

**EFFECTS OF EDUCATION PROCESS:**  
Student knows and understands the technologies of designing and implementing web applications. Student has knowledge in the field of protecting intellectual property of content published on websites. Student is able to plan, design and program websites and web applications in the layer of elements supported by web browsers (front-end), using HTML, CSS and JavaScript technology. Student is able to select and use appropriate tools supporting the work of the creator of web applications and increasing the usability and functionality of websites  
Student is ready to comply with the principles of professional ethics of a webmaster and is aware of the responsibility for the operation of the created web applications

**LITERATURE (OPTIONAL):**

**TEACHING METHODS:** Project

**ASSESSMENT METHODS:** Pracitcal task

**TEACHER (NAME, EMAIL CONTACT):** Ph. D. Eng. Barbara Buraczyńska, b.buraczynska@pollub.pl



FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

**E-commerce and social media WI24**

<b>FACULTY: MATHEMATICS and INFORMATION TECHNOLOGY</b>	<b>CLASS TYPE: project</b>
<b>NUMBER OF HOURS: 30</b>	<b>ECTS: 3</b>
<b>SEMESTER: winter/summer</b>	<b>CLASS LEVEL: undergraduate/master</b>
<b>MINIMAL NUMBER OF STUDENTS: 5</b> * should the number be smaller, the course may not be opened	

<b>LANGUAGE OF INSTRUCTION: English</b>
<b>PRELIMINARY REQUIREMENTS: Basic digital literacy and the ability to search, critically evaluate and use information from various online sources.</b>
<b>CONTENTS: E-business Models and Business Concept Development. E-commerce Operations and Strategy Planning. Performance Measurement in E-business. Social Media Platforms and Profile Management. Social Media Strategy and Channel Development. Digital Content Creation for Social Media. Final Project Development and Presentation.</b>
<b>EFFECTS OF EDUCATION PROCESS:</b> Student has knowledge of e-commerce models and the role of social media in digital business. Student understands the principles of online communication, digital marketing, and basic performance measurement in e-commerce. Student can design and implement a social media strategy for a digital business project. Student can create digital content and adapt it to selected social media platforms. Student can use analytical tools to assess the effectiveness of e-commerce and social media activities. Student is ready to independently plan, implement, and creatively manage digital business activities.
<b>LITERATURE (OPTIONAL):</b>
<b>TEACHING METHODS: Project-based learning, guided discussions</b>
<b>ASSESSMENT METHODS: Practical tasks, evaluation of submitted and presented project</b>
<b>TEACHER (NAME, EMAIL CONTACT): Barbara Buraczyńska, b.buraczynska@pollub.pl</b>