ECTS catalogue for courses offered in English at Faculty of Mathematics and Information Technology

in academic year 2024/2025*

Course code	Course name	Semester	Number of hours	Teacher	ECTS
P01	Applications of MATHCAD to some technical issues of mechanics and physics	I	30	prof. Mikhaylo Pashechko	5
P23	C++ programming	I	30	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	5
P18	Calculus	I,II	30	dr inż. Magdalena Jastrzębska	5
P24	Cloud Computing	II	30	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	5
P19	Complex Analysis	I,II	30	dr inż. Anna Futa	5
P26	Diploma Seminar	II	30	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	5
P03	Econometrics	II	15	dr Anna Makarewicz-Trześniewska	4
P04	Electronics	I, II	30	dr inż. Michał Charlak	4
P27	Full-Stack Development in Cloud Computing	II	30	dr hab. Inż. Dariusz Czerwiński, prof. uczelni	5
P21	Fundamentals of Control Theory	I,II	60	dr inż. Radosław Cechowicz	6
P05	Graph Theory	I	30	dr Izolda Gorgol	5
P15	Introduction to Data Analysis	I	30	dr Dariusz Majerek	5
P14	Introduction to Functional Analysis	I,II	15	dr Renata Buczko	4

P22	Introduction to Industrial Robotics	I,II	60	dr inż. Radosław Cechowicz	6
P29	Introduction to Machine Learning	I,II	30	mgr inż. Michał Błaszczykowski	5
P07	Linear Algebra	I, II	30	dr Ewa Łazuka, prof. uczelni	5
P08	Mathematical Foundations of Life Insurance	II	30	dr Paweł Wlaź	5
P20	Probability Theory	I,II	30	mgr inż. Dagmara Dudek	5
P10	Random Processes	I,II	30	dr hab. Yaroslav Chabanyuk, prof. uczelni	5
P13	Selected Topics of Financial Mathematics	I,II	30	dr Janusz Szuster	5

* All courses, contents of them and teachers are subject to change.

There is no possibility to apply for the whole academic year 2024/25, only applications for one semester can be approved.

There won't be possibility for extending mobility from winter to summer semester.

A course will be opened if at least 8 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

Applications of MATHCAD to some technical issues of mechanics and physics – P01

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: lecture+ laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter	CLASS LEVEL: bachelor/master
MINIMAL NUMBER OF STUDENTS: 10 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: calculus, basic physics
CONTENTS: matrix calculations, plotting, solving system of equations, differential and integral calculus, limits, technical mechanics and physics, kinematics, dynamics
EFFECTS OF EDUCATION PROCESS: student will be able to apply MATHCAD to solve some technical problems from mechanics or physics
LITERATURE (OPTIONAL):
TEACHING METHODS: lecture+ laboratory
ASSESSMENT METHODS: project
TEACHER (NAME, EMAIL CONTACT): Mychajło Paszeczko, mpashechko@hotmail.com, m.paszeczko@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

C++ programming – P23

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: winter	**CLASS LEVEL: bachelor**
NUMBER OF STUDENTS: 8 .... * should the number be smaller, the course may not be opened	

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 knows 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): PhD, D.Sc., Eng. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

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Calculus – P18

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: lecture + class
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter/summer	CLASS LEVEL: bachelor
MINIMAL NUMBER OF STUDENTS: 8	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: basic mathematical knowledge

CONTENTS: concepts of functions, limits and continuity, differentiation rules, applications of derivatives, techniques of integration

EFFECTS OF EDUCATION PROCESS: 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

LITERATURE (OPTIONAL):   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

TEACHING METHODS: lecture, solving exercises

ASSESSMENT METHODS: homework, written exam

TEACHER (NAME, EMAIL CONTACT): Magdalena Jastrzębska, m.jastrzebska@pollub.pl

Cloud Computing – P24

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: lecture and laboratory
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: summer	CLASS LEVEL: bachelor
NUMBER OF STUDENTS: 8 …. * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: basic skills of programming, Java programming
CONTENTS: 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
EFFECTS OF EDUCATION PROCESS: 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.
LITERATURE (OPTIONAL): 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.
TEACHING METHODS: theory – lecture, practice – laboratory
ASSESSMENT METHODS: Final coursework assessment (exam)
TEACHER (NAME, EMAIL CONTACT): PhD, D.Sc., Eng. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Complex Analysis – P19

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: lecture + class**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: winter/summer	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

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): Anna Futa, a.futa@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Diploma Seminar – P26

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: lecture and seminar**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: summer	**CLASS LEVEL: master**
NUMBER OF STUDENTS: 8 …. * should the number be smaller, the course may not be opened	

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): PhD, D.Sc., Eng. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Econometrics – P03

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: laboratories**
NUMBER OF HOURS: 15	**ECTS: 4**
SEMESTER: IV	**CLASS LEVEL: bachelor/master**
MINIMAL NUMBER OF STUDENTS: 4 * should the number be smaller, the course may not be opened	

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

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LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Electronics – P04

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: tutorial**
NUMBER OF HOURS: 30	**ECTS: 4**
SEMESTER: winter/summer	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS:

CONTENTS: Semiconductors: diode, bipolar transistor, operational amplifier. Rectifier. AC/DC Power Adapter. Power amplifier. Function generator. Logic gates, flip-flops. Microprocessor architecture**.**

EFFECTS OF EDUCATION PROCESS: Students can apply fundamental electrical circuit's laws to design and measure simply electronic device

LITERATURE (OPTIONAL): Kuphaldt T.R., 2009 Lessons In Electric Circuits. Volume III – Semiconductors. full text access http://openbookproject.net/electricCircuits/

TEACHING METHODS: tutorial in lab

ASSESSMENT METHODS: exercise evaluation, class test

TEACHER (NAME, EMAIL CONTACT): Michał Charlak, m.charlak@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Full-Stack Development in Cloud Computing – P27

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: lecture and laboratory**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: summer	**CLASS LEVEL: master**
NUMBER OF STUDENTS: 8 …. * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Knowledge of the following languages and tools: JavaScript, HTML, CSS, PHP, SQL, Java, basic programming in algorithmic languages
CONTENTS: 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
EFFECTS OF EDUCATION PROCESS: 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.
LITERATURE (OPTIONAL): 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.
TEACHING METHODS: theory – lecture, practice – laboratory
ASSESSMENT METHODS: Final coursework assessment (exam)
TEACHER (NAME, EMAIL CONTACT): PhD, D.Sc., Eng. Dariusz Czerwinski, university professor, d.czerwinski@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Fundamentals of Control Theory – P21

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: Lecture + Laboratory**
NUMBER OF HOURS: 60 (30 lecture + 30 laboratory)	**ECTS: 6**
SEMESTER: winter/summer	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 6 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basic skills in numerical software (like Matlab/Scilab), fundamentals of calculus
CONTENTS: 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.
EFFECTS OF EDUCATION PROCESS: 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.
LITERATURE (OPTIONAL):   K. J. Åström, R. M. Murray: Feedback Systems: An Introduction for Scientists and Engineers http://www.cds.caltech.edu/~murray/amwiki/Main_Page   P. Dawkins,: Paul's Online Notes, http://tutorial.math.lamar.edu/
TEACHING METHODS: lecture, laboratory exercises
ASSESSMENT METHODS: lecture: exam, laboratory: assessment of reports,
TEACHER (NAME, EMAIL CONTACT): Radosław Cechowicz, PhD Eng.; r.cechowicz@pollub.pl

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LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Graph Theory – P05

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: lecture**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: winter	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

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): Izolda Gorgol, i.gorgol@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Introduction to Data Analysis – P15

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: Lecture**
NUMBER OF HOURS: 15	**ECTS: 4**
SEMESTER: winter	**CLASS LEVEL: bachelor/master**
MINIMAL NUMBER OF STUDENTS: 8	

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): Dariusz Majerek, d.majerek@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Introduction to Functional Analysis – P14

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: lecture+class+discussion**
NUMBER OF HOURS: 15	**ECTS: 4**
SEMESTER: winter	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

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

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Introduction to Industrial Robotics – P22

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: Lecture + Laboratory**
NUMBER OF HOURS: 60 (30+30)	**ECTS: 6**
SEMESTER: winter/summer	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: none
CONTENTS: 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.
EFFECTS OF EDUCATION PROCESS: 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.
LITERATURE (OPTIONAL): 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;
TEACHING METHODS: lecture, laboratory exercises
ASSESSMENT METHODS: lecture: exam, laboratory: assessment of reports,
TEACHER (NAME, EMAIL CONTACT): Radosław Cechowicz, PhD Eng.; r.cechowicz@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Introduction to Machine Learning – P22

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: laboratory**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: winter/summer	**CLASS LEVEL: bachelor**
MINIMAL NUMBER OF STUDENTS: 8	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: logical thinking, basic computer skills, basic knowledge in probability
CONTENTS: machine learning fundamentals, regression analysis, classification techniques, clustering algorithms, dimensionality reduction methods, data preprocessing
EFFECTS OF EDUCATION PROCESS: 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.
LITERATURE (OPTIONAL): C.M. Bishop, „Pattern Recognition and Machine Learning", Springer, 2006
TEACHING METHODS: laboratory
ASSESSMENT METHODS: project
TEACHER (NAME, EMAIL CONTACT): Michał Błaszczykowski, m.blaszczykowski@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Linear Algebra – P07

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: lecture + class + discussion
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter or summer	CLASS LEVEL: bachelor
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: basic mathematical concepts and notations

CONTENTS: complex numbers; matrix algebra; determinants; systems of linear equations; vector spaces, linear independence, basis and dimension; linear transformations; eigenvectors and eigenvalues; diagonalization

EFFECTS OF EDUCATION PROCESS: 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

LITERATURE (OPTIONAL): 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.

TEACHING METHODS: lecture, solving exercises, discussion

ASSESSMENT METHODS: homework, written exam

TEACHER (NAME, EMAIL CONTACT): Ewa Łazuka, e.lazuka@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Mathematical Foundations of Life Insurance – P08

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE:** lectures and exercises
NUMBER OF HOURS: 30	**ECTS:** 5
SEMESTER: summer	**CLASS LEVEL:** bachelor/master
MINIMAL NUMBER OF STUDENTS: 5	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: differential and integral calculus, probability theory (discrete and continuous random variables)
CONTENTS: demographic models, life tables, typical life insurance policies and their actuarial values, life annuities, premiums, losses and reserves
EFFECTS OF EDUCATION PROCESS: 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
LITERATURE (OPTIONAL): N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones, C.J. Nesbitt, Actuarial Mathematics, The Society of Actuaries 1997
TEACHING METHODS: lectures by teacher, textbook assignments, problem solving
ASSESSMENT METHODS: recognition of course work, written and oral examinations
TEACHER (NAME, EMAIL CONTACT): PAWEŁ WLAŹ, p.wlaz@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Probability Theory – P20

FACULTY: Faculty of Mathematics and Information Technology	CLASS TYPE: lecture+class
NUMBER OF HOURS: 30	ECTS: 5
SEMESTER: winter/summer	CLASS LEVEL: bachelor
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English
PRELIMINARY REQUIREMENTS: Basic knowledge and skills in the field of calculus, set theory and algebra
CONTENTS: 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.
EFFECTS OF EDUCATION PROCESS: 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.
LITERATURE (OPTIONAL):
TEACHING METHODS: Lecture and practical classes
ASSESSMENT METHODS: Written exam
TEACHER (NAME, EMAIL CONTACT): Dagmara Dudek dagmara.dudek@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Random Processes – P10

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: lecture + class**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: winter/summer	**CLASS LEVEL: bechelor/master/PhD**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Knowledge: derivative, integral, concept of probability, application of numerical characteristics of random quantities

CONTENTS: Multiplication Rule. Permutation. Combination. Probability Measure.Some Properties of the Probability Measure Conditional Probabilities Bayes' Theorem Distribution Functions of Discrete Random Variables Distribution Functions of Continuous Random Variables Percentiles for Continuous Random Variables Expected Value of Random Variables Variance of Random Variables Chebychev Inequality Moment Generating Functions Bernoulli Distribution Geometric Distribution Hypergeometric Distribution Poisson Distribution Uniform Distribution Gamma Distribution Normal Distribution Lognormal Distribution Bivariate Discrete Random Variables Conditional Distributions Independence of Random Variables Covariance of Bivariate Random Variables Independence of Random Variables Variance of the Linear Combination of Random Variables Correlation and Independence Moment Generating Functions Conditional Expected Values Conditional Variance Distribution Function Method Random Processes. Definition and Simple Examples. Averages of a Random Process TIME AVERAGE, TIME VARIANCE, TEMPORAL CROSS/AUTO CORRELATION EXPECTED VALUE, STATISTICAL VARIANCE, AUTO-CORRELATION Stationary Random Processes Markov Processes Independent Increment Processes Counting Processes and Poisson Process Mean and Autocorrelation Functions

EFFECTS OF EDUCATION PROCESS: Be able to calculate and apply the main numerical characteristics of stationary and non -stationary random processes

LITERATURE (OPTIONAL): Rosenthal, J. S. (2000). A First Look at Rigorous Probability Theory. Singapore: World Scientific. Ross, S. (1988). A First Course in Probability. New York: Macmillan. Ross, S. M. (2000). Introduction to Probability and Statistics for Engineers and Scientists. San Diego: Harcourt Academic Press. Roussas, G. (2003). An Introduction to Probability and Statistical Inference. San Diego: Academic Press. Sahai, H. and Ageel, M. I. (2000). The Analysis of Variance. Boston: Birkhauser.Prasanna Sahoo. (2010). Bruce Hajek. (2015). Random Processes for Engineers. Cambridge University Press

TEACHING METHODS: lecture

ASSESSMENT METHODS: The assessment is obtained on the basis of a written exam

TEACHER (NAME, EMAIL CONTACT): Yaroslav Chabanyuk, y.chabanyuk@pollub.pl

FACULTY OF MATHEMATICS AND INFORMATION TECHNOLOGY

LUBLIN UNIVERSITY OF TECHNOLOGY PL LUBLIN03

Selected Topics of Financial Mathematics – P13

FACULTY: Faculty of Mathematics and Information Technology	**CLASS TYPE: seminar**
NUMBER OF HOURS: 30	**ECTS: 5**
SEMESTER: winter/summer	**CLASS LEVEL: bachelor/master/PhD**
MINIMAL NUMBER OF STUDENTS: 8 * should the number be smaller, the course may not be opened	

LANGUAGE OF INSTRUCTION: English

PRELIMINARY REQUIREMENTS: Knowledge of calculus II and basic probability theory

CONTENTS: Types of accumulation and discounting; Basic annuities; The term structure of interest rates; Types of interest rates; Fundamental categories of derivatives; FRA contracts; IRS contracts; Futures and Forward; Stock options; Binomial models**.**

EFFECTS OF EDUCATION PROCESS: : The student knows and understands: notions of accumulation and discounting and types of them, the dependence of the term structure of the type of the accumulation process, types of annuities, types of interest rates. The student knows and understands notions and properties of basic derivatives. The student knows and understands the structure of FRA and IRS contracts and also he knows the methods of valuation of those contracts. The student knows and understands Futures and Forward contracts and stock options.The student knows and understands the binomial models: one-step and multi-step as well as methods of valuation of derivatives and the algorithm of the valuation of the contract with use of binomial tree. The student is able to: utilize the notions of nominal and effective interest rates and the relation between the term structure of interest rates and the type of the accumulation process, use the notion of the annuity and apply the appropriate types of annuities to determine the present and future value of the

capital and loan, use derivatives related notions and apply the properties of basic derivatives, apply FRA, IRS, Future and Forward contracts in basic investment strategies, perform the valuation of the derivative instrument with use of the binomial models.

LITERATURE (OPTIONAL): Hull J.C., Options, Futures & Other Derivatives, Prentice Hall, 2002; Kellison S.G., The Theory of Interest, McGraw-Hill, 1991

TEACHING METHODS: seminar

ASSESSMENT METHODS: The student presents main theoretical concepts and ideas and solves the problems.

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