Title:	**Algorithms and Data Structures**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	3
Assessment methods:	homework, tests, exam
Language of instruction:	English
Prerequisites:	familiarity with any programming language or Sage
Course content:	Abstract data structure as an organization of data with specified properties; Big oh and theta notations, average, the best and the worst case analyses; simple recurrence relations and their applications to algorithms analyses; Data structures: arrays, lists, stacks, trees; Algorithm designing techniques: divide and conquer, dynamic programming, recursion; Graphs: representation, breadth and depth first searches, shortest path, minimal spanning tree, etc.
Learning outcomes:	By the end of the course students should know: fundamental data structures, efficient algorithms for a number of fundamental problems and should be able to: use appropriate data structures, prove correctness and analyse running times of algorithms, translate algorithms into computer programs using any software tool (Python, C++, Sage). Students should also intensify cooperative work and demonstrate positive interpersonal skills.
Name of lecturer:	Dr Marcin Kowalewski
Contact (email address):	marcinko@ukw.edu.pl
Literature:	1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Florida International University, 2014. 2. Data Structures & Algorithms, 2016 by Tutorials Point. 3. William A. Stein et al.: Sage Mathematics Software (Version 5.2), The Sage Development Team, 2012, http://www.sagemath.org. 4. William Stein, Sage for Power Users, 2012.

Title:	**Complex Analysis**
Lecture hours:	45
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	Written test
Language of instruction:	English
Prerequisites:	basics of Calculus
Course content:	Complex numbers, polar form, complex plane; Complex differentiability, holomorphic functions; Examples including the exponential function, the trigonometric function; Power series, radius of convergence, analytic functions; Path integrals in the complex plane, Cauchy integral theorem, Cauchy's integral formula; Laurent series; Isolated singularity: removable singularity, pole, essential singularity; Residues.
Learning outcomes:	By the end of the course students should know notions of holomorphic and analytic functions and their equivalence, radius of convergence of power series and the way to compute it, Cauchy integral theorem, Cauchy's integral formula. They should be able to expand holomorphic functions into Taylor and Laurent series, to define isolated singularities and to use residues to compute path integrals.
Name of lecturer:	dr Waldemar Sieg
Contact (email address):	waldeks@ukw.edu.pl
Literature:	1. M. Beck, G. Marchesi, D. Pixton, L. Sabalka, "A first course in Complex Analysis", version 1.53, http://math.sfsu.edu/beck/papers/complex.pdf 2. Ch. Berg, "Complex analysis", 2012, http://www.math.ku.dk/noter/filer/koman-12.pdf

Title:	**Combinatorics**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	4
Assessment methods:	homework, test
Language of instruction:	English
Prerequisites:	math induction, basics of Calculus and Group Theory
Course content:	Combinatorial schemes: variations, combinations, permutations, etc., counting number and set partitions, Diophantine equation's solutions, binary sequences under constraints; Dirichlet pigeon-hole principle; recursion, generating functions as a tool in Combinatorics; Pólya's theory.
Learning outcomes:	Students are expected to be acquainted with several (over those elementary) tools in solving combinatorial problems. Strong demand shall be put on practice.
Name of lecturer:	Dr Piotr Sworowski
Contact (email address):	piotrus@ukw.edu.pl
Literature:	Victor Bryant, Aspects of Combinatorics, Cambridge University Press, 1993 Ronald Graham, Donald Knuth, Oren Patashnik, Concrete Mathematics, Addison-Wesley, 1994

Title:	**Differential Geometry**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	5
Assessment methods:	exam
Language of instruction:	English
Prerequisites:	basics of Linear Algebra with Geometry and Calculus
Course content:	1.Plane and space: Linear Algebra and Geometry. 2.Curves in plane and space: vector function of one variable, parameterized curves, curvature, space curves. 3. Regular surfaces: parameterizations of surfaces, Measurement in curved coordinates: the 1. fundamental form, Normal sections and normal curvature, Normal and geodesic curvature; the second fundamental form, Principal curvatures, Gaussian curvature and Mean curvature, Special surfaces
Learning outcomes:	1. Students will understand and apply theorems related to curves and surfaces embedded in the Euclidean Space. 2. Students will understand and apply results of tensor Calculus and the language of differential forms. 3. Students will prove basic results in Differential Geometry of Curves and Surfaces, as embedded in the Euclidean Space as well as abstract manifolds of dimensions 1 and 2. 4. Students will be able to write solutions to problems and extend theoretical proofs to examples.
Name of lecturer:	Dr Karolina Mroczyńska
Contact (email address):	kamrok@ukw.edu.pl
Literature:	1.Martin Roussen, Elementary differential geometry 2. Serge Lang, Fundamentals of differential geometry 3. Andrew Pressley, Elementary differential geometry

Title:	**Discrete Mathematics**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	classroom assessment; written test
Language of instruction:	English
Prerequisites:	induction, basics of Calculus and Group Theory
Course content:	Counting schemes: permutations, variations, combinations, Stirling numbers, Dirichlet rule; Recurrence; Redfield-Polya's theorem; Euler/Hamilton paths and cycles: Euler's theorem, Ore's theorem, Meyniel's theorem; Planarity: Kuratowski's criterion of planarity; Trees and forests: spanning trees, Kirchhoff and Cayley's formulas; Connectivity: Menger's theorem; Independence and colouring: matchings and covers, Berge's theorem, Hall's theorem, map colouring, Vizing's theorem; Flows in digraphs: Ford-Fulkerson's theorem.
Learning outcomes:	By the end of the course students should know: several (over those elementary) tools in solving combinatorial problems; should be able to: use basic combinatorial and graph theory tools to solve various practical problems.
Name of lecturer:	Dr Piotr Sworowski
Contact (email address):	piotrus@ukw.edu.pl
Literature:	Victor Bryant, Aspects of Combinatorics, Cambridge University Press, 1993 Ronald Graham, Donald Knuth, Oren Patashnik, Concrete Mathematics, Addison-Wesley, 1994 Robin J. Wilson, Introduction to Graph Theory, Longman, 1985 Béla Bollobás, Modern Graph Theory, Springer, Berlin, 1998 Reinhard Diestel, Graph Theory, Springer, Berlin, 2000

Title:	**Functional Analysis**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	classroom assessment, written exam
Language of instruction:	English
Prerequisites:	Calculus, Linear Algebra, Topology
Course content:	Linear spaces, Hamel basis, dimension; finite-dimensional spaces; norm, metric, and topology on linear spaces; examples of norms; Minkowski's functional; Hölder and Minkovski's inequalities; l_p-spaces; completeness of normed spaces; operators on Banach spaces – examples; Banach-Steinhaus theorem, closed graph and open mapping theorems; Hahn-Banach theorem; dualiy.; Hilbert spaces; complementability of closed subspaces; Bessel's inequality, Parseval's identity; operators on Hilbert spaces; spectral theorem.
Learning outcomes:	By the end of the course students should know: Hahn-Banach and Banach-Steinhaus theorems, The Open Mapping Theorem, complemented subspaces of Hilbert space, Parseval's identity; Basic examples of Banach spaces: Hilbert, $C(K)$ for K compact, l_p, L_p, basic examples of bounded operators; duality and reflexivity.
Name of lecturer:	Prof. Marek Wójtowicz
Contact (email address):	mwojt@ukw.edu.pl
Literature:	J. B. Conway, *A Course in Functional Analysis*, 1994. W. Rudin, *Real and Complex Analysis*, 1987.

Title:	**Formal Languages**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	homework, test
Language of instruction:	English
Prerequisites:	Elementary notions of abstract algebra
Course content:	regular expressions and regular languages, finite state automata, formal grammars, Chomsky hierarchy, context-free languages, pushdown automata, pumping lemmata
Learning outcomes:	The aim is to provide students with basics of formal language theory, in particular, of algorithms for recognition and parsing.
Name of lecturer:	Prof. Oleh Nykyforchyn
Contact (email address):	oleh.nyk@gmail.com
Literature:	James Power, "Notes on Formal Language Theory and Parsing", http://www.cs.nuim.ie/~jpower/Courses/Previous/parsing/index.html

Title:	**Generalized Integrals**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	5
Assessment methods:	test, homework assessment
Language of instruction:	English
Prerequisites:	basics of Real Functions Theory
Course content:	Kurzweil-Henstock integral; McShane integral; Perron integral; classical Perron integral and δ-variation; Denjoy-Perron integral; applications.
Learning outcomes:	By the end of the course students should define and recognize differences between various modes of integrability: Newton, Riemann, Kurzweil-Henstock, McShane, Perron, Dejoy-Perron. She/he should be able to know and apply various criteria of integrability and provide examples of nonintegrable and integrable functions. She/he should recognize and describe connections between generalized integrability and classical Measure Theory, concerning e.g. variation and absolute continuity of measures.
Name of lecturer:	Dr Piotr Sworowski
Contact (email address):	piotrus@ukw.edu.pl
Literature:	Robert G. Bartle, A modern theory of integration, Graduate Studies in Mathematics, 32, AMS, Providence 2001 Russell A. Gordon, The integrals of Lebesgue, Denjoy, Perron, and Henstock, Graduate Studies in Mathematics, 4, AMS, Providence 1994

Title:	**Graph Theory and Ramsey Theory**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	homework, test
Language of instruction:	English
Prerequisites:	math induction
Course content:	Euler trails and circuits: Euler theorem; Hamilton paths and cycles: Ore theorem; Planarity: Kuratowski's criterion of planarity; Trees and forests: spanning trees, Kirchhoff and Cayley's formulas, Kruskal's algorithm; Connectivity: Menger's theorem; Independence and colouring: matchings and covers, Berge theorem, Hall theorem; Colouring, Brooks' and Vizing's theorems, map colouring; Flows in digraphs: Ford&Fulkerson's theorem; Ramsey's theorem; Exact values and bounds for Ramsey numbers; Ramsey numbers for graphs; arithmetic progressions: van der Waerden's theorem, Erdos-Turan problem.
Learning outcomes:	Students should know basic theorems with proofs, describe applications for various graph theory problems, recognize the Ramsey theory leitmotiv in various contexts, and provide examples of false Ramsey-type results. Should be able to argue as for determining some small Ramsey numbers.
Name of lecturer:	Dr Piotr Sworowski
Contact (email address):	piotrus@ukw.edu.pl
Literature:	Robin J. Wilson, Introduction to Graph Theory, Longman, 1985 Béla Bollobás, Modern Graph Theory, Springer, Berlin, 1998. Reinhard Diestel, Graph Theory, Springer, Berlin, 2000 Ronald L. Graham, Rudiments of Ramsey Theory, American Mathematical Society, Providence, Rhode Island, 1981

Title:	**Teaching ICT**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	4
Assessment methods:	homework, exam
Language of instruction:	English
Prerequisites:	basic course of Psychology, General Didactics
Course content:	ICT and education; constructive theories of learning and knowledge; feeling and motivation, cognitive dimension; various teaching approaches; planning for ICT learning; assessment and public examinations; ICT communications; using ICT.
Learning outcomes:	By the end of the course students should distinguish ethical, social, emotional and cognitive dimension of learning ICT, start to relate various forms of classroom organization to particular pedagogic intentions and tasks, know the roles of exposition, investigation, questioning, listening, explanation, select appropriate teaching strategies, tasks and resources, plan ICT lessons and units of works, identifying clear objectives and content, plan assessment opportunities, etc.
Name of lecturer:	Dr Katarzyna Chmielewska
Contact (email address):	kasiach@ukw.edu.pl
Literature:	Kennewell S., Parkinson J., Tanner H, Learning to Teach ICT in the Secondary School, RoutledgeFalmer, London/New York, 2007 Perez-Marin D., Information and Communications Technology in the 21st Century Classroom, De Gruyer Open Ltd, Warsaw/Berlin 2014 Gillespie H., Unlocking Learning and Teaching with ICT, David Fulton, New York 2007

Title:	**Measure Theory**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	homework, test
Language of instruction:	English
Prerequisites:	basics of one- and many-dimensional calculus
Course content:	Measurability, measurable functions, classical integration, product measures and integrals, general measure theory, Hausdorff measures.
Learning outcomes:	To give a general view at summation and integration, also in connection to derivation.
Name of lecturer:	Prof. Oleh Nykyforchyn
Contact (email address):	oleh.nyk@gmail.com
Literature:	Endre Pap, 2002, Handbook of measure theory, Amsterdam, North Holland/Elsevier, http://www.sciencedirect.com/science/book/9780444502636

Title:	**Numerical Methods**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	5
Assessment methods:	homework assessment, test
Language of instruction:	English
Prerequisites:	Familiarity with Linear Algebra and Calculus. Familiarity with any programming language, e.g., C++, Python or Sage, will be helpful.
Course content:	By the end of the course students should know: core ideas and concepts of Numerical Methods, how to use computational tools and should be able to: analyze and describe the initial mathematical problem, show logical thinking in encoding it into an algorithmic form; translate numerical algorithms into computer programs using any software tool (Python, C++, Sage), estimate errors.
Learning outcomes:	Binary numbers; number representation; error analysis; locating roots of equations; numerical interpolation; Gaussian elimination method of solution of a linear systems of equations; LU decomposition, QR decomposition; eigenvalue problems; iterative methods of numerical integration: Newton-Cotes quadrature, orthogonal polynomials and Gaussian quadrature; approximation; matrix norms, etc.
Name of lecturer:	Dr Marcin Kowalewski
Contact (email address):	marcinko@ukw.edu.pl
Literature:	Richard L. Burden, J. Douglas Faires, Numerical Analysis, 2011, Brooks/Cole. Numerical Computing with Sage, Release 5.2, The Sage Development Team, 2012, http://www.sagemath.org/pdf/numerical sage.pdf A.Rasila: Introduction to numerical methods with Python language, part 1, Mathematics Newsletter / Ramanujan Mathematical Society 14: 1 and 2 (2004), 1 -15. http://www.ramanujanmathsociety.org/ William A. Stein et al.: Sage Mathematics Software (Version 5.2), The Sage Development Team, 2012, http://www.sagemath.org.

Title:	**Ordinary Differential Equations**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	30
Assessment methods:	classroom assessment, written test
Language of instruction:	English
Prerequisites:	basics of Calculus
Course content:	The notion of ordinary differential equation (ODE) and its solution; graphical interpretation of solution (direction field); theorems on existence and uniqueness of solutions of first order ODE; separation of variables method; first order linear ODE; integrating factors; envelopes as singular solutions; linear ODE of higher rank.
Learning outcomes:	By the end of the course students should know: the notion of ordinary differential equation (ODE) and its solution (in various settings); graphical interpretation of a solution, theorems on existence and uniqueness of solutions of first and higher order ODE. Should be able to: solve ODEs of various types, discuss the question of uniqueness under some initial conditions and a structure of general solution.
Name of lecturer:	Dr Piotr Sworowski
Contact (email address):	piotrus@ukw.edu.pl
Literature:	James C. Robinson, An Introduction to Ordinary Differential Equations, Cambridge University Press, 2004

Title:	**Partial Differential Equations**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	written exam, individual problem solving
Language of instruction:	English
Prerequisites:	basics of Calculus and ODE
Course content:	The notion of a partial differential equation (PDE) and its solution; Cauchy's problem for PDE, a brief excursion into mathematical physics. Transport equation; first integrals of a first order linear PDE – characteristics method. Classification of second order PDEs: hyperbolic, parabolic, elliptic; canonic forms of second order PDE; characteristics method. Equation of infinite string vibrations, d'Alembert formula. Finite string equation, Fourier method of separation of variables. Heat (difusion) equation, maximum principle. Elliptic equations; harmonic functions, Green function.
Learning outcomes:	By the end of the course students should know: the concept of partial differential equation and should be able to: solve various kinds of PDE under Cauchy's problem (first and second order PDE), describe some classical equations of mathematical physics.
Name of lecturer:	Prof. Taras Radul
Contact (email address):	tarasradul@yahoo.co.uk
Literature:	Walter A. Strauss. Partial differential equations. John Wiley and Sons. 2000

Title:	**Probability and Statistical Methods in Economy**
Lecture hours:	45
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	classroom assessment, project, written exam
Language of instruction:	English
Prerequisites:	basic Probability and Statistics
Course content:	Introduction and descriptive statistics; normal distribution; sampling distributions; intervals of confidence; hypothesis testing; comparison of two populations; variance analysis; simple linear regression and correlation; time series, forecasting; nonparametric methods and chi-square test; Bayesian statistics and decision analysis appendices; sampling methods.
Learning outcomes:	By the end of the course students should know: methods of a structure analysis, basic distributions, methods of determining confidence intervals, methods of hypothesis testing, methods of correlation and regression analyses, theory of forecasting, theory of Bayesian statistics.
Name of lecturer:	Dr Katarzyna Chmielewska
Contact (email address):	kasiach@ukw.edu.pl
Literature:	Douglas C. Montgomery, George C. Runger, *Applied Statistics and Probability for Engineers*, John Wiley & Sons, Inc, USA 2003 Amir D. Aczel, *Complete Business Statistics*, Hardcover – 2012

Title:	**Portfolio Theory**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	4
Assessment methods:	written test
Language of instruction:	English
Prerequisites:	Probability and Linear Algebra
Course content:	**Static portfolio choice** **1.** Expected return of portfolio. 2. Utility theory and choice of portfolio. **Market equilibrium models** **1.** One- and two-period equilibrium models. **2.** Capital asset pricing model (CAPM). **3.** Arbitrage pricing theory (APT). **4.** Options pricing. Futures contract pricing.
Learning outcomes:	Students should describe various methods of choice of an optimal portfolio (with or without a risk-free asset) and basic methods of asset pricing (CAPM, APT), and formulate fundamental theorems with proofs. Students should be able to: compare portfolios with maximizing their utility, price assets using basic equilibrium models.
Name of lecturer:	Dr Piotr Sworowski
Contact (email address):	piotrus@ukw.edu.pl
Literature:	Edwin J. Elton et al., Modern Portfolio Theory and Investment Analysis

Title:	**Real Analysis**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	classroom assessment, written test
Language of instruction:	English
Prerequisites:	basics of Calculus
Course content:	Continuous functions – equivalent definitions; Uniform continuity; Baire classification; Differentiation; An example of continuous nowhere differentiable function; Convex functions; Jensen inequality; Mean value theorems; Primitives; Equivalent definitions of the Riemann integrals; Newton integral; Comparison with the Riemann integral; Differentiability of the indefinite Riemann integral; Integrability in the Newton sense of a continuous function; Criteria for Riemann integrability; Riemann-Lebesgue theorem; Improper integral; Functional series and conditions for termwise differentiation and integrations.
Learning outcomes:	By the end of the course students should know the principal notions of the Real Functions Theory related to continuity, differentiability, integrability and functional series. They should be able to apply criteria for Riemann integrability, including Riemann-Lebesgue theorem and tests for improper integrability.
Name of lecturer:	to be determined
Contact (email address):	piotrus@ukw.edu.pl
Literature:	Isidor Natanson, Theory of functions of a real variable, Dover, 2016 Russell A. Gordon, The integrals of Lebesgue, Denjoy, Perron, and Henstock, Graduate Studies in Mathematics, 4, AMS, Providence 1994

Title:	**Software Laboratory (Sage)**
Lecture hours:	15
Study period: (summer/winter)	winter or summer
Number of credits:	2
Assessment methods:	problem solving (classroom assessment)
Language of instruction:	English
Prerequisites:	basic programming
Course content:	Environment of Sage – introduction; calculations: variables, constants, numbers, mathematical operations and functions; strings; vectors; lists; numerical and symbolic operations; programming in Sage; graphic in Sage, 2D and 3D graphs.
Learning outcomes:	Student should be able to solve some math problems using Sage.
Name of lecturer:	Dr Marcin Kowalewski
Contact (email address):	marcinko@ukw.edu.pl
Literature:	1. William A. Stein et al.: Sage Mathematics Software (Version 5.2), The Sage Development Team, 2012, http://www.sagemath.org. 2. William Stein, Sage for Power Users, 2012. 3. Sage Tutorial, The Sage Development Team, 2017.

Title:	**Statistics**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	exam, problem solving
Language of instruction:	English
Prerequisites:	Combinatorics, basics of Calculus and Measure Theory
Course content:	Probability; Random variables; Limit theorems; Basic concepts of Statistics Estimation; Testing hypotheses; Multivariate Distributions, Correlation.
Learning outcomes:	By the end of the course students should know: basic concepts of Probability and should be able to: compute probability of random events, expected value, variance and standard deviation, analyse basic experiments scheme, analyse structure of empirical data, conduct simple statistical inference, e.g. testing statistical hypotheses, examining correlation.
Name of lecturer:	Dr Katarzyna Chmielewska
Contact (email address):	kasiach@ukw.edu.pl
Literature:	Douglas C. Montgomery, George C. Runger, *Applied Statistics and Probability for Engineers*, John Wiley & Sons, Inc, USA 2003

Title:	**Introduction to Topology**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	oral and written exam
Language of instruction:	English
Prerequisites:	basic set theory, basics of calculus
Course content:	Metric spaces: definition and examples. Convergence in metric spaces. Open and closed subsets of metric spaces; interior, closure and boundary of sets. Metric products of metric spaces. Continuous and uniformly continuous mappings. Homeomorphisms and isometries. Complete spaces; theorems of Banach, Cantor and Baire. Separable metric spaces. Compact and connected metric spaces; continuous maps on compact and connected metric spaces; compactness in Euclidean spaces.
Learning outcomes:	A student should demonstrate knowledge of basic properties of subsets of metric spaces, various sorts of metric spaces and continuous functions defined on them. A student also should prove some basic propositions concerning metric spaces and its properties.
Name of lecturer:	Prof. Taras Radul
Contact (email address):	tarasradul@yahoo.co.uk
Literature:	S.Kumaresan. Topology of Metric Spaces. Alpha Science International Ltd. Harrow. 2005 Walter Rudin. Principles of Mathematical Analysis. 3rd ed. International Student Edition. McGraw-Hill. 1985 Seymour Lipschutz. Theory and Problems of General Topology. Schaum's Outlines Series. McGraw-Hill Education. 2011

Title:	**General Topology**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	oral and written exam
Language of instruction:	English
Prerequisites:	basic Set Theory, basic Calculus and Topology of Metric Spaces
Course content:	Definition of topology and examples; open and closed sets; bases and sub-bases of a topology, weight of topological spaces; interior, closure, and boundary of sets in a topological space. Continuous functions and homeomorphisms; topological invariants. Subspaces, quotient spaces and products of topological spaces; Tychonoff topology. Compact and local compact spaces, Alexander lemma, Tychonoff product theorem. Axioms of separation; normal spaces, Urysohn lemma; Tychonoff spaces and Tychonoff cubes, separating families of continuous functions, embeddings in Tychonoff cubes. Connected spaces; components and quasi-components; locally connected and linearly connected spaces.
Learning outcomes:	A student should demonstrate knowledge of basic properties of subsets of topological spaces, various sorts of topological spaces and continuous functions defined on them. A student also should prove some basic propositions concerning topological spaces and its properties.
Name of lecturer:	Prof. Taras Radul
Contact (email address):	tarasradul@yahoo.co.uk
Literature:	Ryszard Engelking. General Topology. Polish Scientific Publishers. 1977 Seymour Lipschutz. Theory and Problems of General Topology. Schaum's Outlines Series. McGraw-Hill Education. 2011

Title:	**Teaching Mathematics**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	5
Assessment methods:	assessment of teacher's documents prepared by student, exam
Language of instruction:	English
Prerequisites:	Basic course of Psychology, General Didactics.
Course content:	Mathematics and education; theories of learning and knowledge; feeling and motivation, cognitive dimension; various teaching approaches; planning for Mathematics learning; assessment and public examinations; mathematical communications; using ICT.
Learning outcomes:	By the end of the course students should distinguish the social, emotional and cognitive dimension of learning Mathematics, be making links between reading and experience in school, start to relate various forms of classroom organization to particular pedagogic intentions and tasks, know the roles of exposition, investigation, questioning, listening, explanation, select appropriate teaching strategies and tasks and resources etc.
Name of lecturer:	Dr Katarzyna Chmielewska
Contact (email address):	kasiach@ukw.edu.pl
Literature:	Johnston-Wilder S., Johnston-Wilder P., Pimm D., Westwell J., Learning to Teach ICT in the Secondary School, Routledge Taylor and Francis Group, New York 2007

Title:	**Calculus 1**
Lecture hours:	45
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	oral and written exam
Language of instruction:	English
Prerequisites:	none
Course content:	Fields of real and complex numbers. Metric spaces. Open and closed subsets of metric spaces; interior, closure and boundary of sets, perfect, compact, connected, and dense sets. Convergence of sequences of points in metric spaces. Convergence of sequences of real and complex numbers. Cauchy criterion. Lower and upper limits. Relations between convergence and the operations. Series of complex numbers: absolute and conditional convergence. Rearranging series and Riemann's theorem. The comparison, root and ratio tests. The theorems of Leibniz, Abel and Dirichlet. Pointwise and uniform convergence. Power series and radius of convergence. Continuity of functions and its characterization. Continuity, operations and composite functions. Uniform continuity.
Learning outcomes:	A student should demonstrate knowledge of basic properties of subsets of metric spaces, sequences, series and functions. A student also should verify convergence and continuity, openness/closedness/compactness/connectedness.
Name of lecturer:	Prof. Oleh Nykyforchyn
Contact (email address):	oleh.nyk@gmail.com
Literature:	1. E. Hewitt, K.R. Stromberg. Real and Abstract Analysis. Springer-Verlag, 1965 2. Walter Rudin. Principles of Mathematical Analysis. 3rd ed. International Student Edition. McGraw-Hill. 1985 3. K.R. Stromber. An Introduction to Classical Real Analysis. Wadsworth, California, 1981

Title:	**Calculus 2**
Lecture hours:	45
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	oral and written exam
Language of instruction:	English
Prerequisites:	Rudiments of metric topology. Convergence of sequences and series.
Course content:	Limit of a function, Cauchy criterion, limits and algebraic operations on functions, limits and orders, limits and uniform convergence, connection between continuity and uniform convergence, Dini's theorem, jump points, classification of jump points, limits of monotone functions, some remarkable limits, elementary functions, differentiability and linear approximability, differentiability and continuity, differentiability and algebraic operations on differentiable functions, chain rule, local maxima and minima, Fermat's principle, the Rolle-Lagrange-Cauchy-Darboux mean value theorem, de l'Hospital's rules, Taylor's theorem, monotonicity and differentiability, convex functions, primitives, basic integrals, integration rules, Riemann integral and criteria of integrability, properties of indefinite integrals, integrating methods, the Newton-Leibniz, Lebesgue, and improper Riemann integrals and their criteria of integrability
Learning outcomes:	A student should demonstrate basic knowledge in connection with continuity, differentiability, and integrability. In particular, he/she should be able to explain and discuss (with suitable examples) if and how these properties are affected by certain algebraic and limit operations. He/she should be able to evaluate indefinite integrals of several basic types and apply basic integrability criteria for (improper) Riemann, Newton-Leibniz, and Lebesgue integrals.
Name of lecturer:	Prof. Oleh Nykyforchyn
Contact (email address):	oleh.nyk@gmail.com
Literature:	1. E. Hewitt, K.R. Stromberg. Real and Abstract Analysis. Springer-Verlag, 1965 2. Walter Rudin. Principles of Mathematical Analysis. 3rd ed. International Student Edition. McGraw-Hill. 1985 3. K.R. Stromber. An Introduction to Classical Real Analysis. Wadsworth, California, 1981

Title:	**Linear Algebra**
Lecture hours:	45
Study period: (summer/winter)	winter or summer
Number of credits:	6
Assessment methods:	written test
Language of instruction:	English
Prerequisites:	basics of Calculus
Course content:	complex numbers; matrices; determinants; systems of linear equations; Gauss' method of solving systems of linear equations; linear spaces; basis and dimension of linear space; linear mappings; kernel and image of linear mapping; values and eigenvectors of linear mappings
Learning outcomes:	By the end of the course students should: • know complex numbers and its arithmetic; • make actions on matrices and should be able to use matrices to solve systems of linear equations; • know what a linear space is and how its basis and dimension are determined; • be able to check if a given mapping is linear; if the answer is „yes" – should be able to determine its kernel and image; • be able to calculate eigenvalues and eigenvectors of linear mappings
Name of lecturer:	Dr Halina Wiśniewska, Dr Waldemar Sieg
Contact (email address):	halinkaw@ukw.edu.pl, waldeks@ukw.edu.pl
Literature:	1. L. Hogben, „Handbook of linear algebra", Iowa State University, Ames USA 2. S. Lang, „Introduction to Linear Algebra", Springer-Verlag, New York (1986) 3. J. Hefferon, „Linear Algebra", Saint Michael's College Colchester, Vermont USA, 2001

Title:	**Probability**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	4
Assessment methods:	exam, problem solving
Language of instruction:	English
Prerequisites:	Combinatorics, basics of Calculus and Measure Theory
Course content:	1. Sample Space and Probability a. Sets b. Probabilistic Models c. Conditional Probability d. Total Probability Theorem and Bayes' Rule e. Independence f. Counting 2. Random Variables a. Basic Concepts b. Probability Mass Functions c. Functions of Random Variables d. Expectation, Mean, and Variance e. Conditioning f. Independence 3. General Random Variables a. Continuous Random Variables b. Cumulative Distribution Functions c. Normal Random Variables d. Multiple Random Variables e. Conditioning f. The Continuous Bayes' Rule 4. The Bernoulli and Poisson Processes a. The Bernoulli Process b. The Poisson Process
Learning outcomes:	By the end of the course students should know: basic concepts of Probability and should be able to: describe basic discrete and continuous distributions of random variables, compute probability of random events, expected value, variance and standard deviation, check independence of random variables, describe and apply Conditional Probability, Total Probability Theorem and Bayes' Rule, describe and apply the Bernoulli and Poisson Processes.
Name of lecturer:	Dr Katarzyna Chmielewska
Contact (email address):	kasiach@ukw.edu.pl
Literature:	Charles M. Grinstead, J. Laurie Snell, *Introduction to Probability* Douglas C. Montgomery, George C. Runger, *Applied Statistics and Probability for Engineers*, John Wiley & Sons, Inc, USA 2003

Title:	**Soft Skills Training**
Lecture hours:	30
Study period: (summer/winter)	winter or summer
Number of credits:	4
Assessment methods:	Current activity assessment. Essay. Grade 5.0: 38-40 points Grade 4.5: 33-37 points Grade 4.0: 28-32 points Grade 3.5: 23-27 points Grade 3.0: 18-22 points Grade 2.0: (negative) less than 18 points
Language of instruction:	English
Prerequisites:	Combinatorics, basics of Calculus and Measure Theory
Course content:	1. Changeability of a labor market. 2. Skills most demanded by employers in the future. 3. Activating methods – learning vs. teaching. a. Mentoring. b. Edu-coaching. c. Tutoring. 4. Soft skills trainings: a. Communication. b. Self-asssertion. c. Creativity. d. Time management. e. Self-efficacy. f. Career planning.
Learning outcomes:	The main aims of this course are: - understanding reasons and results of changeability of a labor market, - distinguishing hard and soft skills and their importance for the curriculum development, - distinguishing variety of constructive learning methods, - development of basics soft skills pointed out as the most expected by the future labor market.
Name of lecturer:	Dr Katarzyna Chmielewska
Contact (email address):	kasiach@ukw.edu.pl
Literature:	Marcel M. Robles, Executive Perceptions of the Top 10 Soft Skills Needed in Today's Workplace Archived 2016-08-12 at the Wayback Machine, Business Communication Quarterly, 75(4) 453–465 (pdf) "Identifying your Skills & Attributes". Retrieved 5 December 2016