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I. DESCRIPTION OF STUDY PROGRAMME FORM

BASIC INFORMATION	
Title of study programme	**Graduate course in Mathematics – Teacher Training**
study programme coordinator	**University of Rijeka**
Study programme implementor	**Department of Mathematics – University of Rijeka**
Type of study programme	**University**
Level of study programme	**Graduate**
Academic/professional degree awarded upon completion of study	**Master of Science in Mathematics Education**

1. INTRODUCTION

1.1. Reasons for initiating the study

The four year studies of mathematics, as a single major or in a combination with physics and computer science have been carried out at the Faculty of Humanities and Social Sciences in Rijeka (i.e. its predecessors) since 1964. In October 2004 the Ministry of Science, Education and Sports issued the accreditation for the teaching studies of mathematics and mathematics and computer sciences which verified that the studies carried out at the Department of Mathematics of the Faculty of Humanities and Social Sciences in Rijeka were at the desired level. After that, in accordance with the Bologna process, in June 2005 the accreditations for carrying out the Undergraduate course in Mathematics, the Graduate course in Mathematics (Teacher Training) and the Graduate course in Mathematics and Computer Science (Teacher Training) at the Department of Mathematics of the Faculty of Humanities and Social Sciences in Rijeka were issued. Upon the foundation of the Department of Mathematics at the University of Rijeka, the Ministry of Science, Education and Sports in its declaration from 16th January 2009 (class: 602-04/08-13/00041, reg. no.: 533-07-09-0002) stated that the change of the legal successor has not influenced the content and legal validity of the previously issued accreditations and that the Department of Mathematics will keep the accreditations for carrying out the given study programmes, about which a certain recordation in the Register of Higher Education Institutions is going to be made.
The Graduate course in Mathematics – Teacher Training prepares students to work in teaching process in elementary schools and high schools.

1.2. Estimation of purpose with respect to labor market needs in public and private sector

The results of the analysis of labour market carried out previously by the Croatian Employment Service indicate that in the area under the Area office Rijeka of the Croatian Employment Service there are no unemployed graduates of the Graduate course in Mathematics – Teacher Training and that shortly after obtaining their diplomas the graduates of the Teacher Training programme find their employment in elementary schools and high school in the Primorsko-goranska county and wider. Since there are relatively a small number of private schools in the area, the majority of graduates find their employment in a public sector.
As the evidence of the deficit of mathematicians there are numerous scholarships for deficit occupations that are offered to the students of mathematics both on local and national levels.

1.2.1. Relationship with the Local Community (economy, business, civil society)

Since its foundation in April 2008, the Department of Mathematics of the University of Rijeka has been establishing and systematically fostering relationship with local community, which positively affects the implementation of the Graduate course in Mathematics – Teacher Training. The members of the Department are serving at the leading positions and have active roles in the following associations:

- **The Society of Mathematicians and Physicians,**
- **The Alumni Club of the Department of Mathematics of the University of Rijeka,**
- **Association Golden Ratio,**

And the following manifestation:

- **The Science Festival.**

The students of the Graduate course in Mathematics – Teacher Training are taking part in the activities of the given associations and manifestation, where by interacting with their teachers they gain valuable experience and feedback about their work on projects.

1.2.2. Compatibility with the requirements of professional associations (recommendation)

When the study programme concept was made, special attention was given to the source: Tuning Educational Structures in Europe (http://www.unideusto.org/tuningeu/), especially the part that refers to the following competences: basic competences (http://www.unideusto.org/tuningeu/competences/generic.html), specific competences in the field of education (http://www.unideusto.org/tuningeu/competences/specific/education.html) and specific competences in the field of mathematics (http://www.unideusto.org/tuningeu/competences/specific/mathematics.html). Besides, the recommendations for designing the study programmes in mathematics were taken into account (http://www.unideusto.org/tuningeu/subject-areas/mathematics.html). Apart from the recommendations from national professional associations, the Department of Mathematics of the University of Rijeka follows modern trends and recommendations for higher education of the professional associations such as:

- **European Mathematical Society (EMS) (http://www.ems-ph.org/journals/journal.php?jrn=news),**
- **Société Mathématique de France (SMF) (http://smf.emath.fr/content/enseignement) and**
- **American Mathematical Society (AMS) (http://www.ams.org/profession/leaders/emp-articles).**

1.2.3. List of the possible partners outside the higher education system who expressed interest for study program

The partners outside the higher education system that have expressed interest for the given study programme are elementary schools and high schools.

1.3. Comparability of study program with similar programs of accredited institutions of higher education in Croatia and the EU (specify and explain the comparability of the two programs, of which at least one of the EU, with a program that is proposed, and state network sites)

The proposed syllabuses of the majority of courses coincides with the syllabuses of the undergraduate study in mathematics at other Croatian universities, which enables transfer of the students of mathematics between the University of Rijeka and other Croatian universities. Basic mathematical courses of the same or similar name and of the similar content constitute the study programmes of mathematics at the majority of European universities, such as:

- **Queen Mary University of London (http://qmplus.qmul.ac.uk/course/view.php?id=1530),**
- **Ruprecht-Karls-Universität Heidelberg (http://www.mathematik.uni-heidelberg.de/).**

1.4. Openness to the horizontal and vertical student mobility in national and international higher education

This graduate course can be enrolled by the bachelors who finished the graduate course in mathematics at any Croatian or foreign university. The enrolment at the Graduate course in Mathematics (Teacher Training) is possible if one or the following conditions is satisfied:

a) **The applicants who have finished the university graduate course and have acquired minimally 135 ECTS from mathematical courses,**
b) **the applicants have who finished the university graduate course and have acquired minimally 120 ECTS from mathematical courses and have passes the examination organized by the Department of Mathematics.**

After finishing this course the masters of science in mathematics will be able to enrol the University Postgraduate Study of Mathematics at University J.J. Strossmayer of Osijek, University of Rijeka, University of Split and University of Zagreb, as well as related foreign studies.
Considering the currently signed agreements as a part of the Erasmus programme with Karl-Franzens-Universitaet Graz, University of Ghent, St. Cyril and St. Methodius University of Veliko Turnovo and University of Ljubljana, the students of the Department of Mathematics have a possibility of international mobility.

1.5. Compatibility with mission and strategy of the University of Rijeka

The study programme is thoroughly in accordance with the University of Rijeka Strategy 2007-2013, since according to the Strategy special attention is going to be given to the development of natural sciences.
This study programme contributes to the following goals of the Strategy:

- **To increase the number of multidisciplinary study programmes (programmes in which at least ¼ of teachers from other scientific areas are engaged).**

The study programme comprises the majority of education module courses together with pedagogical-psychological courses carried out (and associated by) the employees of the Department of Pedagogy and the

Department of Psychology of the Faculty Of Humanities And Social Sciences in Rijeka. From the study programme it is visible that at least ¼ of teachers from other scientific areas are engaged.

- **All study programmes at the University are structured in a way that at least 20% of learning outcomes in each programme develop generic competencies**

Apart from professional competencies, this study programme develops generic competencies such as IT and information literacy, presentation skills through presentation of seminars and final works in front of groups, communication skills though methodical practice in elementary and high schools, teamwork and collaborative work through common works. Through professional courses logical thinking as well as reasoned presentation and work are developed. Furthermore, the students often use sources in English.

- **To build institutional partnerships at the University level and at the level of constituents, with enterprises and public institutions participating in planning, organizing and conducting study programmes.**

The partnership in carrying out the methodical practice is based on the signed contracts with mentors in workplaces for the methodical practice (elementary schools and high schools in Rijeka).

- **E-learning tools are used in at least 50% courses of each study programme (hybrid teaching or completely on-line teaching).**

The majority of course programmes list e-learning and/or multimedia and on-line learning as a way of teaching.

- **To increase the number of institutional popularization activities as well as the number of teaching staff and students who participate in them.**

The significant projects carried out in collaboration with community and directed towards community are participation in and organization of the Science Festival in Rijeka, organization of several workshops and lectures for pupils in elementary and high schools in Rijeka and wider area, organization of the Open Days of the University departments of the University of Rijeka and the Evening of Mathematics. In the realization of the given activities, as a part of the methodical courses of the graduate study programme (Teacher Training), also participate the students of the Department of Mathematics. In 2015 it is planned to organize several activities under the manifestation the Encounters of Mathematicians in Rijeka, which is the meeting of regional character with several lectures and workshops for teachers and pupils from high schools in Istarska county, Primorsko-goranska county and Ličko-senjska county that is recognized as the specialization programme of teachers by the Education and Teacher Training Agency.

- **To provide internal mobility of professors and of students.**

In the realization of the Graduate course in Mathematics participate teachers from other higher educational institutions at the University of Rijeka such as the Department of Informatics and the Faculty Of Humanities And Social Sciences in Rijeka.

In 2004 the Dublin Descriptors (http://archive.ehea.info/getDocument?id=2117) set learning outcomes for all three levels of university education. The Descriptors are given in general, for a single educational level and not for a single discipline or the field of study. They are given in five dimensions: knowledge and understanding which students should posses in order to gain a certain qualification, application of knowledge and understanding, inference and reasoning, communication and teaching skills. In accordance with the University of Rijeka Strategy 2007-2013 the University started the reform of the curriculum based on learning outcomes on the 31st session of the Senate at the end of 2007. The Draft of the Croatian Qualifications Framework was relevant during the curriculum reform (the Croatian Qualifications Framework was adopted in February 2013). The Dublin Descriptors were used as foundation for determining learning outcomes. From these outcomes the learning outcomes of each course were determined (by using Bloom's Taxonomy of Educational Objectives, which is the world's most widespread taxonomy). The learning outcomes of each course are in line with the content of courses, the methods of teaching and the methods of grading achievements on courses. The described methodology was used to derive learning outcomes for all study programmes (undergraduate, graduate, postgraduate specialistic and postgraduate doctoral studies) and for all lifelong learning programmes.

1.6. Institutional development strategy of study programs (compatibility with the mission and strategic aims of the institution)

The Department of Mathematics, University of Rijeka, is a member institution of the University of Rijeka which does both research and professional work in the field of mathematics and assures the development of the personnel in mathematics at the University of Rijeka. The Department of Mathematics organizes and carries out courses from its field and also participates in the organization and performance of study programmes at other institutions of the University of Rijeka. Striving towards excellence in science and teaching both on national and international levels, the Department of Mathematics contributes to the development of the University of Rijeka and to the development of the whole society.

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1.7. Other important information - in the opinion of the proposer

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2. GENERAL PART

2.1. Title of study programme

Graduate course in Mathematics – Teacher Training

2.1.1. Type of study programme

University

2.1.2. Level of study programme

Graduate

2.1.3. Area of study programme (scientific/artistic) – indicate the title

Mathematics

2.2. Study programme coordinator

University of Rijeka

2.3. Implementor/s of study programme

Department of Mathematics – University of Rijeka

2.4. Duration of study programme (indicate possibilities of part-time study, long distance study)

Study lasts 4 semesters, there is no possibility of attending classes in working time, neither through distance learning.

2.4.1. ECTS credits – minimal number of credits required for completion of study programme

120 ECTS

2.5. Enrolment requirements and selection procedure

Candidates who achieved mathematical competencies described by the following learning outcomes can enroll the study programme:

1. **axiomatically and inductively construct the fields of real and complex numbers**
2. **describe an algebraic, metrical and topological structure of Euclidean space Rn**
3. **determine limits of a function, continuity and uniform continuity, and other properties of a function from Rn to Rm**
4. **analyse algebraic structures and differentiate basic properties of groups, rings, fields and vector spaces**
5. **differentiate properties of a linear operator**
6. **axiomatically construct Euclidean geometry with the overview of its historical development**
7. **formulate properties and existence conditions of regular polygons and polyhedra**
8. **formulate and analyse graph properties**
9. **formulate basic notions of descriptive statistics**
10. **use basic notions related to binary quadratic forms**
11. **describe set operations on finite and infinite sets**
12. **apply and understand properties of real elementary functions and fundamental complex functions of a complex variable**
13. **apply and understand use of differential calculus in geometry and in the analysis of properties of functions that are given in an explicit, implicit and parametric form**
14. **apply and understand use of integral calculus in geometry**
15. **apply and understand vector operations in problem solving**
16. **apply and understand properties of cyclic and permutation groups in problem solving**
17. **apply and understand the algorithm for finding the shortest path and the optimal tree in a graph**
18. **apply and understand properties of probability**

19. **apply and understand division algorithms**
20. **apply and understand numerical methods for solving nonlinear equations, definite integrals and ordinary differential equations, while analysing the obtained results**
21. **apply and understand simple and compound interest formulas in financial mathematics**
22. **solve indefinite and definite integral, Riemann integral of a function of several variables, and line and surface integral**
23. **expand functions into Taylor and Laurent series**
24. **determine the Jordan form of a matrix**
25. **choose an appropriate geometric construction for solving constructive problems using geometry equipment**
26. **choose an appropriate counting principle and/or a form of Dirichlet's principle for solving problems**
27. **solve combinatorial problems using recurrence relations**
28. **solve problems using properties of random variables**
29. **conduct statistical data analysis and testing hypothesis using computers**
30. **count using modular arithmetic, solve congruence equations and different types of congruence systems**
31. **apply methods for solving interpolation problems and function approximations**
32. **determine present value of money flow, financial rent, installments loan and compound interests in applications**
33. **solve problems using Lagrange's theorem, Sylow's theorems and Chinese remainder theorem**
34. **analyse convergence of sequences and series in Rn**
35. **construct orthonormal basis for an inner product space**
36. **differentiate vector and matrix norms, differentiate inner product spaces, normed spaces and metric spaces**
37. **differentiate and apply methods for solving systems of linear equations and geometrically interpret solvability of the systems in the plane and in the space**
38. **analyse mappings of algebraic structures with the emphasis on the isomorphism theorems**
39. **relate types of walks in a graph and their properties with applications in problem solving**
40. **compare plane geometries (Euclidean and non-Euclidean) and their models according to their characteristics**
41. **analyse mappings of n-dimensional Euclidean space and corresponding methods in solving problems using a constructive and an analytical approach**
42. **analyse basic probability models and distributions**
43. **explain a role of mathematical logic in mathematics as a science, the historical and intuitive importance of the logic of statements, and reasons for occurrence of the stronger logical theories, especially first-order logic**

This graduate courses at the Department of Mathematics can be enrolled by the bachelors who finished the graduate course if one or the following conditions is satisfied:

1. **The applicants who have finished the university graduate course and have acquired minimally 135 ECTS from mathematical courses, which is determined on the submitted documentation,**
2. **the applicants have who finished the university graduate course and have acquired minimally 120 ECTS from mathematical courses and have passed the examination organized by the Department of Mathematics.**

Applications for the examination are accepted every year until 15th May, while the time period for the examination lasts from 1st June until 15th July.

2.6. Study programme learning outcomes

2.6.1. Competences which student gains upon completion of study (according to CROQF (HKO): knowledge, skills and competences in a restricted sense –independence and responsibility)

Basic guidelines for this teaching curriculum and the study programme for the profile master of science in mathematics education was the request for professional, didactical – methodical, psychological – pedagogical competencies of the future masters of science in mathematics education in modern upbringing and education processes. In the first place, the intention is to make the study appropriate to the profession for which it educated, by selection of teaching content and by application of certain teaching methods and forms of work.

After finishing this study, the students will be able to:

- **plan and organise a teaching class in mathematics**
- **plan and organise out-of curriculum and out-of school activities**

- **create a written preparation for a teaching class in mathematics**
- **create teaching materials for teaching classes in mathematics**
- **independently organize a teaching class in accordance with the written preparation and teaching principles with and without using ICT**
- **apply and understand the aspects of real and complex analysis in solving problems**
- **apply and understand the aspects of linear algebra and algebra in solving problems**
- **apply and understand the aspects of models of geometry with the emphasis on Euclidean geometry in solving problems, while using a constructve and an analytical approach**
- **apply and understand the aspects of discrete and combinatorial mathematics, probability and statistics in solving problems**
- **apply and understand the aspects of number theory, set theory and mathematical logic in solving problems**
- **apply and understand the aspects of applied mathematics in solving problems**
- **evaluate students' achievements in mathematics**
- **evaluate quality of the educational process**
- **self-evaluate the performance**
- **interpret and apply main contents of pedagogy**
- **interpret and apply main contents of psychology of education**
- **help students to develop a positive attitude towards mathematics**
- **communicate with students, parents and other participants**
- **cooperate with parents, expert school employees and other participants**

Through this study, the students develop independence and responsibility, especially through seminar works and projects and by solving tasks independently.

2.6.2. Employment possibility (list of possible employers and compliance with professional association's requirements)

Elementary and high school in the Republic of Croatia.

2.6.3. Possibility of continuation of study on higher level

After finishing this course, the students will be able to enrol the University Postgraduate Study of Mathematics at University J.J. Strossmayer of Osijek, University of Rijeka, University of Split and University of Zagreb, as well as related foreign studies.

2.7. Upon applying for graduate studies list proposer's or other Croatian institution's undergraduate study programmes which enable enrolment to the proposed study programme

Enrolment in this graduate course is possible after finishing the Undergraduate course in Mathematics at the Department of Mathematics at the University of Rijeka. The course can be also enrolled by the students who fulfil the requirements given under point 2.5.

2.8. Upon application of integrated studies - name reasons for integration of undergraduate and graduate level of study programme

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3. PROGRAMME DESCRIPTION

3.1. List of compulsory and elective subjects and/or modules (if existing) with the number of active teaching hours required for their implementation and number of ECTS-credits

Table 1

3.2. Description of each subject

Table 2

3.3. Structure of study programme, dynamic of study and students' obligations

The study programme consists of the larger number of compulsory subjects (95 ECTS) and the smaller number of elective subjects (25 ECTS, i.e. 20.83% of the total number of ECTS on the study).
By selecting elective subjects the student additionally define them and can individually acquire knowledge in related fields of physics, computer science or education in mathematics. The collaboration with the Department of Physics, the Department of Informatics and the Faculty of Humanities and Social Sciences increases interdisciplinarity of this study.
The rhythm of the study is defined by the Study regulations at the University of Rijeka as well as general obligations, while specific obligations of the students are given in description of each subject and its syllabus that is given out annually at the beginning of a semester.

3.3.1. Enrolment requirements for the next semester or trimester (course title)

Admission requirements are determined by the Study regulations at the University of Rijeka.

3.4. List of courses and/or modules student can choose from other study programmes

Course title (course status within the proposed program)	***The existing program in which the course is taught (course status within the other program)***	***Note***
Linear Programming (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory) Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*
Mathematics Education 1 (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory) Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Developmental psychology (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory) Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
General pedagogy (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory) Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
Educational psychology 1 - Psychology of learning and teaching (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory) Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
Basic of Linguistic Culture	*Graduate course in Mathematics and Computer*	*FHSS*

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(compulsory)	*Science – Teacher Training (compulsory)* *Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	
Seminar 3 – Foundations of mathematics (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Mathematics Education 2 (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Using computers in teaching mathematics (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)*	*DM*
Educational psychology 2 - Individual differences and classroom interaction (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
Didactics 1 (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
Teaching pupils with special needs (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
Coding Theory and Cryptography (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*
System Theory (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course in Computer Science; double major (elective)* *Undergraduate course in Computer Science; single major (compulsory)*	*DI*
Additional teaching of mathematics (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)*	*DM*
Methodical practice in mathematics 1 (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)*	*DM*
Vector Spaces 1 (compulsory)	*Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*
Didactics 2 (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Teaching module of the graduate studies - all teacher training programmes of the University of Rijeka (compulsory)*	*FHSS*
Measure and Integral (elective)	*Graduate course Discrete Mathematics and its*	*DM*

	Applications (compulsory)	
Introduction to databases (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Graduate course Discrete Mathematics and its Applications (elective)* *Undergraduate course in Computer Science; single major (compulsory)*	*DI*
Computer Networks 1 (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Graduate course Discrete Mathematics and its Applications (elective)* *Undergraduate course in Computer Science; single major (compulsory)* *Undergraduate course in Computer Science; double major (compulsory)*	*DI*
Formal languages and compilers 1 (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course Discrete Mathematics and its Applications (elective)* *Undergraduate course in Computer Science; single major (compulsory)* *Undergraduate course in Computer Science; double major (compulsory)*	*DI*
Hypermedia Systems in Education (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course in Computer Science; (compulsory)* *Graduate course in Computer Science; double major (elective)*	*DM*
Probability Theory (elective)	*Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Partial Differential Equations (elective)	*Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Selected sections from numerical analysis (elective)	*Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Graph theory (elective)	*Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*
History of Mathematics (compulsory)	*Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Selected lectures from teaching mathematics (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)*	*DM*
Methodical practice in mathematics 2 (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)*	*DM*
Seminar / M. Sc. thesis (compulsory)	*Graduate course in Mathematics and Computer Science – Teacher Training (compulsory)* *Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*
Introduction to optimization (elective)	*Graduate course Discrete Mathematics and its*	*DM*

	Applications (elective)	
Databases (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course Discrete Mathematics and its Applications (elective)* *Undergraduate course in Computer Science; single major (compulsory)* *Graduate course in Computer Science; double major (compulsory)*	*DI*
Formal languages and compilers 2 (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course Discrete Mathematics and its Applications (elective)* *Undergraduate course in Computer Science; single major (compulsory)* *Undergraduate course in Computer Science; double major (compulsory)*	*DI*
Computer Networks 2 (elective)	*Graduate course in Mathematics and Computer Science – Teacher Training (elective)* *Graduate course Discrete Mathematics and its Applications (elective)* *Undergraduate course in Computer Science; single major (compulsory)* *Undergraduate course in Computer Science; double major (compulsory)*	*DI*
Science popularization (elective)	*Graduate course Discrete Mathematics and its Applications (elective)* *Graduate course in Physics and Mathematics – Teacher Training (elective)*	*DP*
Statistics (elective)	*Graduate course Discrete Mathematics and its Applications (compulsory)*	*DI*
Topics in contemporary mathematics (elective)	*Graduate course Discrete Mathematics and its Applications (elective)*	*DM*
Vector Spaces 2 (elective)	*Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*
Harmonic analysis (elective)	*Graduate course Discrete Mathematics and its Applications (compulsory)*	*DM*

DM – Department of Mathematics
DP – Department of Physics
DI – Department of Informatics
FHSS – Faculty of Humanities and Social Studies

3.5. List of courses and/or modules that can be implemented in a foreign language (specify the language)

All compulsory courses of this study can be performed in English.

3.6. Allocated ECTS credits that enable national and international mobility

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The proposed study is open to the student mobility on all related studies of national and international universities.
3.7. Multidisciplinarity/interdisciplinarity of study programme
The study programme covers courses in mathematics, computer science, psychology and pedagogy.
3.8. Mode of study programme completion
A student completes the study programme by taking the final exam in front of a three member committee. A part of the final exam is presentation and defence of the work that the student does during the last semester of the study. The student gains a right to access the final exam after he has taken all exams and has done all obligations proscribed by the study programme.
3.8.1. Conditions of approval of final work /thesis and/or final/thesis exam application
Conditions for approval of application for the graduate exam are assigned by Regulation of thesis and final exam at the university graduate courses of Department of Mathematics, University of Rijeka (http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html).
3.8.2. Composing and furnishing of final work/thesis
Forming thesis is defined by Regulations of thesis and final exam at university graduate courses of Department of Mathematics, University of Rijeka (http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html).
3.8.3. Final work/thesis assessment procedure and evaluation and defence of final work/thesis
Evaluation process of thesis and graduate exam is defined by Regulations of thesis and final exam at the university graduate courses of Department of Mathematics, University of Rijeka (http://www.math.uniri.hr/hr/propisi/propisi-i-dokumenti.html).

Table 1

LIST OF MODULES/COURSES							
Semester 1.							
MODULE	COURSE	COURSE COORDINATOR	L	E	S	ECTS	STATUS[1]
	Linear programming		30	30	0	5	C
	Mathematics education 1		30	0	30	7	C
	Developmental psychology		30	15	0	5	C
	General pedagogy		30	0	15	5	C
	Educational psychology 1 - Psychology of learning and teaching		30	15	0	5	C
	Basics of linguistic culture		15	0	15	3	C
Semester 2.							
	Seminar 3 – Foundations of mathematics		0	0	30	4	C
	Mathematics Education 2		30	0	30	6	C
	Using computers in teaching mathematics		15	15	0	4	C
	Educational psychology 2 - Individual differences and classroom interaction		30	15	0	4	C
	Didactics 1		30	15	0	4	C

[1] **IMPORTANT:** Put C for compulsory course or E for elective course.

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	Teaching pupils with special needs		30	15	0	4	C
	Additional teaching of mathematics		30	30	0	4	C
Semestar 3. (the number of elective courses that have to be selected: at least 16 ECTS)							
	Methodical practice in mathematics 1		0	60	0	4	C
	Vector spaces 1		30	30	0	6	C
	Didactics 2		30	15	0	4	C
	Measure and integral		30	30	0	6	E
	Introduction to databases		30	30	0	5	E
	Computer Networks 1		30	30	0	5	E
	Algebra 1		30	30	0	6	E
	Hypermedia systems in education 1		15	0	30	5	E
	Number theory		30	30	0	6	E
	Graph theory		30	15	15	6	E
Semester 4. (the number of elective courses that have to be selected: at least 11 ECTS)							
	History of mathematics		15	0	30	3	C
	Selected lectures from teaching mathematics		30	30	0	4	C
	Methodical practice in mathematics 2		0	60	0	4	C
	Seminar / M. Sc. thesis		0	0	30	4	C
	Databases		30	30	0	5	E
	Coding theory and cryptography		30	0	15	6	E
	System theory		30	30	0	5	E
	Algebra 2		30	30	0	6	E
	Computer networks 2		30	30	0	5	E
	Science popularization		15	15	0	2	E
	Probability theory		30	30	0	6	E
	Topics in contemporary mathematics		15	0	15	3	E
	Vector spaces 2		30	30	0	6	E
	Harmonic analysis		30	0	15	6	E
	Partial differential equations		30	30	0	6	E
	Graduation					4	C

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General information		
Lecturer		
Course title	Linear programming	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with:
- basic types of the linear programming problems
- basic principles and algorithms for solving problems of finding minimum and maximum values
- notions of dual problems of linear programming
- basic notions of the matrix game theory
- basics of convex programming
- basics of integer programming

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- classify basic convex sets of points in n-dimensional Euclidean space and proper analytical methods of solving linear programming problems (A6, B6, C6, D6, E6, F6)
- apply properties of a linear (affine) function to a linear programming problem with understanding (A6, B6, C6, D6, E6, F6)
- define the goal function in simple linear programming problems (A6, B6, C6, D6, E6, F6)
- apply and understand various algorithms for finding extreme values of a linear function on a convex set (A6, B6, C6, D6, E6, F6)
- solve the dual problem of linear programming (A6, B6, C6, D6, E6, F6)
- apply and understand the Simplex algorithm (A6, B6, C6, D6, E6, F6)
- analyse the concept of matrix games (A6, B6, C6, D6, E6, F6)
- solve problems of integer programming (A6, B6, C6, D6, E6, F6)
- analyse the basics of convex programming (A6, B6, C6, D6, E6, F6)

1.4. Course content

Convex sets in R^n. Polyhedral sets. Gauss-Jordan method for solving system of equations. Basic linear programming problems. Fourier-Motzkin method and some graphical methods for solving linear programming problems. Simplex method. Degeneracy case. Dual simplex method. Parametric linear programming. Duality. Integer linear programming. Transportation problems. Basics of matrix game theory. Basics of convex programming.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work	☒ independent work ☒multimedia and the internet ☐ laboratory ☐tutorials ☒consultations ☐other

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[2]

Class attendance & class participation			1.5	Seminar paper		Experiment	
Written exam	1.5	Oral exam	2	Essay		Research work	
Project		Continuous assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. N.Linić, H.Pašagić, Č.Rnjak : Linearno i nelinearno programiranje, Informator, Zgb, 1978.
2. K.Murty : Linear and Combinatorial Programming, John Wiley and Sons, NY, 1983.

1.11. Recommended literature (when proposing the program)

1. R.V. Benson : Euclidean Geometry and Convexity, Mc Graw - Hill, NY, 1966.
2. L.Lyusternik : Convex Figures and Polyhedrons, Dover publications, NY, 1963.
3. M.Radić : Linearno programiranje, Školska knjiga, Zgb, 1974.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*
N.Linić, H.Pašagić, Č.Rnjak : Linearno i nelinearno programiranje, Informator, Zgb, 1978	5	10
K.Murty : Linear and Combinatorial Programming, John Wiley and Sons, NY, 1976	1	10

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[2] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Mathematics education 1	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with practical and theoretical aspects of the methods for teaching mathematics in higher grades of elementary schools and in secondary schools. For this purpose it is necessary within the course to:

- define and analyse basic and special theories of teaching mathematics in higher grades of elementary schools and in secondary schools,
- prepare students for organizing a math teaching class in accordance with teaching principles,
- introduce the national curriculum for mathematics in higher grades of elementary schools and in secondary schools,
- acquaint students with the mathematical knowledge that is necessary for effective teaching of mathematics in higher grades of elementary schools and in secondary schools.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- quote the principles of mathematics education and their basic properties, and use them with understanding (A7, B6, C6, D6, E6, F6),
- differentiate several forms of defining mathematical terms and highlight their advantages and deficiencies in school mathematics (A7, B6, C6, D6, E6, F6),
- interpret and compare different ways of proving mathematical theorems (A7, B6, C6, D6, E6, F6),
- analyse the national curriculum of mathematics in higher grades of elementary schools and in secondary schools (A6, B6, C5, D6, E5, F5),
- in accordance with the principles of teaching mathematics, clearly and precisely present mathematical content using teaching aids and facilities (A6, B6, C6, D6, E7, F7),
- use relevant and recent professional literature independently and critically (A6, B6, C6, D5, E7, F7),
- cooperate with colleagues to acquire and develop professional competences, and use the feedback in the aim of improving the teaching process (A6, B6, C5, D6, E7, F7),
- use the basic communication principles and techniques of effective professional communication, and express themselves accurately and fluently in spoken and written forms of communication in the language of teaching and in the official language (A6, B6, C6, D6, E6, F6).

1.4. Course content

The subject of teaching mathematics. The objectives and tasks of teaching mathematics. Principles of teaching mathematics – scientific approach (an axiom, a mathematical definition, the definition of a term, a theorem, a proof), activity, independence and awareness (a formalism in mathematics class), motivation (games in teaching mathematics, mathematical billboard), individualization, visualization, suitability (factors that affect on the process of learning mathematics, degrees of knowing the mathematics, mathematical personality), systematicity, stability (remembering mathematical facts and procedures). In seminars, students will become familiar with the mathematical curriculum in the higher grades of elementary school and present selected topics in mathematics that are processed in the higher grades of elementary schools or in

secondary school.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☐exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[3]

Class attendance & class participation			2	Seminar paper	0.8	Experiment	
Written exam	0.4	Oral exam	1.2	Essay		Research work	
Project		Continuous assessment	1.6	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Current textbooks for elementary and secondary schools
2. Matematika bez suza, ed. Ilona Posokhova, Ostvarenje, Lekenik, 2000.
3. Kurnik: Oblici matematičkog mišljenja, Element, Zagreb, 2013.
4. Kurnik: Posebne metode rješavanja matematičkih problema, Element, Zagreb, 2010.
5. Kurnik: Znanstveni okvir nastave matematike, Element, Zagreb, 2009.
6. Literature available in the e-library of the course

1.11. Recommended literature (when proposing the program)

1. Polya,G.: Kako ću riješiti matematički zadatak, Školska knjiga, Zagreb, 1984.
2. XXX: Matematika i škola, časopis za nastavu matematike, Element, Zagreb
3. Available methodical and science popularization journals (printed or online form)

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
Aktualni udžbenici iz matematike o osnovnim i srednjim školama i odgovarajući priručnici za učitelje	20	15
Kurnik: Oblici matematičkog mišljenja, Element, Zagreb, 2013	1	15
Kurnik: Posebne metode rješavanja matematičkih problema, Element, Zagreb, 2010	2	15
Kurnik: Znanstveni okvir nastave matematike, Element, Zagreb, 2009	2	15

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[3] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Basic information		
Course coordinator		
Course title	Developmental psychology	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30 + 15 + 0

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

The main aim of the course is to familiarise students with the basic concepts of the development necessary for the understanding of the legality of upbringing and education. On the basis of perceptions regarding the psychological development of children and adolescence, to enable the understanding of applied educational procedures, as well as their appropriateness for a child's specific age. The sensitivity of students for specific functioning of children of various ages as well as the understanding of individual differences. The acquiring of assessment skills and critical judgement of the appropriateness regarding the upbringing-educational work with children and adolescence.

1.2. Course enrolment requirements

No requirements

1.3. Expected course learning outcomes

Upon completing the course, the students will be able to:
- understand specifics of development of childhood and adolescence
- explain standard development and specifics of individual development
- apply knowledge to understand individual differences among children and adolescents
- analize the roll of the family and school in child development and importance of interaction this two factors.

1.4. Course content

Developmental Theories; Physical growth and development; Puberty and biological changes; Cognitive development; Intelectual development and accomplishment; Moral development; Self concept; Development of gender role and sex differences; Growing up in the family: relationship with parents; School role; Relationship with peers; Develomental lessons in adolescence; Stress in children and adolescents; Adjusting problems in adolescence.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☒ multimedia and network
	☒ exercises	☐ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other

1.6. Comments

1.7. Student's obligations

Regular course attendance and active partake in class: writing essay on a chosen topic. Students are required to write two tests during the semester. Final written and oral exam.

1.8. Evaluation[4] of student's work

Course	0,8	Activity/Participation	0,4	Seminar paper		Experiment	

4 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

attendance							
Written exam	1	Oral exam		Essay	0,8	Research work	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio		Practice report	1				

1.9. Assessment and evaluation of student's work during classes and on final exam

Student's work will be evaluated and assesed during the class and on the final exam. Complete number of credits a student can achieve during the class is 70 (they are being marked for the activities in the previous table), while passing the final exams the student is achieving 30 credits.
Detailed list of evaluating and assesing the student will be presented in the executive plan of the subject!

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Vasta, R., Haith, M.M., Miller, S.A. (1998). Dječja psihologija. Jastrebarsko: Slap.
2. Lacković-Grgin, K. (2006). Psihologija adolescencije. Jastrebarsko: Slap. (pg.53-70; 103-226)
3. Vizek Vidović, V., Rijavec, M., Vlahović-Štetić, V., Miljković, D. (2003). Psihologija obrazovanja. Zagreb: VERN (pg. 41-105)

1.11. Optional / additional reading (at the time of proposing study program)

1. Bastašić, Z. (1995). Pubertet i adolescencija. Zagreb: Školska knjiga.
2. Buggle, F. (2002). Razvojna psihologija Jeana Piageta. Jastrebarsko: Slap.
3. Buljan-Flander, G., Kocijan-Hercigonja, D. (2003). Zlostavljanje i zanemarivanje djece, Zagreb: Marko.M.,
4. Juul, J. (1995). Vaše kompetentno dijete. Zagreb: Educa.
5. Klarin, M. (2006). Razvoj djece u socijalnom kontekstu. Jastrebarsko: Slap
6. Lacković-Grgin, K. (2000). Stres u djece i adolescenata. Jastrebarsko, Slap.
7. Lacković-Grgin, K. (1993). Samopoimanje mladih, Jastrebarsko, Slap.
8. Olweus (1998). Nasilje među djecom u školi. Zagreb: Školska knjiga.
9. Raboteg-Šarić, Z. (1995). Psihologija altruizma. Zagreb: Alinea
10. Salovey, P. (1999). Emocionalni razvoj i emocionalna inteligencija. Zagreb: Educa.
11. Zarevski, P. (2000). Struktura i prirode inteligencije. Jastrebarsko, Slap

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Vasta, R., Haith, M.M., Miller, S.A. (1998). *Dječja psihologija*. Jastrebarsko: Slap.	13	80
Lacković-Grgin, K. (2006). *Psihologija adolescencije.* Jastrebarsko: Slap. (pg.53-70; 103-226)	4	80
Vizek Vidović, V., Rijavec, M., Vlahović-Štetić, V., Miljković, D. (2003). Psihologija obrazovanja. Zagreb: VERN (pg. 41-105).	22	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

The course quality will be monitored through discussions with the students, as with the application of questionnaire, for evaluating satisfaction with the course and lecturer's work.

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Basic information		
Course coordinator		
Course title	General pedagogy	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30 + 0 + 15

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

Course objective is to familiarise students with basic principles, concept, clasification of pedagogy and to form critical thinking about education in modern world.
The course is correspondent to other courses that have similar themes to history of pedagogy and pedagogy as a science.

1.2. Course enrolment requirements

No requirements

1.3. Expected course learning outcomes

Upon finishing the course, students will be able to show general skills such as:
- speculative operations (induction, analisis, sintesis, comparation, evaluation…);
- analysing complexity of phenomenon of education;
- planing and organizing;
- applying ideas in analisis of practise work;
- conducting informations and presentation of informations.

Upon finishing the course, specific skill will provide students to be able to:
- describe, define and explain the phenomenon of education;
- analyse phenomenon of education on examples and cases;
- form and show ideas, actively engage in discussion

1.4. Course content

Pedagogy as a science (subject, methodology, pedagogy placement in the science system, pedagogy discipline system, pedagogy concept). Education and reproduction of human life. Education as social and humanistic phenomenon. Important features of human being – anthropological base of education. Education – constant of communion and culture (social, incultural, encultural, asimilated, individual). Relevant features of education. Education as a life need of a community (functionality, intentionality, instituationalization, fromalization of educational praxis). Education: effect of inheritance and social enviroment. Education as social function. Education as governing. Education as development. Educational goals, ideals and tasks. Educational enviroment: big social band, education family potencials, peers, school enviroment, mass media, free time enviroment, professional and working enviroment, enviroment for children with special needs.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☐ laboratories ☐ mentorship ☒ other: consultation
1.6. Comments	The course will be presented in hy*brid* form; combining long distance education (e-learning), class and individual and team work outside the class, using *Merlin*, system based on Moodle (Modular Object-Oriented Dynamic Learning Environment). Students will be instructed to	

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	use Merlin system. Active learning and teaching is recommended.

1.7. Student's obligations

- active course attendance (when in class), preparation for class, active participating in class and planned activities on Merlin;
- presentation on paper;
- two tests during semester.

1.8. Evaluation[5] of student's work

Course attendance	1,0	Activity/Participation	1,0	Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Sustained knowledge check	2,0	Report		Practice	1,0
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation will take place without final exam. Student's work will be assessed during classes in the form of sustained assessments of activities on *Moodle*, two written tests and their exercises presentation.

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Giesecke, H.(1993), Uvod u pedagogiju, Zagreb Educa
2. Gudjons, H.(1994), Pedagogija - temeljna znanja, Zagreb, Educa
3. Mušanović, M., Rosić, V.(2003), General pedagogics (skripta). Rijeka: Filozofski fakultet u Rijeci

1.11. Optional / additional reading (at the time of proposing study program)

1. Bratanić, M. (1991) Mikro-pedagogija. Zagreb: Školska knjiga
2. Rafajac, B.: (1991) Odgoj kao razvoj autonomne vrijednosne svijesti. Rijeka: Pedagoški fakultet u Rijeci,
3. Polić, M. (1993) Odgoj I svije(s)t. Zagreb: Hrvatsko filozofsko društvo
4. Švajcer, V. (1964) Grupa kao subjekt obrazovanja., Zagreb: Matica hrvatska
5. Neill, A.S. (1988): Slobodna djeca Samerhila. Beograd: BIGZ
6. Winkel, R. (1996): Djeca koju je teško odgajati. Zagreb: Educa
7. Madelin, A. (1991): Osloboditi školu. Zagreb: Educa

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Quality will be sustainly monitored during the course. Periodicaly will be used questionarries, assessment scale and discussions. Comments, suggestions and informations are used to improve lessons, lectures and other forms of work.

5 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

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Basic information		
Course coordinator		
Course title	Educational psychology 1 – Psychology of studying and teaching	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30 + 15 + 0

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

The objective of this course is to apply the findings of psychology of learning to school practices. The students will acquire knowledge about main factors that contribute to successful learning, including students' characteristics and motivation for learning. The course is correspondent to similar courses in teacher education modul.

1.2. Course enrolment requirements

No requirements

1.3. Expected course learning outcomes

After passing the course students will be able to:

- describe and understand learning through classical and operant conditioning in schools
- describe and understand learning by observation in school
- describe and understand theory of information processing i constructive theory of learning and their appliance in teaching
- describe and understand possibilities in use of theory of studying in teaching
- plan teaching class using constructive principles of learning
- apply effective learning strategies (mnemonic strategies, summarising, questioning)
- describe factors of quality knowledge assessment
- describe and apply various methods in student's knowledge assessment
- apply normative and criterion approach to assessment

1.4. Course content

Classical conditioning in classroom; Operant conditioning; Modeling; Self-regulation of behavior and mentoring; Information processing theory; Cognitive and metacognitive strategies; Constructive theory of learning; Appliance of cognitive strategies of learning in teaching; Subjectivity assessment and impartially evaluation of knowledge; Alternative assessment

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☒ multimedia and network
	☒ exercises	☐ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☒ other: consultation

1.6. Comments

1.7. Student's obligations

Students are required to attend classes regulary and actively participate; they are required to complete writen assignements based on clasroom practices, and pass three written preliminary exams during semestar and final exam.

1.8. Evaluation[6] of student's work

Course attendance	1,0	Activity/Participation	1,2	Seminar paper		Experiment	
Written exam	0,5	Oral exam	0,5	Essay		Research work	
Project		Sustained knowledge check	1,8	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Writen assignements have to be positively evaluated, as well as tests during semester to be able to approach final exam. Passing criteria is 50% of correct answers on midterm tests; 70% of the grade student earns in class and 30% of the grade student earns with the final exam.

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Kolić-Vehovec, S. (1999). Edukacijska psihologija. Rijeka: Filozofski fakultet.
2. Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). Psihologija obrazovanja. Zagreb: IEP.

1.11. Optional / additional reading (at the time of proposing study program)

1. Grgin, T. (2001). Školsko ocjenjivanje znanja. Jastrebarsko: Slap.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Kolić-Vehovec, S. (1999). *Edukacijska psihologija*. Rijeka: Filozofski fakultet.	13	80
Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). *Psihologija obrazovanja*. Zagreb: IEP.	22	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

The course quality will be monitored through discussions with the students, as with the application of questionnaire, for evaluating satisfaction with the course and lecturer's work.

6 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

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Basic information		
Course coordinator		
Course title	Introduction to linguistic culture	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	3
	Number of hours (L+E+S)	15 + 0 + 15

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

The main course objective is mastering the basics of linguistic and grammar norms, in written as well as oral expression. Students will gradualy become aquainted with accurate terminology as well as uses of normative manuals (ortography, grammar, dicitionaries, linguistic reference books et al.)
The course belongs to the humanist segment of the student's education as a necessary segment of every intelectual education. The course Introduction to linguistic culture within the frame of other mandatory courses of taching module correlates with courses Rhetorics and methodological courses of specific profession. In the seminar part of the course, student develops skills usefull in realisation of other courses in which the students will particular written and oral expression competence be expected to have.

1.2. Course enrolment requirements

No requirements

1.3. Expected course learning outcomes

After finished course, students will be able to:
- independently research linguistic reference books and intenet and to interpret collected data;
- independently interpret basic features of croatian standard language in 21st century;
- read basic features in various functional styles and apply them;
- apply in the class gained skills in written (on class material, presentation, blackboard etc.) and oral expression (presentation, debate, questioning etc.)

1.4. Course content

Language as system and language as standard (system norms and norms of function); standard language and its norms; standard language realization and functional styles (stylistic norms); elements of grammar (morphological, syntactic) and lexical norm; normative reference books (grammar books, dictionaries, orthographic lexica) and their use.
Written expression; orthographic norm; rules of orthography; spell checking and the use of spell-checkers; forms of written expression and text structure.
Oral expression; orthoepic norms; values of spoken language (syntax melody, diction and accentuation); sentence as a unit of communication (expression); suprasyntactic unity (text, discourse); speech composition; forms of oral expression; rhetoric.
Language in professional use; scientific style as one of the functional styles of standard language; characteristics and layers within styles (professional, popular-scientific, scientific etc.); terminology; terminological lexica; Croatian unilingual dictionaries; organization of scientific/professional text (written and/or spoken).

1.5. Teaching methods

☒ lectures	☒ individual assignment
☒ seminars and workshops	☒ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☐ mentorship
☐ fieldwork	☒ other consultation

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1.6. Comments	All students can participate except the students of Croatian language and literature study.

1.7. Student's obligations

Studenti are obligated to participate in all forms of class. Independent and group work of practical language exercises.

1.8. Evaluation[7] of student's work

Course attendance	0.5	Activity/Participation	0.5	Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Evaluation and assessment of student's work during classes

Student's work on the course will be evaluated during classes (no final exam).
Activity on clas and solving assignments is graded in the form of continuous knowledge evaluation:
Class activity: 30 credits
Sustained knowledge check: 70 credits (two tests; 30 + 40 credits)
Total: 100 credits

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Babić, Stjepan – Finka, Božidar – Moguš, Milan, Hrvatski pravopis, Školska knjiga, Zagreb 1996.
2. Frančić, Anđela – Lana Hudeček – Milica Mihaljević, *Normativnost i višefunkcionalnost u hrvatskome standardnom jeziku*, Hrvatska sveučilišna naklada, Zagreb 2005.
3. Silić, Josip, Funkcionalni stilovi hrvatskoga jezika, Disput, Zagreb 2006.
4. Težak, Stjepko – Babić, Stjepan, Gramatika hrvatskoga jezika, Školska knjiga, Zagreb (od) 71992nd
5. www.prirucnik.hr
6. http://savjetnik.ihjj.hr/

1.11. Optional / additional reading (at the time of proposing study program)

1. Anić, Vladimir, Rječnik hrvatskoga jezika, Novi Liber, Zagreb 31998. (ili koje ranije izdanje).
2. Anić, Vladimir – Goldstein, Ivo, Rječnik stranih riječi, Novi Liber, Zagreb 1999.
3. Badurina, Lada – Marković, Ivan – Mićanović, Krešimir, Hrvatski pravopis, Matica hrvatska, Zagreb 2007.
4. Barić, Eugenija – Lončarić, Mijo – Malić, Dragica – Pavešić, Slavko – Peti, Mirko – Zečević, Vesna – Znika, Marija, Hrvatska gramatika, Školska knjiga, Zagreb 1995.
5. Barić, Eugenija – Hudeček, Lana – Koharović, Nebojša – Lončarić, Mijo – Lukenda, Marko – Mamić, Mile – Mihaljević, Milica – Šarić, Ljiljana – Švaćko, Vanja – Vukojević, Luka – Zečević, Vesna – Žagar, Mateo, Hrvatski jezični savjetnik, Institut za hrvatski jezik i jezikoslovlje, Pergamena, Školske novine, Zagreb 1999.
6. Govorimo hrvatski (jezični savjeti) – na www.hrt.hr
7. Rječnik hrvatskoga jezika, ur. Jure Šonje, Leksikografski zavod - Školska knjiga, Zagreb 2000.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
***Fakulty library has sufficient number of copies of assigned and optional literature. Dictionaries, grammars, linguistic reference books are auxiliary and they are not to be taken out of the library.*		

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Students evaluation 5 weeks from the beggining of class and at the end of the execution of the course, evaluation of suggested and completed assignments within class activities as well as continuous knowledge evaluation and feedback information.

7 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

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General information		
Lecturer		
Course title	Seminar 3 – Foundations of mathematics	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	0 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with the basic concepts of the foundations of mathematics. For this purpose it is necessary within the course to:

- describe the axiomatic method and analyse mathematical-logical-philosophical reasons for its introduction to mathematics,
- describe and analyse Euclidean geometry and its logical shortcomings,
- analyse the problem of "obviously true" statements,
- use visualization in the proof of theorems,
- have knowledge of the paradoxes introduced in mathematics at the beginning of the 20th century and their influence on further development of mathematics,
- describe and analyse Hilbert axiomatic system, Principia Mathematica and Gödel theorems,
- describe the ZFC system of axioms and the theory of categories as an alternative way of foundation of mathematics.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- describe and analyse some axiomatic systems (A6, B7),
- relate and explain causes and consequences of the development of mathematical ideas and methods, and the role of mathematics in science, art and society (A6, B7),
- use different communication types and forms, including information and communication technology (A6, B6, C6, E7, F7),
- use relevant and recent professional literature independently and critically (A6,B7,E6),
- express yourself accurately and fluently in spoken and written communication in the correct official language (D6).

1.4. Course content

Axiomatic method and axiomatic system: historical overview. Problems with visualization and intuition, paradoxes, Hilbert's formalism, Frege's logicism. Gödel's results. The ZFC system of axioms and the theory of categories as an alternative way of foundation of mathematics.

1.5. Modes of instruction	☐lectures ☒seminars and workshops ☐exercises ☐e-learning ☐field work	☒independent work ☐multimedia and the internet ☐laboratory ☐tutorials ☐other _____

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[8]

Class attendance & class participation			0.5	Seminar paper	3.5	Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Continuous assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (seminars) and on the final exam.
Total number of points student can earn during the semester is 100. The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Frege, G., 1995, Osnove Aritmetike i drugi spisi, Kruzak, Zagreb.
2. Moore, A.W., 1990, The Infinite, Routledge, London
3. http://mathforum.org/library/drmath/view/51849.html
4. http://plato.stanford.edu/entries/intuitionism/
5. https://web.math.princeton.edu/~nelson/papers/int.pdf
6. http://www.philosophie.ch/philipp/teaching/papers/vanGarrel_FregeHilbert.pdf
7. http://dialecticonline.wordpress.com/dialectic-autumn-11/is-choosing-semantics-enough/

1.11. Recommended literature (when proposing the program)

1. Wittgenstein, L., 1937-44/1972, Remarks on the Foundations of Mathematics, The M.I.T. Press, Cambridge.
2. Benacerraf, P. i Putnam, H., 1983, Philosophy of Mathematics-Selected Readings, second edition, Cambridge University Press, Cambridge.
3. Boolos, G., 1998, Logic, Logic and Logic, Harvard University Press.
4. Nagel, E. i Newman, J.R., 2001, Gödelov dokaz, Kruzak, prevedeno iz Nagel, Newman, 1993, Gödel's Proof, Routledge
5. Brown, J.R., 1999, An Introduction to the World of Proof and Pictures, Routledge

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurances which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[8] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Mathematics education 2	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with practical and theoretical aspects of the methods for teaching mathematics in higher grades of elementary schools and in secondary schools. For this purpose it is necessary within the course to:

- introduce the national curriculum for mathematics in higher grades of elementary schools and in secondary schools,
- prepare students for choosing the appropriate methods in the process of teaching mathematics,
- acquaint students with the mathematical knowledge that is necessary for effective teaching of mathematics in higher grades of elementary schools and in secondary schools,
- prepare students for organizing a math teaching class in higher grades of elementary schools and in secondary schools.

1.2. Course prerequisite

Mathematics education 1.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- analyse the mathematical curriculum in higher grades of elementary schools and in secondary schools (A6, B6, C5, D6, E5, F5),
- differ and valorise different methods of teaching mathematics, especially methods according to the mathematical topics (A7, B6, C6, D6, E7, F7),
- organize a mathematics teaching class in higher grades of elementary schools and in secondary schools in accordance with contemporary teaching methods and principles while using suitable teaching strategies (A7, B6, C6, D6, E7, F7),
- plan and organize a mathematics teaching class in accordance with contemporary teaching methods and principles while using suitable teaching strategies, with the aim of developing mathematical processes and better understanding of mathematical concepts (A7, B6, C6, D6, E7, F7),
- present mathematical content using the teaching aids and facilities (e.g. informational communicational technology) with the proper use of mathematical terminology and language (A6, B6, C6, D6, E7, F7),
- independently create teaching materials in mathematics with or without using the advanced tools of ICT (A6, B6, C6, D6, E7, F7),
- independently adjust current teaching materials in mathematics for becoming motivational for learning and suitable for accomplishing the planned learning outcomes (A6, B5, C5, D6, E5, F5),
- use relevant and recent professional literature independently and critically (A6, B6, C6, D5, E7, F7),
- cooperate with colleagues to acquire and develop professional competences, and use the feedback in the aim of improving the teaching process (A6, B6, C5, D6, E7, F7),
- use the basic communication principles and techniques of effective professional communication, and express themselves accurately and fluently in spoken and written forms of communication in the language of teaching and in the official language (A6, B6, C6, D6, E6, F6).

1.4. Course content

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Methods of teaching mathematics (methods according to the source of knowledge and methods according to the mathematical topics). Empirical methods, induction, deduction, analysis and synthesis, generalization, abstraction, concretization, problem-solving methods (heuristics, solving problems), analogy and comparison, special mathematical cases. Methods for specific mathematical topics. In seminars, students will become familiar with the mathematical curriculum in the higher grades of elementary school and in secondary schools. Students will present selected topics in mathematics that are processed in higher grades of elementary school or in secondary schools.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☐exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[9]

Class attendance & class participation			2	Seminar paper	1.5	Experiment	
Written exam	0.5	Oral exam	1	Essay		Research work	
Project		Continuous assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Current textbooks for elementary and secondary schools and teachers' manuals
2. Matematika bez suza, ed. Ilona Posokhova, Ostvarenje, Lekenik, 2000.
3. Kurnik: Oblici matematičkog mišljenja, Element, Zagreb, 2013.
4. Kurnik: Posebne metode rješavanja matematičkih problema, Element, Zagreb, 2010.
5. Kurnik: Znanstveni okvir nastave matematike, Element, Zagreb, 2009.
6. Literature available in the e-library of the course

1.11. Recommended literature (when proposing the program)

1. Polya,G.: Kako ću riješiti matematički zadatak, Školska knjiga, Zagreb, 1984.
2. XXX: Matematika i škola, časopis za nastavu matematike, Element, Zagreb
3. Available methodical and science popularization journals (printed or online form)

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[9] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Using computers in teaching mathematics	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	15 + 15 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to:

- prepare students for application of the informational and communicational technology (ICT) and programming tools in teaching mathematics without breaking the principles of teaching mathematics,
- prepare students for organizing teaching classes in mathematics and their performance when using the ICT,
- prepare students for using different e-learning approaches and create teaching materials for use within the e-learning system,
- prepare students for using tools for evaluating knowledge within the e-learning systems,
- develop mechanisms for acquiring mathematical knowledge that is necessary for effective teaching of mathematics in elementary schools and in secondary schools.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- organize and present mathematical content using the mathematical terminology and language while using teaching aids and facilities (information-communication technology), with the aim of developing mathematical processes and better understanding of mathematical concepts (A6, B6, C6, D6, E7, F7),
- without breaking the principles of teaching mathematics, present mathematical concepts adjusted to students' capabilities and age (A6, B6, C6, D6, E6, F6),
- independently create teaching materials for mathematics and plan the teaching process using modern models of teaching and applying advanced tools of ICT considering specifics of mathematics as a profession (A6, B5, C6, D6, E7, F7),
- use different e-learning approaches (mixed or hybrid learning, distance learning), create teaching materials for use within the e-learning system and use different communication types and forms, including information and communication technology (A6, B5, C6, D6, E6, F6),
- independently plan and organize different types of evaluation in mathematics while using tools for evaluating knowledge within the e-learning systems (A6, B6, C6, D6, E6, F6),
- use relevant and recent professional literature independently and critically and adjust current teaching materials in mathematics for becoming motivational for learning and suitable for accomplishing the planned learning outcomes (A6, B6, C6, D6, E7, F7),
- use the basic communication principles and techniques of effective professional communication, and express themselves accurately and fluently in spoken and written forms of communication in the language of teaching and in the official language (A6, B6, C6, D7, E7, F7).

1.4. Course content

E-learning. Computer programs in teaching mathematics. Students' motivation while using the ICT. Independent learning while using the ICT. Examination while using the ICT. Planning and performing teaching classes in mathematics while using the ICT. Using the ICT for presenting teaching contents in elementary and secondary schools.

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1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☒other Consultations and practical teaching
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[10]

Class attendance & class participation			1	Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Continuous assessment	1	Presentation		Practical work	2
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 100. The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. M. Pavleković, Metodika nastave matematike s informatikom I, Element, Zagreb, 1997.
2. M. Pavleković, Metodika nastave matematike s informatikom II, Element, Zagreb, 1999.

1.11. Recommended literature (when proposing the program)

1. A.J.Oldknow, R. Taylor, Teaching Mathematics with ICT, Continuum, London, 2002.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
M. Pavleković, Metodika nastave matematike s informatikom I, Element, Zagreb, 1997.	5	12
M. Pavleković, Metodika nastave matematike s 5informatikom II, Element, Zagreb, 1999.	5	12

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[10] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Basic information		
Course coordinator		
Course title	Educational psychology 2 – Individual differencies and class interaction	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30 + 15 + 0

1. DESCRIPTION OF SUBJECT

1.14. Course objectives

Course objective is to familiarize students with student's characteristics and motivation for studying as the main factors of individual differences in school achievement, and also with the effect that social interaction in the class has on the success in studying.
The course is correspondent to similar courses in teacher education modul.

1.15. Course enrolment requirements

No requirements

1.16. Expected course learning outcomes

After completing the final exam the students will be able to:
- explain intelligence and its effect on school achievement
- plan a teaching class with consideration to various intelligence
- explain relationship between self-concept and school achievement
- describe and compare different theories about relation between motivation and school achievement
- differentiate categories of social status in classroom and plan methods for social status improvement
- understand components on student-teacher relationship
- apply social skills in order to establish positive social interactions in classroom and change undesirable students' behaviours
- understand different approaches to discipline management and to apply principles of operant conditioning in clasroom

1.17. Course content

Intelligence and learning; Students' personality characteristics and learning; Motivation and learning; Interactions among students in classroom; Interaction between teachers and students; Different approaches to discipline management.

1.18. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☒ multimedia and network
	☒ exercises	☐ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☒ other: consultation

1.19. Comments

1.20. Student's obligations

Students are required to attend classes regulary and actively participate; they are required to complete writen assignements based on clasroom practices, and pass three written preliminary exams during semestar and oral exam.

1.21. Evaluation[11] of student's work

11 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

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Course attendance	0,8	Activity/Participation	1	Seminar paper		Experiment	
Written exam	0,6	Oral exam		Essay	0,2	Research work	
Project		Sustained knowledge check	1,4	Report		Practice	
Portfolio							

1.22. Assessment and evaluation of student's work during classes and on final exam

Writen assignements have to be positively evaluated, as well as tests during semester to be able to approach final exam. Passing criteria is 50% of correct answers on midterm tests; 70% of the grade student earns in class and 30% of the grade student earns with the final exam.

1.23. Assigned reading (at the time of the submission of study program proposal)

1. Kolić-Vehovec, S. (1999). Edukacijska psihologija. Rijeka: Filozofski fakultet.
2. Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). Psihologija obrazovanja. Zagreb: IEP.

1.24. Optional / additional reading (at the time of proposing study program)

1. Kroflin, L., Nola, D. (ur.). (1987). Dijete i kreativnost. Zagreb: Globus.
2. Faber, A., Mazlish, E. (2000). Kako razgovarati s djecom da bi bolje učila. Zagreb: Mozaik knjiga.
3. Janković, J. (1996). Zločesti đaci genijalci. Zagreb: Alinea.
4. Neill, S. (1994). Neverbalna komunikacija u razredu. Zagreb: Educa.
5. Pintrich, P.R., Schunk, D.H. (1996). Motivation in education: Theory, research and application. Englewood Clifs, HJ: Prentice Hall.
6. Salovey, P., Sluyter, D.J. (1999). Emocionalni razvoj i emocionalna inteligencija. Pedagoške implikacije. Zagreb: Educa.
7. Winkel, R. (1996). Djeca koju je teško odgajati. Zagreb: Educa.

1.25. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Kolić-Vehovec, S. (1999). *Edukacijska psihologija*. Rijeka: Filozofski fakultet.	13	
Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). *Psihologija obrazovanja*. Zagreb: IEP.	22	

1.26. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Course quality will be assessed based on students' achievement on exams, and on students' evaluation of the course.

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Basic information		
Course coordinator		
Course title	Didactics 1	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30 + 15 + 0

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

The objectives of this course are to familiarize students with concept and subject of didactics; theoretical and methodological basis of didactics; didactic system of education and class with critical point towards didactical practice; process of planning and programing lessons (curriculum): curriculum development; curriculum theory; elements of class situations and other education situations; comunicational processes in class; transfer and interference didacitcs to various situations in education process; motivate for research work in the field of didactics and teaching vocation.

1.2. Course enrolment requirements

No requirements

1.3. Expected course learning outcomes

The students will be able to:

- identify didactics as a discipline of pedagogy, and its correlations to other scientific disciplines
- identify and explane relation between didactics and methodology
- define and explane basic didactic concepts
- identify and analyse causal connection of various didactic phenomenons
- explain various didactic theories, models and systems
- differentiate teacher types and their influence on education process
- enumerate and describe teaching perspectives
- enumerate and describe education process elements
- describe phase, approach and aspects of the process of planning and developing
- define concept of curriculum and explain the types
- explain and analyse curriculum approach in the process of planning and developing
- analyse the contents of National curriculum
- explain and analyse concept of education standards and their impact on education process
- correctly define and state objective and outcome of learning
- explane and compare various theory of choice in class content
- enumerate and explain didactic principles in the process of learning and education
- make and analyse executive program (subject curriculum) for single subject class
- enumerate and describe comunication models
- identify problems in comunication process
- define and analyte concept of education ecology
- identify and describe factors that make impact on education enviroment

1.4. Course content

- Methodological and epistemiological foundations of didactics
- Basic didactic concepts and didactic system
- Didactical theories and schools of thoughts
- Teacher types and teaching perspectives
- Lesson plan, program and curriculum

- Curriculum design (curriculum approach; probable outcome based curriculum)
- National curriculum
- Education standards
- Choice and course theme structuring theory
- Didactic principles in education and learning process
- Education and class
- Comunication processes in the class
- Education ecology

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☐ laboratories ☐ mentorship ☒ other: consultation
1.6. Comments		

1.7. Student's obligations

Student's obligations are active participation in all forms of class and learning; analisis on the National curriculum; to make executive program (subject curriculum for single subject class); to read assigned reading and materials from the lectures; consultation; test; written and oral exam.

1.8. Evaluation[12] of the student's work

Course attendance	0,5	Activity/Participation	0,5	Executive program	0,5	Experiment	
Written exam	1	Oral exam	0,5	Essay		Research work	
Project		Sustained knowledge check	0,5	Report		Practice	
Portfolio		Presentation and review	0,5	Learning log			

1.9. Assessment and evaluation of student's work during classes and on final exam

Students will be assesed during classes and on final exam. Maximum credits for activities during classes is 70 (those from the table), maximum credits for final exam is 30.
Detailed list of evaluating and assesing the student will be presented in the executive plan of the subject!

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Bognar, L., Matijević, M. (2002), Didaktika. Zagreb: Školska knjiga. (odabrana poglavalja)
2. Lavrnja, I. (1998), Poglavlja iz didaktike. Rijeka: Pedagoški fakultet. (odabrana poglavlja)
3. Previšić, V. (ur.) (2007), Kurikulum: Teorije – Metodologija – Sadržaj – Struktura. Zagreb: Zavod za pedagogiju Filozofskog fakulteta Sveučilišta u Zagrebu, Školska knjiga. (odabrana poglavlja)

1.11. Optional / additional reading (at the time of proposing study program)

1. Bezić, K., Strugar, V. (1998), Učitelj za treće tisućljeće. Zagreb: HPKZ.
2. Bežen, A., Jelavić, F., Kujundžić, N., Pletenac, V. (1991), Osnove didaktike. Zagreb: Školske novine.
3. Jelavić, F. (1994), Didaktičke osnove nastave. Jastrebarsko: Slap.
4. Jensen, E. (2003), Super-nastava. Zagreb: Educa.
5. Kramar, M. (1993), Načrtovanje in priprava izobraževalno-vzgojnega dela v šoli. Novo mesto, Nova Gorica: Educa.
6. Kyriacou, C. (1995), Temeljna nastavna umijeća. Zagreb: Educa.
7. Marentič-Požarnik, B., Strmčnik, F., Cencič, M., Blažič, M. (1991), Izbrana poglavlja iz didaktike. Novo mesto: Pedagoška obzorja.
8. Marsh, J.C. (1994), Kurikulum: temeljni pojmovi. Zagreb: Educa.
9. Meyer, H. (2002), Didaktika razredne kvake.Rasprave o didaktici, metodici i razvoju škole. Zagreb: Educa.
10. Pastuović, N. (1999), Edukologija. Zagreb: Znamen.
11. Terhart, E. (2001), Metode poučavanja i učenja. Zagreb: Educa.

12 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

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1.12. Number of assigned reading copies with regard to the number of students currently attending the course		
Title	*Number of copies*	*Number of students*
Bognar, L., Matijević, M. (2002), Didaktika. Zagreb: Školska knjiga. (odabrana poglavalja)	17	20
Lavrnja, I. (1998), Poglavlja iz didaktike. Rijeka: Pedagoški fakultet. (odabrana poglavlja)	21	20
Previšić, V. (ur.) (2007), Kurikulum: Teorije – Metodologija – Sadržaj – Struktura. Zagreb: Zavod za pedagogiju Filozofskog fakulteta Sveučilišta u Zagrebu, Školska knjiga. (odabrana poglavlja)	2	20

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

The course quality will be monitored through discussions with the students, as with the application of questionnaire, for evaluating satisfaction with the course and lecturer's work**.**
It will be personaly made for each student. Evaluation will take place in the midterm and at the end of the semester.

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Basic information		
Course coordinator		
Course title	Teaching the children with special needs	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30 + 15 + 0

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

Course objectives are to familiarize students with categories of development disability kategorijama, specificity in finctioning persons with various development disabilities as with appropriate methods of teaching children with development disabilities.
Program of this course correlates with the program of courses Developmental psychology and Educational psychology.

1.2. Course enrolment requirements

No requirements .

1.3. Expected course learning outcomes

After completing this course students will be able to:
- diferentiate and describe various categories of pupils with special needs
- describe specific problems in education that pupils with special need encouter with
- describe adequate methods of teaching pupils with various special needs.

1.4. Course content

Who are the children with special needs? Children with special needs and their enviroment. Intellectual disabilities. Learning disabilities. Difficulties in communication, language and speech. Social behaviour and emotional disorder. Hearing impairment. Sight impairment. Autism. Multiple disabilities. Physical disabilities and health problems. Gifted children. Education of children with special needs.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Active attendance and participation in activities,mid semester test and final exam.

1.8. Evaluation[13] of student's work

Course attendance	1	Activity/Participation	0,5	Seminar paper		Experiment	
Written exam	1	Oral exam		Essay		Research work	
Project		Sustained knowledge check	1,5	Report		Practice	

13 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

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Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Version 1 (final exam) Student's work will be assesed during class and on final exam.Total credits number is 70 (activities in the table), and on final exam is 30.

Detailed assessment and evaluation of student's work can be found in executive course plan!

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Vizek Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). Psihologija obrazovanja (poglavlja: Učenici s posebnim potrebama; Daroviti učenici). Zagreb: Udžbenici Sveučilišta u Zagrebu.

1.11. Optional / additional reading (at the time of proposing study program)

1. Davis, R.D., Braun, E.M. (2001). Dar disleksije: zašto neki od najpametnijih ljudi ne znaju čitati i kako mogu naučiti. Zagreb: Alinea.
2. Cvetković-Lay, J., Sekulić-Majurec, A. (1998). Darovito je, što ću s njim? Zagreb: Alinea.
3. Čuturić, N. (1995). Zabrinjava me moje dijete: ponašanje djece od 2nd do 6. godine. Zagreb: Školska knjiga.
4. Kirk, S., Gallagher, J.J., Coleman, M.R.., Anastasiow, N. (2009). Educating exceptional children. Boston: Houghton Mifflin Company.
5. Kocijan-Hercigonja, D. (2000). Mentalna retardacija – biologijske osnove, klasifikacija i mentalno zdravstveni problemi. Jastrebarsko: Naklada Slap.
6. Kocijan-Hercigonja, D., Buljan-Flander, G., Vučković, D. (2002). Hiperaktivno dijete uznemireni roditelji i odgajatelji. Jastrebarsko: Naklada Slap.
7. Ribić, K. (1991). Psihofizičke razvojne teškoće. Zadar: ITP Forum.
8. Wenar, C. (2003). Razvojna psihologija i psihijatrija od dojenačke dobi do adolescencije. Jastrebarsko: Naklada Slap.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Vizek Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). *Psihologija obrazovanja*). Zagreb: Udžbenici Sveučilišta u Zagrebu.	22	80

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

The course quality will be monitored through discussions with the students, as with the application of questionnaire, for evaluating satisfaction with the course and lecturer's work.

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General information		
Lecturer		
Course title	Additional teaching of Mathematics	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with the theory of gifted students. For this purpose it is necessary within the course to:

- introduce methods for an identification and work with gifted pupils,
- introduce mathematics competitions,
- acquaint students with the mathematical knowledge that is necessary for effective teaching of mathematics for additional classes in elementary and secondary schools.

1.2. Course prerequisite

None. There is a strong correlation with the courses Elementary mathematics 1 and Mathematics education.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- in accordance with the principles of teaching mathematics, in the correct official language, clearly and precisely present mathematical content (A6, B6, C4, D7, E7, F8),
- while working with students, create precise instructions adjusted to students' capabilities and age (A6, B6, C5, D6, E7, F8),
- predict students' abilities in mastering the mathematics curriculum and use historical facts and problems from the everyday life, as well as the connection with other subjects, with the aim of increasing their motivation, (A6, B5, C6, D7, E7, F8),
- use different methods in the teaching process with the aim of preparing students for independent solving of advanced tasks (A6, B6, C6, D7, E7, F7),
- independently create teaching materials for mathematics according to individual characteristics of students (A6, B6, C6, D7, E7, F7),
- use relevant and recent professional literature independently and critically (A7, B6, C7, D7, E8, F7).

1.4. Course content

Definitions of basic notions. Characteristics and identification of gifted pupils. Methods for working with gifted pupils. Curriculum expansion. Mathematics competitions (national competitions, Klokan...).

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☐other
1.6. Comments		
1.7. Student requirements		

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Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[14]

Class attendance & class participation			2	Seminar paper	0.3	Experiment	
Written exam		Oral exam	0.7	Essay		Research work	
Project		Continuous assessment	0.7	Presentation		Practical work	0.3
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. George, D.: Obrazovanje darovitih: kako identificirati i obrazovati darovite i talentirane učenike, Educa, Zagreb, 2005.
2. Mathematics competition exercises (available in electronic format)

1.11. Recommended literature (when proposing the program)

1. Vlahović-Štetić, V.: Daroviti učenici: teorijski pristup i primjena u školi, IDIZ, Zagreb, 2005.
2. Lukač, N. i dr.: Matematičko natjecanje Klokan bez granica 1999.-2004., HMD, Zagreb, 2005.
3. A. Dujella, M. Bombardelli, S. Slijepčević, Matematička natjecanja učenika srednjih škola, HMD i Element, Zagreb, 1996.
4. Kurnik. Z.: Zabavna matematika u nastavi matematike, Element, Zagreb, 2009.
5. Methodical and popular magazines (printed or on-line)
6. Other methodical professional literature as help for preparing the lessons

1.12. Number of copies of required literature in relation to the number of students currently attending classes o the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[14] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Methodical practice in mathematics 1	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	0 + 60 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with:
- performing, realizing and analysing different teaching methods in compulsory, elective and additional classes in elementary and secondary schools,
- training for lifelong mathematical education

1.2. Course prerequisite

Mathematics education 1, Mathematics education 2

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- plan and organize a teaching class in accordance with contemporary teaching methods and principles while using suitable teaching strategies, with the aim of developing mathematical processes and better understanding of mathematical concepts (A7, B6, C8, D7, E8, F8),
- in accordance with the planned learning outcomes and using different methods, create teaching materials for mathematics, while making connections with other fields according to the principles of the teaching profession (A6, B7, C7, D7, E7, F8),
- without breaking the principles of teaching mathematics, in the correct official language, clearly and precisely present mathematical content using the mathematical terminology and language, as well as the concepts adjusted to students' capabilities and age (A6, B6, C4, D7, E7, F8),
- predict students' abilities in mastering the mathematics curriculum and use historical facts and problems from the everyday life with the aim of increasing their motivation (A6, B5, C6, D7, E7, F8),
- integrate different communication resources and forms, as well as teaching aids, in leading students through the teaching lesson, while developing their critical thinking (A6, B6, C6, D7, E7, F8),
- create a self-analysis of the held teaching class with the aim of the self-reflection and improving own performance (A6, B7, C4, D7, E8, F8),
- describe the school documentation (A1, B2, C2, D2, E2, F2).

1.4. Course content

Planning and organizing teaching classes in elementary and secondary school (classes types, students' and teachers' literature, teaching aids, classes plan). Methodology of teaching mathematics in elementary and secondary school. Teaching labs.

1.5. Modes of instruction	☐lectures ☐seminars and workshops ☐exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☐other _____

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[15]

Class attendance & class participation				Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Continuous assessment		Presentation		Practical work	
Lecture analysis	0.2	Preparations for the lecture	0.9	The assessment lecture	0.5	Diary of practices	0.3
Self-analysis of the assessment lecture	0.1	Demonstrations	2				

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 100. The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Current textbooks in mathematics for elementary and secondary schools and teachers' manuals
2. e-literature

1.11. Recommended literature (when proposing the program)

1. Curriculum
2. Popularization articles and methodological magazines
3. Professional and methodological literature

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[15] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Vector spaces 1	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with basic concepts of vector space theory. For this purpose, it is necessary within the course to:

- define vector space and describe characteristic examples of vector spaces
- define linear operators and analyse their properties
- analyse matrix representation of a linear operator
- define adjoint space
- define and analyse invariant subspaces and operator eigenvalues
- describe reduction of operator on finite dimensional vector spaces
- define bilinear form
- define and describe properties of a normal operator

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- know basic examples of vector spaces and linear operators (A6, B6, C6, D4, E4, F3)
- solve problems related to the calculation of the rank (A6, B6, C6, D4, E5, F3)
- solve problems related to adjoint spaces (A6, B6, D4, E5, F3)
- construct Jordan basis (A6, B6, C6, D4, E5, F3)
- apply and understand the procedure of reduction of an operator on finite dimensional vector spaces in particular problems (A6, B6, D4, E5, F3)
- know bacis examples of unitary spaces (A6, B7, D4, E5, F3)
- classify main properties of bilinear forms (A6, B6, D4, E5, F3)
- classify main properties and examples of normal operators (A6, B6, D4, E5, F3)
- mathematically prove validity of all procedures and formulas that are used within the course (A6, B6, D4, E5, F3)

1.4. Course content

Vector space, basic notions and example. Quotient space. Linear operators, basic notions and examples. The space (X,Y). Limit in the space Hom(X,Y). Algebra. Minimal polynomial. Adjoint space and adjoint operator.
Invariant subspaces and eigenvalues. Nilpotent operator. Reduction of operators on finite dimensional vector spaces. Jordan matrix of an operator. Operator functions. Resolvent.
Geometry of unitary spaces. The structure of bilinear forms. Normal operators.

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1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☐e-learning ☐field work	☒independent work ☐multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[16]

Class attendance & class participation			1.5	Seminar paper		Experiment	
Written exam	2	Oral exam	2	Essay		Research work	
Project		Continuous assessment	0.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. S. Kurepa, Konačno dimenzionalni vektorski prostoi i primjene, Sveučilišna naklada Liber, Zagreb, 1976.
2. H. Kraljević, Vektorski prostori, Odjel za matematiku, Sveučilište u Osijeku

1.11. Recommended literature (when proposing the program)

1. P.R.Halmos, Finite Dimensional Vector Spaces, Van Nostrand, New York, 1958.
2. K.Horvatić, Linearna algebra, Golden marketing – Tehnička knjiga, Zagreb, 2004.
3. S.Lang, Linear algebra, Springer Verlag, Berlin, 1987.
4. S.Lang, Algebra, Addison-Wesley Publishing Company, cop. 1967.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[16] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Basic information		
Course coordinator		
Course title	Didactics 2	
Study program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30 + 15 + 0

1. DESCRIPTION OF SUBJECT

1.1. Course objectives

The objectives of this course are:
to get students acquainted with variety of didactical choices in teaching practice and their adequate use in teaching practice; to enhance students for continiouos educational development and development of their teaching practice, to motivate students for nurturing positive climate and team work in teaching; to encourage students for basic research skills and constant inovation of their teaching practice.

1.2. Course enrolment requirements

No requirements .

1.3. Expected course learning outcomes

In order to fulfill his/her student requirements, students are expected to develope several competencies:

- to interprete and analyse fundamental didactical concepts and theories;
- to give critical interpretation of various didactical theories, schools of thoughts and models;
- to analyse and use various didactical and methodological choices in actual educational and teaching practice;
- to analyse and use adequately various didactical knowledge and skills (curriculum design; micro and macro organisation of teaching; using educational technology; assessment procedures; professional staff development of teachers etc.);
- to carry out and interprete simple research projects in the field of didactics and to suggest possible improvements and innovations of teaching practice.

1.4. Course content

Planning and programing of the education process.
Artikulation of the education process.
Concept and clasification of teaching methods.
Forms of class activities.
Media in class and learning.
Making the materials for independetly learning.
Assessment and evaluation of student.
Constructively associate learning effects, class methods and assessment.
Quality classes.
Research work on the actual didactic problems.

1.5. Teaching methods	☒ lectures ☒ exercises ☒ fieldwork	☒ individual assignment ☒ multimedia and network
1.6. Comments	Class will be executed in a form of interactive lectures and excercises, mostly discussions. It is expected of a student to prepare for discussions by reading assigned literature, following media, network etc. Students have right to consultation with course coordinator (personaly and via e-mail)	

1.7. Student's obligations

Students are obligated to participate actively in all forms of class activities; seminar paper, practical excercise and final exam. Students will be awarded with points to follow actual discussions and research in didactics.
Students have to read titles from assigned literature and at least two titles from optional literature. Requirement for final exam is to fulfill all due exercises, tests and a proof that they read some research or discussion in the field of didactic in a form of seminar paper.

1.8. Evaluation[17] of student's work

Course attendance	1	Activity/Participation	0,5	Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research work	
Project		Sustained knowledge check	0.5	Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Students are required to fulfill all activities during the class to approach the final exam and they need to pass oral exam.
Percentage of each activity in the final grade:
- exercises – 40%
- sustained evaluation (test) - 30%
- final exam – 30%

1.10. Assigned reading (at the time of the submission of study program proposal)

1. Bognar, L. i Matijević, M. (2002). Didaktika. Zagreb: Školska knjiga.
2. Obavezna poglavlja: Teorijski pristupi i terminološka pitanja (13-34); Metodološka pitanja didaktike (71-97); Mediji u odgoju i obrazovanju (323-352); Odgojno-obrazovna komunikacija (357-372)
3. Grgin, T. (2001). Školsko ocjenjivanje znanja. Jastrebarsko: Naklada Slap
4. Lavrnja, I. (1998). Poglavlja iz didaktike. Rijeka: Pedagoški fakultet u Rijeci
5. Lavrnja, I. (2000). Vježbe iz didaktike. Rijeka: Pedagoški fakultet u Rijeci
6. Poljak, V. (1991). Didaktika. Zagreb: Školska knjiga

1.11. Optional / additional reading (at the time of proposing study program)

1. Bežan, A., Jelavić, F., Kujundžić, N. i Pletenac, V. (1991). Osnove didaktike. Zagreb: Školske novine
2. Blažić, M.; Ivanus-Grmek, M.; Kramar, M. i Strmčnik, F. (2003). Didaktika. Novo mesto: Institut za raziskovalno in razvojno delo.
3. Grgin, T. (1994). Školska dokimologija. Jastrebarsko: naklada Slap
4. Jelavić, F. (2003). Didaktika. Jastrebarsko: Naklada Slap
5. Jensen, E. (2003). Super-nastava. Nastavne strategije za kvalitetnu školu i uspješno učenje. Zagreb: Educa
6. Kippert, H. (2001). Kako uspješno učiti u timu. Zagreb: Educa
7. Kyriacu, C. (2001). Temeljna nastavna umijeća. Zagreb: Educa
8. Meyer, H. (2002). Didaktika razredne kvake.Rasprave o didaktici, metodici i razvoju škole. Zagreb: Educa
9. Stevanović, M. (2003). Didaktika. Rijeka: Digital Point
10. Terhat,E. (2001). Metode poučavanja i učenja. Zagreb: Educa
11. Vrcelj, S. (1996). Kontinuitet u vrednovanju školskog uspjeha. Rijeka: Pedagoški fakultet Rijeka.
12. Vrgoč, H. (ur.). (2002). Evaluation i ocjenjivanje školskog uspjeha. Zagreb: HPKZ

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Bognar, L. i Matijević, M. (2002). *Didaktika*. Zagreb: Školska knjiga.	10	120
Grgin, T. (2001). *Školsko ocjenjivanje znanja*. Jastrebarsko: Naklada Slap	10	120
Lavrnja, I. (1998). *Poglavlja iz didaktike*. Rijeka: Pedagoški fakultet u	10	120

17 **IMPORTANT**: For each assessment of student's work put in the part of ECTS credits for each activity so the final number of ECTS credits is the same to the credit value of the subject. Empty fields use for extra activities.

Rijeci		
Poljak, V. (1991). *Didaktika*. Zagreb: Školska knjiga	10	120

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Teaching portfolio.
Student evaluation.
Co-operation with alumni (questionnaire on knowledge earned during the study, need for continous professional development)

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General information		
Lecturer		
Course title	Measure and Integral	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with the basic notions of the measure and integral theory. For this purpose it is necessary within the course to:

- define the measure and analyse its properties,
- describe basic examples of a measure space,
- define the Lebesgue measure and analyse its properties,
- define the notion of a measurable function,
- define the integral of a function on a measure space and analyse its properties,
- prove Lebesgue's monotone and dominated convergence theorem and Fatou's lemma,
- describe the construction of a product measure and prove Fubini's theorem,
- describe the notions of absolute continuity and singularity of a measure,
- prove Radon – Nikodym theorem,
- analyse the connection between Riemann and Legesgue integral.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- use and understand the properties of a measure and integral (A7, B7, C7),
- analyse examples of a measure with a special emphasis on the Lebesgue measure (A7, B7, C7),
- use and understand the convergence theorems in problem solving (A7, B7, C7, F7),
- use and understand the Fubini's theorem in problem solving (A7, B7, C7, F7),
- analyse the notions of absolute continuity and singularity of a measure and the relations among them (A7, B7, C7, F7),
- analyse the connections and differences between Riemann and Lebesgue integral (A7, B7, C7),
- mathematically prove validity of all procedures and formulas that are used within the course (A7, B7, C7, F7).

1.4. Course content

Ring, algebra, σ-algebra of sets, Borel sets. Measure, outer measure. Lebesgue measure. Monotone and dominated convergence theorem, Fatou lemma. Product measures. Fubini's theorem. Absolute continuity and singularity of a measure. Radon-Nikodym theorem. Relationship between the Riemann and Lebesgue integral.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☐other consultations

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[18]

Class attendance & class participation			1.5	Seminar paper		Experiment	
Written exam	2	Oral exam	2	Essay		Research work	
Project		Continuous assessment	0.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. S.Mardešić: Matematička analiza II, Školska knjiga, Zagreb, 1977.
2. Donald L. Cohn: Measure theory, Birkhäuser Boston, 1994.

1.11. Recommended literature (when proposing the program)

1. P. Halmos, Measure Theory, Springer-Verlag, New York, 1974.
2. N. Antonić, M. Vrdoljak: Mjera i integral, PMF-Matematički odjel, Zagreb 2001.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[18] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Introduction to databases	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	5
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

- Introduce students to basic concepts of database theory with emphasize on relational databases
- Make students competent for independent work with relational databases (SQL)

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing the course and meeting requirements in respect to course Introduction to Databases, students are expected to be capable of:

- Defining and updating relational database (SQL)
- Conducting relational algebra operation in relational database model
- Access database using various program tools

1.4. Course content

Introduction to databases. Database concepts. Relational data model. Relational algebra. Operations in relational model. Non-procedural languages for processing relational database – SQL. Integrity rules in relational data model. Concept of nul value and incomplete information. Elements of dependency theory. Normalization; Normal forms.
Temporal databases. Introduction to object-relational database. Basic of physical organization, B-tree, R-trees.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☐e-learning ☐field work ☐practice ☐practicum	☒ independent work ☐multimedia and the internet ☐ laboratory ☐tutorials ☒consultations ☐other
1.6. Comments	During exercises, students are introduced to relational database - Oracle SQL. Students are prepared to independently produce an application along with drawing up and producing a relational database.	

1.7. Student requirements

Students must satisfy the requirements for obtaining the signature (listed in the executive program) and to pass the final exam (written and oral).

1.8. Evaluation of assessment[19]

Class attendance & class participation	1.75	Seminar paper		Experiment	

[19] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Written exam	0.5	Oral exam	0.5	Essay		Research work	
Project		Continuous assessment	1.25	Presentation		Practical work	1
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points.
The detailed work out of monitoring and evaluation of students' work will appear in the executive program.

1.10. Required literature (when proposing the program)

1. R. Elmasri, S.B. Navathe: Fundamentals of Database Systems, Pearson - Addison Wesley, Boston, 2004.
2. R. A. Mata-Toledo, P. K. Cushman: Fundamentals of Relational Databases, Schaums Outline Series, McGraw-Hill, 2000.

1.11. Recommended literature (when proposing the program)

1. S. Tkalac: Relacijski model podataka, DRIP, Zagreb, 1992.
2. P. Atzeni, V. De Antonellis: Relational Database Theory; The Benjamin/Cummings Publ. Co., 1993.
3. A.U. Tansel et.al.: Temporal Databases, The Benjamin/Cummings Publ. Co., 1993.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analysed.

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General information		
Lecturer		
Course title	Computer networks 1	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	5
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

- presenting to students the fundamental knowledge about the structure and architecture of computer networks and communication systems
- teaching students to understand the basic principles of computer networks' implementation
- training students for using Internet services

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

Upon completion of course, students will be able to do the following:

- describe and classify the structure and architecture of computer networks and communication systems
- identify the basic principles of computer networks' implementation
- develop skills for using basic network protocols and Internet services.

1.4. Course content

Organization of computer networks. OSI reference model.
The physical layer: theoretical basis, transmission media. Implementation of the physical layer, cabling.
The data link layer. Error detection and correction. Example data link protocols, HDLC, the data link layer in Internet. The medium access control sublayer (MAC), the channel allocation problem. IEEE 802 LAN standards.
The network layer. Routing and congestion controls algorithms. Internetworking. The network layer in Internet.
The transport layer services and elements of transport protocols. The transport layer in Internet.
The application layer. Internet applications and their protocols: DNS, e-mail, World Wide Web. Data compression. Examples of computer networks. Network security.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☐e-learning ☐field work ☐practice ☐practicum	☐ independent work ☐multimedia and the internet ☐ laboratory ☐tutorials ☒consultations ☐other
1.6. Comments	During exercises the students should acquire editing multimedia elements and development of simple multimedia forms by using appropriate software tools for producing images, sound, animation, and video.	

1.7. Student requirements

Students should actively participate in all forms of works, perform practical exercises and produce seminar papers. They should pass the exam consisting of practical and oral part.

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The practical part of the exam regards the exercises by using computer. This practical exam and seminar papers are the prerequisite for the oral part of the exam where the complete knowledge of the student is examined and evaluated.

1.8. Evaluation of assessment[20]

Class attendance & class participation			1	Seminar paper		Experiment	
Written exam	1	Oral exam	1	Essay		Research work	
Project		Continuous assessment	2	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points.
The detailed work out of monitoring and evaluation of students' work will appear in the executive program.

1.10. Required literature (when proposing the program)

1. Radovan, M.: Računalne mreže, 2004. (digitalna skripta,)
2. Peterson, L. L., Davie, B. S.: Computer Networks: A System Approach, 3rd Edition

1.11. Recommended literature (when proposing the program)

1. Tanenbaum, A.S.: Computer Networks, 4th Edition. Prentice Hall, 2003.
2. Kurose, F. J., Ross, W. K.: Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Addison Wesley, 2003.
3. Glass, K. M.: Beginning PHP, Apache, MySQL Web Development, Hungry Minds Inc, 2004.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analysed.

[20] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Algebra 1	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with the advanced theory of permutation groups. For this purpose it is necessary within the course to:

- define categories and analyse different examples of categories,
- define free groups and analyse their properties,
- define modules and analyse their properties,
- define lattices of groups,
- define subgroup series and characterise different types of subgroup series,
- define solvable groups, analyse their properties and characterise them using different methods,
- define nilpotent groups, analyse their properties and characterise them using different methods.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- define and analyse properties of free groups, apply and understand the adequate method while solving problems (A7, B7, C7, D7, E5, F7, G7),
- differentiate and analyse different categories, apply and understand the adequate method while solving problems (A7, B7, C7, D7, E5, F7, G7),
- define and analyse properties of modules, apply and understand the adequate method while solving problems (A7, B7, C7, D7, E5, F7, G7),
- define solvable groups and characterize them using different methods, apply and understand the adequate method while solving problems (A7, B7, C7, D7, E5, F7, G7),
- define nilpotent groups and characterize them using different methods, apply and understand the adequate method while solving problems (A7, B7, C7, D7, E5, F7, G7),
- mathematically prove validity of all procedures and formulas that are used within the course (B7, F4).

1.4. Course content

Categories and functors. Free groups. Modules. Lattices and subgroup series. Solvable groups. Nilpotent groups.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☐other _____

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[21]

Class attendance & class participation			2	Seminar paper		Experiment	
Written exam	2	Oral exam	1.5	Essay		Research work	
Project		Continuous assessment	0.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. T.W. Hungerford: Algebra, Reinhart and Winston, NY, 1989.

1.11. Recommended literature (when proposing the program)

1. H. J. Rose: A Course on finite groups, Springer-Verlag London, 2009.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
T.W. Hungerford: Algebra, Reinhart and Winston, NY, 1989.	2	15

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[21] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Basic description		
Course coordinator		
Course title	Hypermedia Systems in Education	
Study programme	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	15 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

In the context of this course the students acquire the basic knowledge about the concept of hypermedia and the future trends of hypermedia development. They are trained to use hypermedia courseware in education

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon completion of course, students will be able to do the following:
- identify and define the concept of hypermedia and hypermedia data model
- analyze various types of hypermedia courseware in order to choose the best of them in real situation in schools
- explain elements and characteristics of adaptive hypermedia
- analyze and identify various types of ICT and approaches of ICT use for teaching and learning in informatics courses
- define e-learning and classify different types of e-learning, identify advantages and shortcomings of e-learning
- analyze different approaches to e-learning (blended or hybrid learning, distance learning, online learning)

1.4. Course content

Definition of hypermedia. Comparison: multimedia, hypertext, hypermedia. Interactivity and levels of interactivity using computer. Hypermedia computer networks and global hypermedia (WWW).
Characteristics of hypermedia node-link data model. Problems with hypermedia model and possible solutions. Adaptive hypermedia. Structure of adaptive hypermedia systems. Methods and techniques for adaptation.
Role of hypermedia in education. Hypermedia courseware and using courseware for teaching and learning.
Basic usage of hypermedia authoring tools for off-line and online hypermedia systems developing.
E-learning and distance (online) learning: definitions, advantages, shortcomings, forms and methods, technology. E-learning approaches: blended (hybrid) learning, distance learning.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☐ individual assignment ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments	Blended learning model for the course will be used by combining f2f classroom learning, and students' independent work: e-learning by using LMS (Learning Management System).	

1.7. Student's obligations

Students should actively participate in all forms of works, perform practical exercises and produce seminar papers as individual or team projects.

1.8. Evaluation of student's work

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Course attendance	0.25	Activity/Participation	1.75	Seminar paper	1	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points. The detailed work out of monitoring and evaluation of students' work will appear in the lesson plan.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Oline textbook available in LMS.

1.11. Optional / additional reading (at the time of proposing study programme)

1. Horton, W. (2000). Designing Web-Based Training. New York: John Wiley & Sons, Inc
2. Alessi, S., Trollip, S. (2000). Multimedia for Learning: Methods and Development (3rd Edition), Allyn & Bacon
3. Adaptive Hypertext and Hypermedia Home Page, URL: http://wwwis.win.tue.nl/ah/

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

During the last week of classes, a poll will be conducted, where students would evaluate the quality of classes. Students' achievements will be analyzed.

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General information		
Lecturer		
Course title	Number theory	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

Number theory is a branch of mathematics which has always been considered as a motivation and foundation of all mathematics because of its simply formulated, but very difficult problems (some of which have been attempted to get solved for centuries). In solving these problems, the newest results in the fields of algebra, analysis and geometry are being applied. The main course objective is to get students familiar with the way of thinking and proving statements in the number theory, and especially with the algebraic and analytical methods in the number theory. For that purpose, it is necessary within the course to:

- analyse basic properties of integers: divisibility, prime numbers, prime factorization, Euclidean algorithm, congruencies
- describe the solutions of quadratic congruency by using the Legendre symbol and compare those congruencies by using the quadratic law of reciprocity
- analyse quadratic forms and display of integers by using quadratic forms, and specifically compare display of integers as sums of a fixed number of perfect squares
- define arithmetic functions and compare basic examples
- differentiate basic types of Diophantine equations and describe the methods of solving them
- define elliptic curves, analyse their properties and applications in the number theory
- apply the number theory in the public-key cryptography
- describe algebraic methods in the number theory and their application
- describe analytical methods in the number theory and their application

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- analyse basic properties of integers and apply those properties to simple problems in the number theory related to divisibility and divisibility algorithms (A6, B7, D6, E6, F6)
- calculate using modular arithmetics, solve congruency equations and systems of congruencies (A6, B7, D6, E6, F6)
- apply and understand the quadratic law of reciprocity and formulas for calculating the Legendre symbol, to solve quadratic congruencies (A6, B7, D6, E6, F6)
- describe the display of integers by using quadratic forms in simple cases, compare and classify different quadratic forms (A6, B7, D6, E6, F6)
- show and analyse basic multiplicative functions and their properties, check and show connections between them (A6, B6, D6, E6, F6)
- define basic types of Diophantine equations and describe the methods of solving them (A6, B7, D6, E6, F6)
- define elliptic curves, analyse their basic properties and describe important open problems (A6, B6, D6, E6, F6)
- apply and understand the methods in the number theory in analysis of the public-key cryptosystem (A6, B7, D6, E6, F6)
- describe and analyse algebraic and analytical methods in the number theory and apply them to important problems in the number theory (A6, B6, D6, E6, F6)

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1.4. Course content

Divisibility. Greatest common factor. Euclidean algorithm. Prime numbers. Congruencies. Euler theorem. Chinese remainder theorem. Primitive roots and indices. Quadratic remainders. Legendre symbol. Quadratic law of reciprocity. Divisibility properties of Fibonacci numbers. Quadratic forms. Reduction of binary quadratic forms. Distribution of prime numbers. Diophantine equations. Linear Diophantine equations. Pythagorean triples. Pell equation. Elliptic curves. Application of the number theory in the public-key cryptography.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work ☐practice ☐practicum	☒ independent work ☒multimedia and the internet ☐ laboratory ☐tutorials ☐consultations ☐other _____
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[22]

Class attendance & class participation			2.1	Seminar paper		Experiment	
Written exam	1	Oral exam	1	Essay		Research work	
Project		Continuous assessment	1.9	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Baker: A Concise Introduction to the Theory of Numbers, Cambridge University Press, Cambridge, 1994.
2. Dujella A., Maretić M.: Kriptografija, Element, Zagreb, 2007.
3. Niven, H. S. Zuckerman, H. L. Montgomery: An Introduction to the Theory Numbers, Wiley, New York, 1991.

1.11. Recommended literature (when proposing the program)

1. K. H. Rosen: Elementary Number Theory and Its Applications, Addison-Wesley, Reading, 1993.
2. K. Chandrasekharan: Introduction to Analytic Number Theory, Springer-Verlag, Berlin, 1968.
3. H. E. Rose: A Course in Number Theory, Oxford University Press, 1995.
4. W. M. Schmidt: Diophantine Approximation, Springer-Verlag, Berlin, 1996.
5. B. Pavković, D. Veljan: Elementarna matematika 2, Školska knjiga, Zagreb, 1995.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[22] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Graph theory	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 15 + 15

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with basic concepts in graph theory and applications of graph theory. For this purpose it is necessary within the course to:

- define basic concepts in graph theory and describe their basic properties
- define Eulerian and Hamiltonian graph, prove some of their properties and describe its applications
- define concepts of graph connectivity, analyse properties of connected graphs and the application in constructing reliable communication networks
- define matching and perfect matching in graphs and elaborate corresponding statements and applications
- define basic concepts in Ramsey theory for graphs
- define basic concepts in directed graph theory, elaborate basic properties and some applications
- analyse and compare certain algorithms

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing the course, the students are expected to:

- differentiate the concepts and graphs properties and apply and understand appropriate properties and statements in solving exercises (A7, B7, C7, D7, E5, F7, G7),
- analyse problems of graph connectivity and related properties (A7, B7, C7, D7, E5, F7, G7),
- analyse Eulerian and Hamiltonian graphs and apply and understand the definitions and properties in solving exercises (A7, B7, C7, D7, E5, F7, G7),
- solve problems related to a matching of graphs (A7, B7, C7, D7, E5, F7, G7),
- apply statements and algorithms elaborated within the course (A7, B7, C7, D7, E5, F7, G7),
- mathematically prove validity of all procedures and formulas that are used within the course (B7, F4).

1.4. Course content

Concepts and basic properties of graphs. Eulerian tours and Hamiltonian cycles. Chinese postman problem and Fleury's algorithm. Travelling salesman problem. Graph connectivity. Reliable communication networks. Matching in graphs. Perfect matchings. Employment problem and Hungarian matching algorithm. Optimal employment problem and Kuhn-Munkres algorithm. Independent sets, coverings and cliques. Ramsey theory for graphs. Directed graphs. Application to ranking for tournament graphs. Application to one-way street traffic flow. Transport networks. Ford-Fulkerson algorithm. Topological sorting.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☒other Consultations, project strategies

1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[23]

Class attendance & class participation			0.5	Seminar paper	0.7	Experiment	
Written exam	2	Oral exam	1.8	Essay		Research work	
Project		Continuous assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. D.Veljan: Kombinatorika i diskretna matematika, Algoritam, Zagreb, 2001.
2. D.Veljan: Kombinatorika s teorijom grafova, Školska knjiga, Zagreb, 1989.

1.11. Recommended literature (when proposing the program)

1. N.Biggs: Discrete Mathematics, Clarendon Press, Oxford, 1989.
2. R.Diestel: Graph Theory, Fourth edition, Springer-Verlag, New York, 2010.
3. R.Balakrishnan, K.Ranganathan: A Textbook of Graph Theory, Springer-Verlag, Heidelberg, 2000.
4. R.Balakrishnan: Schaum's outline of Graph Theory: Included Hundreds of Solved Problems, McGraw-Hill, New York, 1997.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
D.Veljan: Kombinatorika i diskretna matematika, Algoritam, Zagreb, 2001.	5	30
D.Veljan: Kombinatorika s teorijom grafova, Školska knjiga, Zagreb, 1989.	5	30

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[23] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	History of mathematics	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	3
	Hours (L+E+S)	15 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with:
- an introduction to the development of mathematical theories and fundamental branches of mathematics, as well as with work and historical significance of some mathematicians,
- analysis of the ways in which certain branches of mathematics developed.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- indicate problems from the everyday life that can be solved using mathematics and point out a relation with other subjects (A7,B5,E5, F5),
- present used mathematical knowledge in the historical and mathematical context (A7, B5, C7, D5, E7, F7, G7),
- relate and explain causes and effects of the development of mathematical ideas and methods, the role of mathematics in science, art and society (A6,B7),
- use different types and forms of communication including information and communication technology (A3,B3, C3, E7, F7),
- mathematically prove validity of all procedures and formulas that are used within the course (A7,B5,E5, F5).

1.4. Course content

History of mathematics in the period before ancient Greece. The ancient greek mathematics. Chinese, Arabic, Indian mathematics, mathematics of the New age. Development of probability and statistics, algebra, set theory, mathematical logic. New directions in mathematics.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☐exercises ☐e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

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1.8. Evaluation of assessment[24]

Class attendance & class participation			0.5	Seminar paper	1	Experiment	
Written exam	0.5	Oral exam	1	Essay		Research work	
Project		Continuous assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Dadić, Žarko: Razvoj matematike. Ideje i metode egzatnih znanosti u njihovu povijesnom razvoju, Školska knjiga, Zagreb,1975.
2. Dadić, Žarko: Povijest ideja i metoda u matematici i fizici, Školska knjiga, zagreb,1992.
3. L. Hogben, Sve o matematici, Mladost, Zagreb, 1970.
4. 4.Z. Šikić, Kako je stvarana novovjekovna matematika, Školska knjiga, Zagreb, 1989.

1.11. Recommended literature (when proposing the program)

1. Z. Šikić, Filozofija matematike, Školska knjiga, Zagreb, 1995.
2. P.J.Davis, R.Hersh, E.A.Marchisotto, Doživljaj matematike, Tehnička knjiga, Zagreb, 2004.
3. V. Devide, Matematika kroz kulture i epohe, Školska knjiga, Zagreb, 1979.
4. J. Stillwell, Mathematics and its history, Springer Verlag, 2001.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[24] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Selected topics in teaching mathematics	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with:
- procedures for assessment and evaluation of students' knowledge in mathematics,
- the school documentation and work related to it,
- selected present topics in teaching mathematics

1.2. Course prerequisite

Mathematics education 1, Mathematics education 2.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- analyse the most important documents governing the way of teaching mathematics and work related to it (A6, B5, C4, D4, E4, F5)
- independently create a written exam with the aim to check learning outcomes (A6, B6, C6, D6, E7, F7)
- evaluate the written exam in accordance with the established objective criteria for valorization of the learning outcomes (A6, B6, C6, D6, E7, F7)
- critically analyse relevant and recent professional literature using it independently (A6, B6, C5, D6, E5, F5)
- carry out a mini research (A7, B7, C8, D7, E7, F8)
- solve problems using logarithm tables (A6, B5, C5, D5, E4, F5).

1.4. Course content

Evaluation of students' work (regulations, students' assessment, creating exams). Outer tests for knowledge examination (national tests, international tests). The regulations for teachers of mathematics.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

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1.8. Evaluation of assessment[25]

Class attendance & class participation			2	Seminar paper	0.6	Experiment	
Written exam	0.3	Oral exam	0.3	Essay		Research work	0.7
Project		Continuous assessment	0.1	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. e-literature

1.11. Recommended literature (when proposing the program)

1. Popul ar and methodical magazines (printed or on line)
2. Regulations for teachers of mathematics (available on line)

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

During the last week of lectures an anonymous survey will be taken, in which the students will evaluate the quality of the given lectures. There will be conducted also an analysis of success of students on the exams.

[25] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Methodical practice in mathematics 2	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	0 + 60 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with:
- performing, realizing and analysing different teaching methods in compulsory, elective and additional classes in elementary and secondary schools,
- training for lifelong mathematical education

1.2. Course prerequisite

Mathematics education 1, Mathematics education 2

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- plan and organize a teaching class in accordance with contemporary teaching methods and principles while using suitable teaching strategies, with the aim of developing mathematical processes and better understanding of mathematical concepts (A7, B6, C8, D7, E8, F8),
- in accordance with the planned learning outcomes and using different methods, create teaching materials for mathematics, while making connections with other fields according to the principles of the teaching profession (A6, B7, C7, D7, E7, F8),
- without breaking the principles of teaching mathematics, in the correct official language, clearly and precisely present mathematical content using the mathematical terminology and language, as well as the concepts adjusted to students' capabilities and age (A6, B6, C4, D7, E7, F8),
- predict students' abilities in mastering the mathematics curriculum and use historical facts and problems from the everyday life with the aim of increasing their motivation (A6, B5, C6, D7, E7, F8),
- integrate different communication resources and forms, as well as teaching aids, in leading students through the teaching lesson, while developing their critical thinking (A6, B6, C6, D7, E7, F8),
- create a self-analysis of the held teaching class with the aim of the self-reflection and improving own performance (A6, B7, C4, D7, E8, F8),
- describe the school documentation (A1, B2, C2, D2, E2, F2).

1.4. Course content

Planning and organizing teaching classes in elementary and secondary school (classes types, students' and teachers' literature, teaching aids, classes plan). Methodology of teaching mathematics in elementary and secondary school. Teaching labs.

1.5. Modes of instruction	☐lectures ☐seminars and workshops ☐exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☐other _____

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[26]

Class attendance & class participation				Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Continuous assessment		Presentation		Practical work	
Lecture analysis	0.2	Preparations for the lecture	0.9	The assessment lecture	0.5	Diary of practices	0.3
Self-analysis of the assessment lecture	0.1	Demonstrations	2				

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 100. The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Current textbooks in mathematics for elementary and secondary schools and teachers' manuals
2. e-literature

1.11. Recommended literature (when proposing the program)

1. Curriculum
2. Popularization articles and methodological magazines
3. Professional and methodological literature

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[26] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Seminar / M.Sc. thesis	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Compulsory	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	4
	Hours (L+E+S)	0 + 0 + 30

1. COURSE DESCRIPTION

1.1. Course objectives

This seminar is the first step towards graduate thesis. The objective of the seminar is to enable students for:
- independent research and work with mathematical literature,
- presentation of mathematical contents.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- present mathematical concepts using teaching aids and facilities (B7, C6, D6, E6, F6),
- express correctly and fluently in speaking communication in the language of teaching and official language (D6),
- use different communication types and forms (D5),
- use relevant and recent professional literature independently and critically (B7, C6, D6, E6, F6).

1.4. Course content

All lecturers of the compulsory mathematics courses will participate in determining the content of this seminar by proposing the themes for the seminars (according to Regulations on graduate work and the final exam for the university graduate studies at the Department of mathematics, University of Rijeka). Each student will publicly present the theme and submit the work in the written form to the mentor. The work will present the basis for the graduate thesis which will be elaborated in conjunction with the mentor.

1.5. Modes of instruction	☐lectures ☒seminars and workshops ☐exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to prepare and publicly present their seminar. Students are required to attend presentations of other students and actively participate in their analysis.

1.8. Evaluation of assessment[27]

Class attendance & class participation	1.5	Seminar paper	2.5	Experiment	

[27] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Written exam		Oral exam		Essay		Research work	
Project		Continuous assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester.
Total number of points student can earn during the semester is 100. The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

Literature for each seminar will be proposed by the mentor - proponent of the topic.

1.11. Recommended literature (when proposing the program)

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

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General information		
Lecturer		
Course title	Databases	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	5
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

- Extend students' knowledge acquired on course Introduction to databases
- Train students for independent work with relational databases (SQL)

1.2. Course prerequisite

Introduction to databases.

1.3. Expected outcomes for the course

After completing the course and meeting requirements in respect to course Databases, students are expected to be capable of:

- Defining and updating relational database (SQL)
- Producing a object-oriented database model (UML)
- Designing database using CASE tool.

1.4. Course content

Database management system. Saved procedures. Triggers. Transactions. Database recovery after crash. Prevention of unauthorized access. Query optimization. Client-server architecture. Distributed databases. Object databases. Object-relational databases. Object-oriented database model – UML.
Semi-structured databases - text and multimedia databases, web as a semi-structured database. Computer aided data and database design – CASE, review of CASE tools.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☐e-learning ☐field work ☐practice ☐practicum	☒ independent work ☐multimedia and the internet ☐ laboratory ☐tutorials ☒consultations ☐other _____
1.6. Comments	During exercises, students continue with hands-on work on computers (connected to course Introduction to databases) using Oracle SQL / PLSQL. Also, students are introduced to some CASE tools and usage of these tools.	

1.7. Student requirements

Students should actively participate in all forms of works, pass the exam consisting of written and oral part. During exercises, students should produce a complete work, proving their capabilities in using software independently.

1.8. Evaluation of assessment[28]

[28] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Class attendance & class participation			1.75	Seminar paper		Experiment	
Written exam	0.5	Oral exam	0.5	Essay		Research work	
Project		Continuous assessment	1.25	Presentation		Practical work	1
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Date, C. J.,An Introduction to Database Systems, 8th edition, Addison-Wesley, 2004.
2. H. Garcia-Molina, J. D. Ullman, J. Widom, Database Systems: The Complete **Book, Prentice Hall, 2002.**

1.11. Recommended literature (when proposing the program)

1. R. Simon; Strategic Database Technology, Morgan Kaufmann Publishers, 1995
2. P. Valduriez, M. T. Ozsu: Principles of Distributed Database Systems, Pearson Education, 1999
3. M. Varga: Baze podataka; konceptualno, logičko i fizičko modeliranje podataka, DRIP, Zagreb, 1994.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

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General information		
Lecturer		
Course title	Coding theory and Cryptography	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 0 + 15

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with basic cryptography systems and basic methods in the coding theory. The content that will be held in this course:

- various cryptography systems will be described, compared and applied,
- the basic principles of cryptanalysis will be analysed,
- the basic principles of coding theory will be analysed,
- various coding methods will be defined, differentiated and applied,
- the methods of detecting errors in coding theory will be analysed,
- the methods of correcting errors in coding theory will be described.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- differentiate and analyse cryptography systems, apply and understand adequate methods while solving problems (A7, B7, C7, D7, E5, F7, G7),
- analyse and differentiate different types of codes, apply and understand adequate methods while solving problems (A7, B7, C7, D7, E5, F7, G7),
- differentiate methods of detecting errors in data transfer with particular coding method, and analyse the conditions under which it is possible to correct the errors (A7, B7, C5, D5, E5, F5, G5),
- mathematically prove validity of all procedures and formulas that are used within the course (B7, F4).

1.4. Course content

Introduction to cryptography. Classical cryptography. Encryption standards. Public-key cryptography. Introduction to coding theory. Linear codes. Cyclic codes. BCH codes. Reed-Solomon codes. Perfect codes.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

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1.8. Evaluation of assessment[29]

Class attendance & class participation			1.5	Seminar paper	1	Experiment	
Written exam	1	Oral exam	1.5	Essay		Research work	
Project		Continuous assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. Dujella: Kriptografija (available online: http://web.math.hr/~duje/kript/kriptografija.html)
2. J.I. Hall, Notes on Coding Theory, 2010 (available online: http://www.math.msu.edu/~jhall/classes/codenotes/coding-notes.html)
3. Igor S. Pandžić, Alen Bažant, Željko Ilić, Zdenko Vrdoljak, Mladen Kos, Vjekoslav Sinković: Uvod u teoriju informacija i kodiranja, Element, 2009.

1.11. Recommended literature (when proposing the program)

1. Assmus, J.D. Key, Designs and their codes, Cambridge University Press, London, 1992.
2. Dujella, M. Maretić, Kriptografija, Element, Zagreb, 2007.
3. N. Koblitz, A Course in Number Theory and Cryptography, Springer Verlag, New York, 1994.
4. J.H. van Lint, Introduction to Coding Theory, Springer-Verlag, Berlin, 1982.
5. F.J. MacWilliams, N.J.A. Sloane, The theory oferror-correcting codes, North-Holland, 1977.
6. B.Schneiner, Applied Cryptography, Wiley, NY 1995.
7. J. Seberry, J. Pieprzyk, Cryptography: an introduction to computer security, Prentice-Hall, 1989.
8. D.R.Stinson, Cryptography. Theory and Practice, CRC Press, Boca Raton, 1996.
9. D. Welsh, Codes and cryptography, Oxford: Clarendon Press, 1988.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
Igor S. Pandžić, Alen Bažant, Željko Ilić, Zdenko Vrdoljak, Mladen Kos, Vjekoslav Sinković: Uvod u teoriju informacija i kodiranja, Element, 2009	3	25

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[29] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Basic description		
Course coordinator		
Course title	System Theory	
Study programme	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is to teach students basic concepts, results and methods of system theory.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After completing the course and meeting requirements, students are expected to be capable of:
- Correctly explaining and analyze basic concepts of system theory.
- Analyzing system theory literature and adequately implement acquired knowledge in information systems.

1.4. Course content

Basic concepts of system theory. Concept of system. Types of systems. System approach. Basics of system analysis. Purpose of analysis. Function of system. Analysis of system. Examples of system analysis in terms of modern research of system. System levels. Development of system. Basic synthesis of system. Mathematical description of system. Presentation of system structure. High order systems. Mathematical description of system's behavior. System's behavior in terms of time. System's functional dependencies. Reliability. Stability. Optimal control.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☒ other
1.6. Comments	During the semester, a student obtains required number of ECTS credits through regular attendance and active participation in all forms of lectures, completion of tasks assigned and elaboration of particular topic.	

1.7. Student's obligations

Regular class attendance and active participation in learning process, completion of certain number of tasks in respect to lectures and exercises. Student is supposed to pass written exam in respect to exercises as a precondition for taking the oral exam, where students' complete knowledge is evaluated and assessed.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation	0.5	Seminar paper	1	Experimental work	
Written exam	0.5	Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

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1.9. Assessment and evaluation of student's work during classes and on final exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

1. V. Čerić, Simulacijsko modeliranje, Školska knjiga, Zagreb, 1993.
2. D. Radošević, Osnove teorije sistema, Nakladni zavod Matice hrvatske, Zagreb, 2001.

1.1. Optional / additional reading (at the time of proposing study programme)

1. Ludwig Bertalanffy, General Systems Theory, 1995.
2. Klir, Slices in System Theory, New York,1991.
3. M. Žaja, Poslovni sustavi, Školska knjiga, Zagreb, 1993.

1.2. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.3. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Periodical evaluation and assessment of students and teachers is foreseen in order to provide continuous improvement of teaching quality. During the last week of classes, a poll will be conducted, where students would evaluate the quality of classes. Students' achievements will be analyzed.

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General information		
Lecturer		
Course title	Algebra 2	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with:
- basic notions of ring theory, especially theory of polynomial rings,
- basic notions of field theory and field extension theory,
- basic notions of Galois theory.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:
- define, give examples and recognise basic algebraic structures with two operations (A7, B7),
- have knowledge of the concept of ring, ideal and ring homomorphism (A7, B7),
- have knowledge of basic theorems of polynomial theory and be able to prove them (F3, B7),
- have knowledge of various types of field extensions and properly apply them (A7, B7, C7),
- successfully solve problems of determining Galois group (A7, B7),
- have knowledge of basics of Galois theory (A7, B7).

1.4. Course content

Rings and ideals. Integral domains. Euclidean domains, principal ideal domains, unique factorisation domains. Polynomial rings. Field extensions (simple, algebraic, finite dimensional, normal, separable, radical). Field automorphisms and Galois groups, Galois field extensions and Fundamental Theorem of Galois theory. Splitting fields for polynomials and algebraic closure. Solvability of Galois group as a condition for solvability of an algebraic equation in radicals. Finite fields.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☐multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

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1.8. Evaluation of assessment[30]

Class attendance & class participation			2	Seminar paper		Experiment	
Written exam	2	Oral exam	1.5	Essay		Research work	
Project		Continuous assessment	0.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. T.W. Hungerford: Algebra, Reinhart and Winston, NY, 1989.
2. H. Kraljević: Algebra, Notes for the lectures held during 2006/07 at the University of Osijek

1.11. Recommended literature (when proposing the program)

1. I. Stewart: Galois Theory, Chapmann and Hall, London, 1973.
2. B. Širola: Rings, fields and algebras, Notes on Algebraic Structures, PMF, Zagreb

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
T.W. Hungerford: Algebra, Reinhart and Winston, NY, 1989.	2	15

1.13. Quality assurances which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[30] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Computer networks 2	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	5
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

This course is a continuation of the course "Computer networks 1". The aims of the course are:
(1) to present the methods of recording of the contents of various kinds, the methods of data compression and the transmission protocols; (2) to present the basic elements of the protection of secrecy and integrity of contents, and of the authenticity of communicators in computer networks; (3) to present the main network services of the application level. In the framework of the exercises, students have to learn to use the main network services and the language HTML.

1.2. Course prerequisite

In this course it is continued with the presentation of the basic knowledge of the computer networks and communication systems. The content of this course draws on those courses that deal with information systems, computer architecture and computer programming, and it directly extends the content of the course "Computer networks 1".

1.3. Expected outcomes for the course

Students are expected to acquire the basic knowledge about the methods of recording of the information contents of various kinds, about the methods of data compression and about the transmission protocols. They have to get familiar with the basic methods of the protection of secrecy and integrity of contents, and of the authenticity of communicators in computer networks, as well as with the network services of the application level, as specified in the "Course content" below. In the framework of the exercises, students have to learn to use the main network services and the language HTML.

1.4. Course content

Digital recording of the information contents: principles and methods. Basic formats and protocols: GIF, JPEG, MPEG, MP3.
Compressing the digital records, with and without the loss of the information contents: principles and the ways of use.
Compression and transmission: on-line transmission (video-conferencing). ITU-T network standards (H-series).
Security and protection. Protecting the secrecy of contents, protecting the integrity of messages, establishing the identity of communicators: principles, protocols (algorithms) and methods of work. Protocols DES, RSA, MR5. Systems PEM, PGP, TLS. "Reliable third side"; firewall, proxy, filters.
The application layer. The Internet applications (services) and their protocols. Domain name system (DNS), electronic mail system (SMTP), web page system (HTTP), multimedia and interactive applications (VIP, VIC).
Controlling the functioning of a compound computer network. Administration and optimization; a system for managing of the functioning of computer network (SNMP).

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☐e-learning ☐field work ☐practice ☐practicum	☒ independent work ☐multimedia and the internet ☐ laboratory ☐tutorials ☒consultations ☐other
1.6. Comments		

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1.7. Student requirements

Students should actively participate in all forms of works, perform practical exercises and produce seminar papers. They should pass the exam consisting of practical and oral part.
The practical part of the exam regards the exercises by using computer. This practical exam and seminar papers are the prerequisite for the oral part of the exam where the complete knowledge of the student is examined and evaluated.

1.8. Evaluation of assessment[31]

Class attendance & class participation			1	Seminar paper		Experiment	
Written exam	1	Oral exam	1	Essay		Research work	
Project		Continuous assessment	2	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester and in the final exam. Total number of points student can achieve during the semester is 70 (to assess the activities listed in the table), while in the final exam student can achieve 30 points.
The detailed work out of monitoring and evaluation of students' work will appear in the executive program.

1.10. Required literature (when proposing the program)

1. Radovan, M.: Računalne mreže, 2004. (digitalna skripta,)
2. Peterson, L. L., Davie, B. S.: Computer Networks: A System Approach, 3rd Edition, Morgan Kaufmann Publishers, 2003.

1.11. Recommended literature (when proposing the program)

1. Tanenbaum, A.S.: Computer Networks, 4th Edition. Prentice Hall, 2003.
2. Kurose, F. J., Ross, W. K.: Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Addison Wesley, 2003.
3. Glass, K. M.: Beginning PHP, Apache, MySQL Web Development, Hungry Minds Inc, 2004.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analysed.

[31] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Science popularization	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	2
	Hours (L+E+S)	15 + 15 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

Science popularization is an integral part of teacher's and scientist's profession in any subject.
The main course objective is to:

- develop the consciousness of the social context for the science and the need for its popularization,
- train for active professional popularization,
- develop the abilities for planning and conducting activities for popularization of science, scientific topics and scientific research results.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing the course, the students are expected to:

- describe and analyse the need and importance of the science popularization,
- differentiate and analyse the channels for the science popularization,
- describe types of popularization activities and their extent, scope, advantages and disadvantages,
- describe the influence of public media on the promotion of scientific activities,
- describe and analyse the interaction between social structures and the promotion of science (local community, educational system, the strategy of the University)
- create a plan for the popularization contributions and activities,
- implement the plan within the field work and within the Rijeka Science Festival.

1.4. Course content

Social context of science. Concept and short history of science popularization and communication and their role in knowledge based society. Channels for science popularization. Methods for direct science promotion (public lectures, presentations, workshops, science cafés, interactive exhibitions). Methods for promotion science in media (public relations, press announcements, articles, radio and TV, multimedia materials suitable for Internet publication). Specialty of popularization of natural sciences. Popularization of mathematics and physics. Social context of mathematics and physics. Popularization of mathematics and physics among kids. Popular literature. Mathematics in the everyday life. Margins of science. Unexplained phenomena.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☐exercises ☒e-learning ☒field work	☒independent work ☒multimedia and the internet ☐laboratory ☐tutorials ☒other Consultations, project strategies
1.6. Comments		

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1.7. Student requirements

Students are required to participate in a field work and to participate in the popularization of science.

1.8. Evaluation of assessment[32]

Class attendance & class participation			0.5	Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project	0.5	Continuous assessment		Presentation		Practical work	1
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester. There is no final exam within the course.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. B.Jergović (ur.): Znanost i javnost, Izvori, Zagreb, 2002.
2. Znanstveno popularne radio emisije «Baltazar», CD, Zlatni rez i Radio Rijeka, 2010, urednica R.Jurdana-Šepić
3. Aktivnosti Udruge Zlatni rez www.zlatnirez.hr

1.11. Recommended literature (when proposing the program)

1. A.Simonić, Znanost najveća avantura i izazov ljudskog roda, Vitagraf, Rijeka, 1999.
2. M. Alley : The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid. Springer-Verlag, 2002
3. T. Caulton: Hands-On Exhibitions: Managing Interactive Museums and Science Centres (The Heritage, Care-Preservation-Management). Routledge, 1998
4. S.M. Cutlip, A.H. Center, G.M. Broom: Odnosi s javnošću (prijevod 'Effective public relations'). Mate, Zagreb, 2003
5. A.Einstein: Moja teorija, Kronos, Zagreb, 1991.
6. A.Einstein: Moj pogled na svijet, Izvori, Zagreb, 1991.
7. Krauss M.L., Fizika zvjezdanih staza, Jesenski i Turk, Zagreb 2004.
8. R. Feynman: Osobitosti fizikalnih zakona, ŠK, Zagreb, 1986.
9. C.Sagan: Kosmos, Izvori, Zagreb 2004.
10. L.Lederman, D.Teresi: Božja čestica, Izvori, Zagreb, 2000.
11. J.Gribbin: U traganju za Schrodingerovom mačkom, Prosveta, Beograd, 1989.
12. J. Walker: The Flying Circus of Physics, J.Willey and Sons, New York, 1977.
13. W.R. Wood: FUNtastic Science activities for Kids, McGrow Hill, New York, 1997
14. W.R. Wood: Physics for Kids, Mc Geaw-Hill, New York, 1997.
15. A.Wilson, J. Gregory, S. Miller; S. Earl: Handbook of science communication, Institute of Physics Publishing, 1998

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	Number of copies	Number of students
B.Jergović (ur.): Znanost i javnost, Izvori, Zagreb, 2002.	2	10
Znanstveno-popularne radio emisije «Baltazar», CD	2	10

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

Student's Portfolio: Monitoring students' work while giving them a feedback on their success and improvement.
Questionnaire: Introductory questionnaire on student's expectations. At the end of the course, anonymous questionnaire of the course quality will be conducted. After the passing the oral exam, the professor requires the feedback for achieved learning objectives: learning methods, potential difficulties while learning the course content, and suggestions for the course.

[32] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Probability theory	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with basic concepts, methods and results in probability theory. For that purpose, it is necessary within the course to:

- define random variables and analyse their basic properties
- define distribution functions and describe the classification of random variables
- define mathematical expectation and prove limit theorems for mathematical expectation
- define variance and moments of random variables
- prove basic inequalities in probability
- describe basic types of convergence of random variables and their relations
- prove weak and strong laws od large numbers
- describe convergence of series of random variables
- define notion of characteristic function of random variable and analyse basic properties of characteristic functions
- prove inversion theorems and continuity theorems for characteristic functions
- describe weak convergence of sequences of distribution functions
- prove central limit theorem

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- apply and understand random variables and their properties in solving problems (A7, B7, E4, F5)
- explain the classification of random variables (A7, B7, E4, F5)
- apply and understand limit theorems for mathematical expectation (A7, B7, E4, F5)
- apply and understand basic probability inequalities (A7, B7, E4, F5)
- know basic types of convergence of random variables and their relations (A7, B7, E4, F5)
- know weak and strong laws of large numbers, and convergence of series of random variables (A7, B7, E4, F5)
- apply properties of characteristic functions in solving problems (A7, B7, E4, F5)
- explain inversion and continuity theorems for characteristic functions (A7, B7, E4, F5)
- explain weak convergence of sequence of distribution functions (A7, B7, E4, F5)
- apply and understand the central limit theorem (A7, B7, E4, F5)
- mathematically prove validity of all procedures and formulas that are used within the course (A7, B7, E4, F5)

1.4. Course content

Random variables. Distribution functions. Classification of random variables. Mathematical expectation. Limit theorems for mathematical expectation. Variance and moments. Important inequalities in probability. Convergence of random variables. Independence of random variables. Laws of large numbers. Convergence of series of random variables. Characteristic functions. Inversion theorem. Weak convergence. Continuity theorem. Central limit theorems.

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1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work ☐practice ☐practicum	☒ independent work ☒multimedia and the internet ☐ laboratory ☐tutorials ☐consultations ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[33]

Class attendance & class participation			2	Seminar paper		Experiment	
Written exam	2	Oral exam	1.5	Essay		Research work	
Project		Continuous assessment	0.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. N. Sarapa, Teorija vjerojatnosti, Školska knjiga, Zagreb, 2002.
2. Ž. Pauše, Vjerojatnost – Informacija – Stohastički procesi, Školska knjiga, Zagreb, 2003.

1.11. Recommended literature (when proposing the program)

1. W.Feller, An Introduction to Probability Theory and Aplication, J.Wiley, New York, 1966.
2. N.Sarapa, Vjerojatnost i statistika, II dio, Školska knjiga, Zagreb, 1996.
3. C.M.Grinstead, J.L.Snell, Introduction to Probablility, American Mathematical Society, 1997. (http://aleph0.clarku.edu/~djoyce/ma217/book-5-17-03.pdf)
4. K.L.Chung, A Course in Probability Theory, Academic Press, 2000.
5. R.Durrett, Probability: theory and examples, Duxbury Press, Belmont, 1996.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[33] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Topics in contemporary mathematics	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	3
	Hours (L+E+S)	15 + 0 + 15

1. COURSE DESCRIPTION

1.1. Course objectives

Objective of this course is to familiarize students with selected topics and current problems of contemporary mathematics.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course students will be prepared for independent research, for working with professional literature and research papers and for mathematical topics presentation.

1.4. Course content

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☐exercises ☒e-learning ☐field work ☐practice ☐practicum	☒ independent work ☒multimedia and the internet ☐ laboratory ☒tutorials ☒consultations ☐other _____
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[34]

Class attendance & class participation			0.6	Seminar paper	2	Experiment	
Written exam		Oral exam		Essay		Research work	
Project		Continuous assessment	0.4	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

[34] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. P. J. Davis, R. Hersh, E. A. Marchisotto, Doživljaj matematike, Golden marketing - Tehnička knjiga, Zagreb, 2004.
2. T. Gowers (editor), Princeton Companion to Mathematics, Princeton University Press, 2008.
3. N. J. Higham (editor), Princeton Companion to Applied Mathematics, Princeton University Press, 2015.
4. literature for each seminar will be determined according to the topic of the seminar

1.11. Recommended literature (when proposing the program)

1. T. Gowers, Mathematics: A Very Short Introduction, Oxford University Press, 2002.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

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General information		
Lecturer		
Course title	Vector spaces 2	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with the basics of the theory of normed and topological vector spaces. For this purpose it is necessary within the course to:

- define topological vector spaces
- define normed space and describe typical examples of normed spaces
- define and analyse local convexity, metrizability and completeness of spaces
- analyse linear functionals

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- formulate examples of topological vector spaces (A6, B6, C6, D4, E4, F3)
- analyse the connection between linear and topological structure (A6, B6, C6, D4, E5, F3)
- formulate examples of normed spaces (A6, B6, C6, D4, E4, F3)
- analyse local convexity, metrizability and completeness of spaces (A6, B6, C6, D4, E4, F3)
- mathematically prove validity of all procedures and formulas that are used within the course (A6, B6, D4, E5, F3)

1.4. Course content

Topological vector spaces. Normed vector spaces. Local convexity. Metrizability. Completeness. Linear functionals and the Hahn-Banach theorem. Weak topologies. Dual spaces.

1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☐e-learning ☐field work ☐practice ☐practicum	☒ independent work ☐multimedia and the internet ☐ laboratory ☐tutorials ☐consultations ☐other _____
1.6. Comments		

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

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1.8. Evaluation of assessment[35]

Class attendance & class participation			1.5	Seminar paper		Experiment	
Written exam	2	Oral exam	2	Essay		Research work	
Project		Continuous assessment	0.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. S.Kurepa, Funkcionalna analiza, Školska knjiga, Zagreb, 1984.
2. W.Rudin, Functional analysis, McGraw-Hill, 1972.

1.11. Recommended literature (when proposing the program)

1. K.Yoshida, Functional analysis, Springer -Verlag, New York, 1985.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[35] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Harmonic analysis	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 0 + 15

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with basic ideas and concepts of harmonic analysis, elements of functional analysis and their application. For that purpose, it is necessary within the course to:

- define Hilbert spaces and analyse their structure and properties
- determine orthonormal systems in a Hilbert space and analyse their completeness
- calculate and analyse Fourier series, and compare them to their original functions
- analyse the consequences of the Banach-Steinhaus theorem and the open mapping theorem related to Fourier series
- calculate and analyse Fourier transforms
- analyse the inversion theorem and compare Fourier transform to its original function
- analyse Plancherel theorem and its consequences
- compare Fourier transform with other integral transforms: for example Laplace, Mellin, discrete Fourier transform
- calculate and analyse those other integral transforms

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- understand and determine the properties of Hilbert spaces, analyse linear independence, orthogonality, orthonormality, completeness of the sets in them (A7, B7, C7)
- calculate and understand Fourier series and analyse their connection with the original functions (A7, B7, C7, F7)
- apply and understand the above mentioned theorems about the Banach spaces and analyse their consequences related to Fourier series (A7, B7, C7, F7)
- calculate and understand the Fourier transform (A7, B7, C7)
- analyse the inversion theorem and compare Fourier transform with the original function (A7, B7, C7, F7)
- analyse and apply Plancherel theorem (A7, B7, C7, F7)
- calculate and apply other integral transforms (A7, B7, C7)

1.4. Course content

Hilbert space. Orthonormal sets. Fourier series. Banach-Steinhaus theorem. The open mapping theorem. Fourier transform. The inversion theorem. Plancherel teorem and Parseval's formula. Examples of other integral transforms and applications.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work ☐practice ☐practicum	☒ independent work ☒multimedia and the internet ☐ laboratory ☒tutorials ☒consultations ☐other

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1.6. Comments	

1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[36]

Class attendance & class participation			1	Seminar paper	1	Experiment	
Written exam	1.5	Oral exam		Essay		Research work	
Project		Continuous assessment	2.5	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. W. Rudin, Real and Complex Analysis, McGraw-Hill, New York, 1987.
2. Anton Deitmar: A First Course in Harmonic Analysis, 2nd edition, Springer, 2005.
3. George Bachmann, Lawrence Narici, Edward Beckenstein: Fourier and Wavelet Analysis, Springer, New York, 2000.

1.11. Recommended literature (when proposing the program)

1. Allan Pinkus, Samy Zafrany, Fourier Series and Integral Transforms, Cambridge University Press, 1997.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[36] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.

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General information		
Lecturer		
Course title	Partial differential equations	
Program	Graduate course in Mathematics – Teacher Training	
Course status	Elective	
Year	2	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with the basics of the theory of partial differential equations.
With that purpose the students are presented the following units:

- classification of second order equations: eliptic, hiperbolic and parabolic equations and examples
- Laplace equation, wave equation and equation of heat conducting
- Dirichlet's and Green's representation
- Cauchy's problem
- Fourier's method, principle of maximum

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- analyse partial differential equations in the sense of their classifications (A7, B7, E4, F5)
- differentiate boundary and initial conditions (A7, B7, E4, F5)
- apply different theorems in analizing eliptic, hiperbolic and parabolic equations (A7, B7, E4, F5)
- solve Laplace equation, analyse Dirichle's and Neumann's problem and apply maximum principle (A7, B7, E4, F5)
- apply Poisson's formula and Green's function (A7, B7, E4, F5)
- solve the heat equation with different initial-boundary conditions (A7, B7, E4, F5)
- solve the wave equation and analyse Cauchy's problem (A7, B7, E4, F5)
- apply Fourier's method in solving partial differential equations (A7, B7, E4, F5)
- mathematically prove validity of all procedures and formulas that are used within the course (A7, B7, E4, F5)

1.4. Course content

Classification of second order equations. Eliptic, hiperbolic and parabolic equations. Examples. Laplace equation. Dirichle's and Neumann's problem. Green's representation. Green's function. Poisson's formula. Principle of maximum. Potentials. Wave equation. Cauchy's problem. D´Alambert's formula. Initial-boundary problem. Fourier's method. Equation of heat conducting. Principle of maximum. Cauchy's problem. Poisson's formula. Initial-boundary problem. Fourier's method.

1.5. Modes of instruction	☒lectures ☒seminars and workshops ☒exercises ☒e-learning ☐field work ☐practice ☐practicum	☒ independent work ☐multimedia and the internet ☐ laboratory ☒tutorials ☒consultations ☐other _____
1.6. Comments		

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1.7. Student requirements

Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[37]

Class attendance & class participation			1.4	Seminar paper		Experiment	
Written exam	2.4	Oral exam	1.6	Essay		Research work	
Project		Continuous assessment	0.6	Presentation		Practical work	
Portfolio							

1.9. Assessment and evaluation of students' work during the semester and on the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) and on the final exam.
Total number of points student can earn during the semester is 70, while on the final exam student can achieve 30 points.
The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.10. Required literature (when proposing the program)

1. D.Gilber, S.Trudinger: Eliptic partial differential equations of second order, Springer, 1977.
2. L. C. Evans: Partial Differential Equations, American Mathematical Sociaty, 2002.
3. H. Levine: Partial Differential Equations, American Mathematical Sociaty, 1997.

1.11. Recommended literature (when proposing the program)

1. I. Aganović, K. Veselić: Linearne diferencijalne jednadžbe, Element, Zagreb, 1997.

1.12. Number of copies of required literature in relation to the number of students currently attending classes of the course

Title	*Number of copies*	*Number of students*

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies

In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

[37] **IMPORTANT**: Fill in the appropriate number of points for each of the chosen categories so that the sum of the allocated points corresponds to the course credit value. Add new categories, if necessary.