Institute of Mathematics

http://uatacz.up.krakow.pl/~wwwmat/en/

Courses given in English:

COURSE TITLE Semester winter	ECTS CREDIT
Algebra I	4
Analysis I	4
Differential Geometry	4
Functional Analysis	4
Geometry	4
Information Technology	4
Introduction to Mathematics	4
Linear Algebra I	4
Numerical Analysis	4
Topology	4

COURSE TITLE Semester summer	ECTS CREDIT
Algebra II	4
Analysis II	4
Differential Equations	4
Information Technology in Teaching Mathematics	4
Linear Algebra II	4

Course title	Algebra I		
semester	winter	ECTS*	4
Lecturer(s)	Dr hab. Prof. UP Katarzyna Słomczyńska		
Department	Mathematics		

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Course objectives (learning outcomes)

Very basic introduction to the theory of groups, rings and fields.

Prerequisites

Knowledge	Complex numbers, foundations of the linear algebra (matrix theory).
Skills	Proficiency in numbers and matrix computations
Courses completed	Introduction to Logic and Set Theory, Linear Algebra 1.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods

Discussions and exercises.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments	

Course content (topic list)

1. Properties of the integers and the integers modulo n.
2. Group theory: basic axioms and examples, groups of permutations, subgroups, cyclic groups, quotient groups and homomorphisms, Lagrange's Theorem, Isomorphism Theorems. finite abelian groups.
3.Ring theory: basic definitions and examples, ideals and quotient rings, ring homomorphisms, Chinese Remainder Theorem, polynomial rins over fields.
4 Field theory: characteristic of a field, field of fractions, field extensions, algebraic and transcendental numbers, finite fields.

Compulsory reading

T. W. Hungerford, *Algebra*, Springer 1996

Recommended reading

T. N. Herstein, *Abstract Algebra*, M

Course title	Algebra II		
semester	summer	ECTS*	4
Lecturer(s)	Dr hab. Prof. UP Katarzyna Słomczyńska		
Department	Mathematics		

Course objectives (learning outcomes)

Learning of more advanced properties of groups, rings and fields.

Prerequisites

Knowledge	Basic definitions and examples concerning groups, rings and fields.
Skills	Recognition and comparison of basic algebraic structures.
Courses completed	Abstract Algebra I

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods

Discussions and exercises.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments	

Course content (topic list)

1. Group theory: group actions on sets, the simplicity of alternating groups, solvable groups.
2. Ring theory: factorization in integral domains (especially in polynomial rings), symmetric polynomials.
3. Field theory: field extensions, Fundamental Theorem of the Galois Theory, solvability of equations by radicals, ruler and compass constructions.

Compulsory reading

T. W. Hungrford, *Algebra*, Springer 1996

Recommended reading

D. S. Dummit, R. M. Foote, *Abstract Algebra*, Wiley 2004

Course title	Analysis I		
semester	winter	ECTS*	4
Lecturer(s)	Dr Paweł Wójcik		
Department	Mathematics		

Course objectives (learning outcomes)

Introduction to the theory and methods of analysis in one real variable.

Prerequisites

Knowledge	There are no prerequisites.
Skills	There are no prerequisites.
Courses completed	There are no prerequisites.

Course organization													
Form of classes	W (Lecture)	Group type											
		A (large group)		K (small group)		L (Lab)		S (Seminar)		P (Project)		E (Exam)	
Contact hours				15									

Teaching methods

Discussions and exercises including computer usage (e.g. Maxima).

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments	

Course content (topic list)

1. Real numbers.
2. Sequences.
3. Series.
4. Continuous functions.
5. Differentiation of functions.
6. The Riemann integral.

Compulsory reading

Tao, T.: Analysis I, Hindustan Book Agency
http://carlossicoli.free.fr/T/Tao_T.-Analysis_I_%28Volume_1%29__-Hindustan_Book_Agency%282006%29.pdf

Recommended reading

Rudin, W.: Principles of mathematical analysis, McGraw-Hill Science 1976

Course title	Analysis II		
seemster	summer	ECTS*	4
Lecturer(s)	Dr Paweł Wójcik		
Department	Mathematics		

Course objectives (learning outcomes)

Introduction to the theory and methods of analysis in one real variable.

Prerequisites

Knowledge	Analysis of real functions of one variable.
Skills	The student can calculate limits of sequences, differentiate functions, compute Riemann Integrals.
Courses completed	Analysis I.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods

Discussions and exercises including computer usage (e.g. Maxima).

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments	

Course content (topic list)

1. Metric spaces.
2. Uniform convergence.
3. Power series.
4. Several variable differential calculus.
5. Lebesgue measure.
6. Lebesgue integral.

Compulsory reading

Tao, T.: Analysis I, Hindustan Book Agency
http://carlossicoli.free.fr/T/Tao_T.-Analysis_I_%28Volume_1%29__-Hindustan_Book_Agency%282006%29.pdf

Recommended reading

Rudin, W.: Principles of mathematical analysis, McGraw-Hill Science 1976

Course title	Differential Equations		
semester	summer	ECTS*	4
Lecturer(s)	Dr hab. Vasyl Fedorchuk		
Department	Mathematics		

Course objectives (learning outcomes)

Introduction to the theory and methods of differential equations.

Prerequisites

Knowledge	Differential calculus of functions of one and several variables. Integral calculus. Algebra of matrices and determinants.
Skills	Calculation of derivatives of functions of one and several variables. Calculation of integrals.
Courses completed	Mathematical Analysis 1, 2, 3. Linear Algebra 1 and 2.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods

Discussions and exercises.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments	

Course content (topic list)

1. Origin of Differential Equations
2. Equations of First Order and First Degree
3. Linear Equations of Order n
4. Systems of Simultaneous Linear Equations
5. Linear Partial Differential Equations of Order One

Compulsory reading

1. W. Walter, *Ordinary Differential Equations*. *Graduate Texts in Mathematics*: Springer, 1998.
2. *F.* Ayres, JR*., Theory and Problems of Differential Equations*: Schaum's Outline Series, McGRAW-HILL BOOK COMPANY, New York, St. Louis, San Francisco, Toronto, Sydney, 1952.

Recommended reading

1. B. Spain, *Ordinary Differential Equations*: Van Nostrand Reinhold Company, London, New York, Toronto, Melbourne, 1969.
2. Shepley L. Ross, *Differential Equations*: Blaisdell Publishing Company, New York, Toronto, London, 1964.

Course title	Differential Geometry		
semester	winter	ECTS*	4
Lecturer(s)	Dr Justyna Szpond		
Department	Mathematics		

Course objectives (learning outcomes)

Introduction to the theory of curves and surfaces, and methods of differential geometry.

Prerequisites

Knowledge	Elements of algebra and vector analysis. Vector spaces, linear and multilinear mappings. Calculus of functions of several variables.
Skills	Calculating of derivatives of functions of several variables.
Courses completed	Introduction to Logic and Set Theory, Mathematical Analysis 1, 2, 3 and 4, Linear Algebra 1 and 2, Geometry

Course organization						
Form of classes	W (Lecture)	Group type				
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods

Discussions and exercises.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments	

Course content (topic list)

1. Curves

1. Examples, Arclength Paramatrization
2. Local Theory: Frenet Frame
3. Some Global Results

2. Surfaces

1. Parametrized Surfaces and the First Fundamental Form
2. The Gauss Map and the Second Fundamental Form
3. The Codazzi and Gauss Equations and the Fundamental Theorem of Surface Theory

Compulsory reading

T. *Shifrin*, *Differential Geometry*: A First Course on Curves and Surfaces
available free at: *www.math.uga.edu/~**shifrin**/**Shifrin**DiffGeo.pdf*

Recommended reading

Michael David Spivak, *A Comprehensive Introduction to Differential Geometry*. Publish or Perish 2005

Course title	Functional Analysis		
semester	winter	ECTS*	4
Lecturer(s)	Dr hab. Prof. UP Jacek Chmieliński		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The course gives an introduction to functional analysis. Student will learn the basic properties of norm (Banach) and inner product (Hilbert) spaces as well as basic facts concerning the linear operator theory.

Prerequisites

Knowledge	Basic knowledge of linear algebra, topology and calculus.
Skills	Calculus on real and complex numbers. Calculus in vector spaces. Checking continuity of mappings with respect to different topologies. Finding limits with respect to different metrics.
Courses completed	It is advised to have taken courses: analysis (1 & 2), linear algebra and topology.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				2

Teaching methods: Tutorial and self-study (supported by elements of e-learning).

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
	x					x				x	x	X	

Assessment criteria	Compulsory participation in the tutorial. Solving problems and writing essay.

Comments	

Course content (topic list)

1. Normed spaces: norm, completeness, examples of classical normed spaces finite and infinite dimensional, compactness, series in normed spaces, Schauder basis.
2. Inner product spaces: norm generatd by inner product, orthogonality, orthogonal projection, orthonormal systems, Fourier series.
3. Linear continuous operators: continuity and boundedness, norm of the operator, classical theorems of functional analysis, dual spaces.

Compulsory reading

1. Karen Saxe, *Beginning Functional Analysis*, UTM, Springer, 2002.

Recommended Reading

7. J. B. Conway, *A Course in Functional Analysis,* 2nd. ed., Springer, New York 1990.
8. J.R. Giles, Introduction to the Analysis of Normed Linear Spaces, Australian Math. Soc. Lect. Series 13, Cambridge University Press, 2000.
9. W. Rudin, *Functional Analysis*.
10. K. Yosida, *Functional Analysis*, Springer Verlag, Berlin – Heidelberg – New York 1971.
11. G. Teschl, *Functional Analysis: http://www.mat.univie.ac.at/~gerald/ftp/book-fa/fa.pdf*
12. WWL Chen, *Linear Functional Analysis,* http://rutherglen.science.mq.edu.au/wchen/lnlfafolder/lnlfa.html

Course title	Geometry		
semester	winter	ECTS*	4
Lecturer(s)	Prof. dr hab. Tomasz Szemberg		
Department	Mathematics		

Course objectives (learning outcomes)

Introduction to the theory and methods of elementary geometry.

Prerequisites

Knowledge	There are no prerequisites.
Skills	Plotting points and figures in cartesian coordinates.
Courses completed	There are no prerequisites.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods

Discussions and exercises.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Students have to write one or two essays.

Comments

Course content (topic list)

1. Triangles.
2. Isometries in the plane.
3. Similarities.
4. Circles and spheres.
5. Coordinates.
6. Complex numbers.

Compulsory reading

Coxeter, H.S.M.: Introduction to geometry, Wiley 1969

Recommended reading

Coxeter, H.S.M., Greizer, S.M.: Geometry revisited, The Mathematical Association of America 1967

Course title	Information Technology		
seemster	winter	ECTS*	4
Lecturer(s)	Dr Tadeusz Ratusiński		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The aim of the course is to familiarize students with selected topics in the field of information technology. In particular, provide students with knowledge of tools with which they can obtain information, select them, process and share with other people.

Prerequisites

Knowledge	Student knows the basic principles of obtaining information on the web and using Windows applications.
Skills	Student is able to develop collected information for its own purposes and share them with others.
Courses completed	Student is able to work in a group.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours				15			

Teaching methods:

Classes based on e-learning platform in blended learning system.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
						X				X			

Assessment criteria	Assessment is based on project (prepared by the student) summarizing his knowledge and skills in the collection and processing of information.

Comments	The student should demonstrate his knowledge and skills to produce a project using IT.

Course content (topic list)

Presentation Graphics. Multimedia presentations. Treatment and processing of texts. Services in computer networks. Student's projects.

Compulsory reading

The literature available on the network and prepared on e-platform course.

Recommended reading

Course title	Information Technology in Teaching Mathematics		
semester	summer	ECTS*	4
Lecturer(s)	Dr Tadeusz Ratusiński		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The aim of the course is to familiarize students with selected topics in the field of use of information technology in the process of teaching mathematics. In particular, provide students with knowledge of tools that can be used during creative lessons, pupils activities, examples of teaching applications, etc.

Prerequisites

Knowledge	Student knows the basic principles of obtaining information on the web and using Windows applications.
Skills	Student is able to develop collected information for its own purposes and share them with others.
Courses completed	Student is able to work in a group.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours				15			

Teaching methods:

Classes based on e-learning platform in blended learning system.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
						X				X			

Assessment criteria	Assessment is based on the project (prepared by the student) summarizing his knowledge and skills in the selection and use of appropriate information technology tools to prepare didactic materials.

Comments	The student should demonstrate his knowledge and skills to produce a didactic project using IT.

Course content (topic list)

Search, evaluation and verification of information on the Internet.
Support presentation using computer programs (including mathematical).
Understanding basics of information technology and skills of its application, according to its capabilities, understanding their benefits and limitations
The selection of appropriate ICT tools most suitable to solve a given didactic problem, as an aid in situations where it is useful, as an aid to expand and enrich the process of mathematics teaching.

Compulsory reading

The literature available on the network and prepared on e-platform course.

Recommended reading

Course title	Introduction to Mathematics		
seemster	winter	ECTS*	4
Lecturer(s)	Dr hab. Prof. UP Piotr Błaszczyk		
Department	Faculty of Mathematics, Physics and Technical Science		

Course objectives (learning outcomes)

The student will be able to formulate a problem in the language of sets and perform set operations.

Prerequisites

Knowledge	
Skills	The student makes appropriate deductions. The student shows basic use of mathematical language.
Courses completed	

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods:

Reading. Exercises. Individual classes.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	The student selects and applies theorems correctly to solve problems. The student shows good use of mathematical notation, symbols and forms of representation (charts, diagrams, graphs,).

Comments	

Course content (topic list)

Propositional and predicate calculus. Algebra of sets. Relations and functions. Equivalence relations. Linear orders. Mathematical induction. Countable and uncountable sets.

Compulsory reading

H. Rasiowa, *Introduction to Modern Mathematics*, NHPC, Amsterdam 1973.
I. Lavrov, L. Maksimova, *Problems in Set Theory, Mathematical Logic and the Theory of Algorithms*, Kluwer, New York, Moscow 2003.

Recommended reading

K. Kuratowski, *Introduction to Set Theory and Topology*, PWN, Warszawa 1973.
M. Goldstern, H. Judath, *The Incompleteness Phenomenon. A New Course in Mathematical Logic*, AK Peters, Natick, Massachusetts 1998.

Course title	Linear Algebra I		
seemster	winter	ECTS*	4
Lecturer(s)	dr Zbigniew Leśniak		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The aim of the course is to familiarize students with the basic concepts of matrix theory and linear algebra, as well as their applications. Emphasis is given to systems of linear equations, matrices, and vector spaces.

Prerequisites

Knowledge	There are no prerequisites.
Skills	There are no prerequisites.
Courses completed	There are no prerequisites.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods:

Reading course, tutorials.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
								X		X			

Assessment criteria	Active participation in tutorials. Submitted written assignment.

Comments

Course content (topic list)

1. Matrices, matrix operations and inverses.
2. Systems of linear equations.
3. Gauss's method, elimination with matrices.
4. Vector spaces - definition and examples.
5. Subspaces and spanning sets.
6. Linear independence, basis and dimension.
7. Linear maps.
8. Range space and null space.
9. Representing linear maps with matrices.

Compulsory reading

1. Sheldon Axler - Linear Algebra Done Right, Undergraduate Texts in Mathematics, Springer
2. Jim Hefferon - Linear Algebra (available free at: http://joshua.smcvt.edu/linearalgebra)

Recommended reading

David C. Lay - Linear Algebra and Its Applications, Pearson.

Course title	Linear Algebra II		
semester	summer	ECTS*	4
Lecturer(s)	prof. dr hab. Marek Ptak		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The aim of the course is to familiarize students with the main concepts and terminology of linear algebra. Emphasis is given to determinants, eigenvalues, orthogonality and symmetric matrices.

Prerequisites

Knowledge	Familiar with Linear Algebra I.
Skills	There are no prerequisites.
Courses completed	There are no prerequisites.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods:

Reading course, tutorials.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
								X		X			

Assessment criteria	Active participation in tutorials. Submitted written assignment.

Comments	

Course content (topic list)

1. Determinants - properties of determinants, the permutation expansion.
2. Laplace's formula.
3. Cramer's rule.
4. Eigenvalues and eigenvectors, invariant subspaces.
5. Diagonalizability.
6. Inner product, orthonormal bases.
7. Orthogonal projection into a line, geometric view of orthogonal projections.
8. Gram-Schmidt orthogonalization.
9. Symmetric matrices.
10. Positive definite matrices.
11. Quadratic forms and eigenvalues.

Compulsory reading

1. Sheldon Axler - Linear Algebra Done Right, Undergraduate Texts in Mathematics, Springer
2. Jim Hefferon - Linear Algebra (available free at: http://joshua.smcvt.edu/linearalgebra)

Recommended reading

David C. Lay - Linear Algebra and Its Applications, Pearson.

Course title	Numerical Analysis		
semester	winter	ECTS*	4
Lecturer(s)	dr Zbigniew Leśniak		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The aim of the course is to familiarize students with the basic concepts of analysis and implementations of algorithms for solving numerically the problems of continuous mathematics (as opposed to symbolic manipulations). Topics covered include: fundamental principles of digital computing and the implications for algorithm accuracy and stability. Emphasis is given to understanding the behaviour of numerical methods for solving linear algebra problems.

Prerequisites

Knowledge	Familiar with basics of linear algebra and real analysis.
Skills	Familiar with basics of Visual C# or C++.
Courses completed	There are no prerequisites.

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods:

Reading course, tutorials.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
								X		X			

Assessment criteria	Active participation in tutorials. Submitted written assignment.

Comments	

Course content (topic list)

1. Floating-point representation of numbers.
2. Finite precision arithmetic, the limits on the accuracy.
3. Round-off errors, truncation and discretization error.
4. Sensitivity of the solution of a problem to small changes in the data, ill-conditioned problems.
5. Backward error analysis, numerical stability of algorithms.
6. Interval arithmetic.
7. Numerically stable algorithms for computing values of functions.
8. Numerically stable algorithms for solving linear systems of equations.

Compulsory reading

1. Ward Cheney, David Kincaid - Numerical Mathematics and Computing, Thompson Brooks/Cole
2. Germund Dahlquist, Åke Björck - Numerical Methods in Scientific Computing, *Volume 1*, SIAM
   (working copy available for students enrolled in specific courses at:
   http://cristiancastrop.files.wordpress.com/2010/09/dahlquist-bjorck-vol-1.pdf)

Recommended reading

Åke Björck - Numerical Methods in Scientific Computing, *Volume 2*, SIAM

Course title	Topology		
semester	winter	ECTS*	4
Lecturer(s)	Dr hab. Prof. UP Katarzyna Słomczyńska		
Department	Institute of Mathematics		

Course objectives (learning outcomes)

The aim of the course is to familiarize students with metric spaces and their basic properties such as completeness, compactness and connectedness, to the extent enabling usage these concepts in other courses (e.g. in mathematical analysis).

Prerequisites

Knowledge	Familiar with the elementary set theory. Familiar with the notion of function.
Skills	Able to compute the limit of sequence of real numbers.
Courses completed	

Course organization							
Form of classes	W (Lecture)	Group type					
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	E (Exam)
Contact hours			15				

Teaching methods:

Reading course, tutorials.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	Written assignment (essay)	Oral exam	Written exam	Other
										X			

Assessment criteria	Active participation in tutorials. Submitted essay.

Comments	

Course content (topic list)

1. Metric spaces, balls, convergence of sequences.
2. Interior and closure.
3. Open, closed, and dense subsets.
4. Continuous functions, homeomorphisms, isometries.
5. Types of metric spaces: separable, complete, compact, and connected.
6. Continuous images of compact and connected sets.
7. Characterization of compact and connected sets in special metric spaces, including R.

Compulsory reading

1. S. Shirali, H. L. Vasudeva, Metric Spaces, Springer 2006.
2. K. Kuratowski, Introduction To Set Theory & Topology, Pergamon Press 1962.
3. T. W. Körner, Metric and Topological Spaces, Cambridge 2013;
https://www.dpmms.cam.ac.uk/~twk/Top.pdf

Recommended reading

Efe A. Ok, Real Analysis with Economic Applications