UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

# Institute of Matematics

**Winter semester:**

**Module I**

| | |
|---|---|
| Analysis | 20 ECTS |
| Geometry | |
| Differential Equations | |
| Linear Algebra | |

**Summer semester:**

**Module I**

| | |
|---|---|
| Algebra | 20 ECTS |
| Differential Geometry | |
| Numerical Analysis | |
| Topology | |

UNIWERSYTET PEDAGOGICZNY IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

## Course card

| | |
|---|---|
| Course title | **Linear Algebra** |

| | | | |
|---|---|---|---|
| Semester (winter/summer) | winter | ECTS | 5 |

| | | |
|---|---|---|
| Lecturer(s) | Dr Karol Gryszka | |

| | | |
|---|---|---|
| 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 systems of linear equations, matrices, and vector spaces, determinants, eigenvalues, orthogonality and symmetric matrices.

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.<br>Submitted written assignment. |

| | |
|---|---|
| Comments | |

Course content (topic list)

1. Matrices, matrix operations and inverses.
2. Systems of linear equations.
3. Vector spaces - definition and examples.
4. Linear independence, basis and dimension.
5. Linear maps.
6. Range space and null space.
7. Representing linear maps with matrices.
8. Determinants - properties of determinants, the permutation expansion.
9. Eigenvalues and eigenvectors, invariant subspaces.
10. Diagonalizability.
11. Inner product, orthonormal bases.
12. Orthogonal projection into a line, geometric view of orthogonal projections.
13. Gram-Schmidt orthogonalization.
14. Symmetric 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

UNIWERSYTET PEDAGOGICZNY IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

Course card

| | | | |
|---|---|---|---|
| Course title | **Algebra** | | |
| Semester (winter/summer) | summer | ECTS | 5 |
| Lecturer(s) | dr hab. Katarzyna Słomczyńska, prof. UP<br>dr hab. Janusz Gwoździewicz, prof. UP | | |
| Department | Mathematics | | |

Course objectives (learning outcomes)

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.<br>Linear Algebra. |

| 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:

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

| | 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.<br>Students have to write one or two essays. |

| | |
|---|---|
| Comments | |

Course content (topic list)

| |
|---|
| 1. Group theory: basic axioms and examples, groups of permutations, subgroups, cyclic groups, quotient groups and homomorphisms, Lagrange's Theorem, Isomorphism Theorems, finite abelian groups, group actions on sets, solvable groups.<br>2. Ring theory: basic definitions and examples, ideals and quotient rings, ring homomorphisms, Chinese Remainder Theorem, prime and maximal ideals, polynomial rings over fields.<br>3. 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

http://www.jmilne.org/math/CourseNotes/GT.pdf
https://www2.bc.edu/mark-reeder/Groups.pdf
http://www.jmilne.org/math/CourseNotes/FT.pdf
http://www1.spms.ntu.edu.sg/~frederique/chap2.pdf

UNIWERSYTET PEDAGOGICZNY IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

Course card

| Course title | **Geometry** |
|---|---|

| Semester (winter/summer) | winter | ECTS | 5 |
|---|---|---|---|

| Lecturer(s) | Prof. dr hab. Tomasz Szemberg<br>Dr hab. Justyna Szpond | |
|---|---|---|

| 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 | | | 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 an essay. |

| | |
|---|---|
| Comments | |

Course content (topic list)

Triangles.
Isometries in the plane.
Similarities.
Circles and spheres.
Coordinates.
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

UNIWERSYTET PEDAGOGICZNY IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

Course card

| Course title | **Analysis** |
|---|---|

| Semester (winter/summer) | winter | ECTS | 5 |
|---|---|---|---|

| Lecturer(s) | Dr Paweł Wójcik | |
|---|---|---|

| Department | Mathematics | |
|---|---|---|

Course objectives (learning outcomes)

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

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)

| |
|---|
| Real numbers and theirs subset.<br>Continuous functions.<br>Derivatives of functions with one variable.<br>Minimum, maximum and monotonicity of functions.<br>The Riemann integral.<br>Metric spaces (open, closed and compact subset).<br>Uniform convergence.<br>Derivatives of functions with two or three variables.<br>Minimum and maximum of functions with two variables<br>Lebesgue measure.and Lebesgue integral |

Compulsory reading

| |
|---|
| Tao, T.: Analysis I, Hindustan Book Agency<br>https://lms.umb.sk/pluginfile.php/111477/mod_page/content/5/TerenceTao_Analysis.I.Third.Edition.pdf |

Recommended reading

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

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

Course card

| | |
|---|---|
| Course title | **Differential Equations** |

| | | | |
|---|---|---|---|
| Semester (winter/summer) | winter | ECTS | 5 |

| | | |
|---|---|---|
| Lecturer(s) | Dr hab. Leszek Gasiński, prof. UP | |

| | | |
|---|---|---|
| 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.<br>Linear Algebra. |

| 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. Differential Equations of First Order
3. Linear Differential Equations of Second Order
4. Linear Partial Differential Equations of First Order

Compulsory reading

W. Walter, *Ordinary Differential Equations*. *Graduate Texts in Mathematics*: Springer, 1998.
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

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

UNIWERSYTET
PEDAGOGICZNY
IM. KOMISJI EDUKACJI
NARODOWEJ W KRAKOWIE

Erasmus+

Course card

| | |
|---|---|
| Course title | **Differential Geometry** |

| | | | |
|---|---|---|---|
| Semester (winter/summer) | summer | ECTS | 5 |

| | | |
|---|---|---|
| Lecturer(s) | Dr hab. Justyna Szpond<br>Prof. dr hab. Tomasz Szemberg | |

| | | |
|---|---|---|
| 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.<br>Vector spaces, linear and multilinear mappings.<br>Calculus of functions of several variables. |
| Skills | Calculating of derivatives of functions of several variables. |
| Courses completed | Introduction to Logic and Set Theory<br>Mathematical Analysis<br>Linear Algebra<br>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 | | | 15 | |

Teaching methods:

Discussions and exercises.

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

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)

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

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/ShifrinDiffGeo.pdf*

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

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

## Course card

| Course title | **Algebra** | | |
|---|---|---|---|

| Semester (winter/summer) | summer | ECTS | 5 |
|---|---|---|---|

| Lecturer(s) | dr hab. Katarzyna Słomczyńska, prof. UP<br>dr hab. Janusz Gwoździewicz, prof. UP | |
|---|---|---|

| Department | Mathematics | |
|---|---|---|

Course objectives (learning outcomes)

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.<br>Linear Algebra. |

| 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 | Active participation in tutorials.<br>Students have to write one or two essays. |

| | |
|---|---|
| Comments | |

Course content (topic list)

1. Group theory: basic axioms and examples, groups of permutations, subgroups, cyclic groups, quotient groups and homomorphisms, Lagrange's Theorem, Isomorphism Theorems, finite abelian groups, group actions on sets, solvable groups.
2. Ring theory: basic definitions and examples, ideals and quotient rings, ring homomorphisms, Chinese Remainder Theorem, prime and maximal ideals, polynomial rings over fields.
3. 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

http://www.jmilne.org/math/CourseNotes/GT.pdf
https://www2.bc.edu/mark-reeder/Groups.pdf
http://www.jmilne.org/math/CourseNotes/FT.pdf
http://www1.spms.ntu.edu.sg/~frederique/chap2.pdf

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

## Course card

| Course title | **Differential Geometry** |
|---|---|

| Semester (winter/summer) | summer | ECTS | 5 |
|---|---|---|---|

| Lecturer(s) | Dr hab. Justyna Szpond<br>Prof. dr hab. Tomasz Szemberg | |
|---|---|---|

| 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.<br>Vector spaces, linear and multilinear mappings.<br>Calculus of functions of several variables. |
| Skills | Calculating of derivatives of functions of several variables. |
| Courses completed | Introduction to Logic and Set Theory<br>Mathematical Analysis<br>Linear Algebra<br>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 | | | 15 | |

Teaching methods:

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

| |
|---|
| 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/ShifrinDiffGeo.pdf*

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

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

## Course card

| | |
|---|---|
| Course title | **Numerical Analysis** |

| | | | |
|---|---|---|---|
| Semester (winter/summer) | summer | ECTS | 5 |

| | | |
|---|---|---|
| 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#, C++ or Java. |
| 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:

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

| |
|---|
| 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.<br>Submitted written assignment. |

| | |
|---|---|
| Comments | |

Course content (topic list)

15. Floating-point representation of numbers.
16. Finite precision arithmetic, the limits on the accuracy.
17. Round-off errors, truncation and discretization error.
18. Sensitivity of the solution of a problem to small changes in the data, ill-conditioned problems.
19. Backward error analysis, numerical stability of algorithms.
20. Interval arithmetic.
21. Numerically stable algorithms for computing values of functions.
22. 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

UNIWERSYTET PEDAGOGICZNY
IM. KOMISJI EDUKACJI NARODOWEJ W KRAKOWIE

Erasmus+

| Course title | **Topology** |
|---|---|

| Semester (winter/summer) | summer | ECTS | 5 |
|---|---|---|---|

| Lecturer(s) | Dr hab. Jacek Chmieliński, prof. UP | |
|---|---|---|

| Department | Institute of Mathematics | |
|---|---|---|

Course objectives (learning outcomes)

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

Prerequisites

| | |
|---|---|
| Knowledge | Familiar with the elementary set theory.<br>Familiar with basics of calculus (the set of reals as a metric space, properties of functions, limits, continuity, etc.) |
| Skills | Able to compute the limit of a sequence of real numbers, verify continuity of a mapping. |
| Courses completed | Mathematical Analysis 1 (Calculus 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:

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.<br>Submitted essay. |

| | |
|---|---|
| Comments | |

Course content (topic list)

1. Metric spaces
2. Topological spaces – basic properties of sets
3. Basis, axioms of countability
4. Continuity and homeomorphisms, topological invariants
5. Axioms of separability
6. Completeness, compactness and connectedness

Compulsory reading

1. K. Kuratowski, *Introduction To Set Theory and Topology*, Part II, Pergamon Press & PWN, 1962, 1972.
2. M.A. Armstrong, *Basic Topology*, Undergraduate Texts in Mathematics. Springer-Verlag, New York-Berlin, 1983.

Recommended reading - courses available in the Internet e.g.:

1. T.W. Koerner, *Metric and Topological Spaces*, https://www.dpmms.cam.ac.uk/~twk/Top.pdf
2. A. Hatcher, *Notes on Introductory Point-Set Topology*, https://www.math.cornell.edu/~hatcher/Top/TopNotes.pdf
3. S.A. Morris, *Topology without tears* (English and various translations), http://www.topologywithouttears.net/