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Graduate study

Mathematics - Teacher Training

General Information	
Title of study programme	Mathematics - Teacher Training
Study programme coordinator	University of Rijeka
Study programme implementor	Faculty 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

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STUDY PROGRAMME LEARNING OUTCOMES AND COMPETENCES	
(I1.)	reasoning and problem solving in real and complex analysis
(I2.)	reasoning and problem solving in linear algebra and algebra
(I3.)	reasoning and problem solving in models of geometry with the emphasis on Euclidean geometry, using a constructve and an analytical approach
(I4.)	reasoning and problem solving in discrete and combinatorial mathematics, probability and statistics
(I5.)	reasoning and problem solving in number theory, set theory and mathematical logic
(I6.)	reasoning and problem solving in applied mathematics
(I7.)	plan and organise teaching a class in mathematics
(I8.)	plan and organise out-of curriculum and out-of school activities
(I9.)	create a written preparation for teaching a class in mathematics
(I10.)	create teaching materials for teaching classes in mathematics
(I11.)	independently organize teaching a class in mathematics in accordance with the written preparation and teaching principles with and without using information and communications technology
(I12.)	evaluate students' achievements in mathematics
(I13.)	evaluate quality of the educational process
(I14.)	self-evaluate the performance
(I15.)	interpret and apply main concepts of pedagogy
(I16.)	interpret and apply main concepts of psychology of education
(I17.)	help students develop a positive attitude towards mathematics
(I18.)	communicate with students, parents and other participants
(I19.)	cooperate with parents, expert school employees and other participants

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LIST OF MODULES/COURSES							
Year of study: 1							
Semester: winter							
MODULE	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS[1]
	Linear programming		30	30	0	6	C
	Methodology of teaching mathematics I		30	0	30	6	C
	Developmental psychology		30	15	0	5	C
	General pedagogy		30	0	15	5	C
	Educational psychology I - Psychology of learning and teaching		30	15	0	5	C
	Basics of linguistic culture		15	0	15	3	C
Semester: summer							
MODULE	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
	Methodology of teaching mathematics I		30	0	30	6	C
	Using computers in teaching mathematics		15	15	0	4	C
	Additional teaching of mathematics		30	30	0	4	C
	Educational psychology II - Individual differences and classroom interaction		30	15	0	4	C
	Didactics I		30	15	0	4	C
	Teaching pupils with special needs		30	15	0	4	C
	Seminar III – Foundations of mathematics		0	0	30	4	C

[1] IMPORTANT: Insert C for compulsory courses or E for elective courses.

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LIST OF MODULES/COURSES							
Year of study: 2							
Semester: winter							
MODULE	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS[2]
	Methodical practice in mathematics I		0	60	0	4	C
	Vector spaces I		30	30	0	6	C
	Didactics II		30	15	0	4	C
	Internal elective course (16 ECTS on elective courses)						
	Probability theory		30	30	0	6	E
	Algebra I		30	30	0	6	E
	Number theory		30	30	0	6	E
	Graph theory		30	15	15	6	E
	Computer networks		30	30	0	4	E
	E-learning for education and business		30	30	0	6	E
	Measure and integral		30	30	0	6	E
Semester: summer							
MODULE	COURSE	COURSE INSTRUCTOR	L	E	S	ECTS	STATUS
	History of mathematics		15	0	30	3	C
	Selected lectures from teaching mathematics		30	30	0	4	C
	Methodical practice in mathematics I		0	60	0	4	C
	Seminar / M. Sc. thesis		0	0	30	4	C
	Graduation					4	C
	Internal elective course (11 ECTS on elective courses)						
	Coding theory and cryptography		30	15	15	6	E
	Algebra II		30	30	0	6	E
	Vector spaces II		30	30	0	6	E
	Harmonic analysis		30	0	15	6	E
	Partial differential equations		30	30	0	6	E
	Popularization of mathematics		15	15	0	3	E
	Mathematical foundations of artificial intelligence		30	30	0	6	E

[2] IMPORTANT: Insert C for compulsory courses or E for elective courses.

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GENERAL INFORMATION		
Course coordinator		
Course title	Linear programming	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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,
- connection between linear programming and game theory,
- basics of convex programming,
- basics of integer programming.

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. 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),
O2. apply, with reasoning, the properties of a linear (affine) function to a linear programming problem (A6, B6, C6, D6, E6, F6),
O3. define the goal function in simple linear programming problems (A6, B6, C6, D6, E6, F6),
O4. apply and understand various algorithms for finding extreme values of a linear function on a convex set (A6, B6, C6, D6, E6, F6),
O5. solve the dual problem of linear programming (A6, B6, C6, D6, E6, F6),
O6. apply and understand the Simplex algorithm (A6, B6, C6, D6, E6, F6),
O7. analyse the concept of matrix games (A6, B6, C6, D6, E6, F6),
O8. solve problems of integer programming (A6, B6, C6, D6, E6, F6),
O9. 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. Selected applications of linear programming (transportation problem, assignment porblem). Basics of matrix game theory. The connection between linear programming and game theory. Basics of convex programming.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work

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	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).
Remark: The exercises on this course will be conducted in classroom form (10 hours) and on computers (20 hours).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
F, S. Hillier, G. J. Lieberman, Introduction to Operations Research, Ninth Edition, McGraw Hill, New York, 2010.	https://dokumen.pub/introduction-to-operations-research-9nbsped-0073376299-9780073376295.html	15
N. Limić, H. Pašagić, Č. Rnjak, Linearno i nelinearno programiranje, Informator, Zagreb, 1978.	5	15
R. J. Vanderbei, Linear programming: foundations and extensions, 2nd ed., Kluwer, 2001.	https://faculty.kfupm.edu.sa/coe/tarek/coe549/LectureSlides/Linear%20Programming.pdf	15
P. R. Thie, E. K. Gerard, An Introduction to Linear Programming and Game Theory, 3rd ed., John Wiley & Sons, 2008	https://zalamsyah.staff.unja.ac.id/wp-content/uploads/sites/286/2019/11/9-An-Introduction-to-Linear-Programming-and-Game-Theory-Thie-Kagouh.pdf	15

1.10. Additional reading

1. D. C. Vella, An Invitation to Linear Programming and Game Theory, Cambridge University Press, 2021.
2. K. Murty, Linear and Combinatorial Programming, John Wiley and Sons, New York, 1983.
3. Lavoslav Čaklović: Geometrija linearnog programiranja, Element, Zagreb, 2010.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Methodology of teaching mathematics I	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 0 + 30

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. quote the principles of mathematics education and their basic properties, and use them with understanding (A7, B6, C6, D6, E6, F6),
O2. differentiate several forms of defining mathematical terms and highlight their advantages and deficiencies in school mathematics (A7, B6, C6, D6, E6, F6),
O3. interpret and compare different ways of proving mathematical theorems (A7, B6, C6, D6, E6, F6),
O4. analyse the national curriculum of mathematics in higher grades of elementary schools and in secondary schools (A6, B6, C5, D6, E5, F5),
O5. 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),
O6. use relevant and recent professional literature independently and critically (A6, B6, C6, D5, E7, F7),
O7. 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),
O8. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☐ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Current textbooks for elementary and secondary schools	20	5
Curriculum for the subject of Mathematics for elementary schools and high schools in the Republic of Croatia	https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_146.html	5
Matematika bez suza, ed. Ilona Posokhova, Ostvarenje, Lekenik, 2000.	6	5
Kurnik: Oblici matematičkog mišljenja, Element, Zagreb, 2013.	1	5
Kurnik: Posebne metode rješavanja matematičkih problema, Element, Zagreb, 2010.	2	5
Kurnik: Znanstveni okvir nastave matematike, Element, Zagreb, 2009.	2	5

1.10. Additional reading

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 popularization journals

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1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies
At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

GENERAL INFORMATION		
Course coordinator		
Course title	**Developmental psychology**	
Study programme	**Mathematics – Teacher Training**	
Course status	Compulsory	
Year	**1.**	
ECTS credits and form of instruction	ECTS credits	5
	Number of hours (L+P+S)	30+15+0

COURSE DESCRIPTION
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
None.
1.3. Expected course learning outcomes
Upon completing the course, the students will be able to: O1. understand specifics of development of childhood and adolescence O2. explain standard development and specifics of individual development O3. apply knowledge to understand individual differences among children and adolescents O4. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☒ field-based learning	☐ other _____

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1.6. Students' 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.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam		Essay	X	Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the 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.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Berk, L. E. (2008). *Psihologija cjeloživotnog razvoja*. Jastrebarsko: Naklada Slap (275-409) ILI	13	10
Vasta, R., Haith, M.M., Miller, S.A. (1998). *Dječja psihologija*. Jastrebarsko, Slap. (str. 24-62, 107-120,191-207, 253- 399, 457-467; 476-486; 488-644) ILI	6	10
Berk, L.E. (2015). *Dječja razvojna psihologija.* Jastrebarsko: Naklada Slap	10	10

1.10. Additional reading

1. Feinstein (2005). Tajne tinejdžerskog mozga. Naklada Kosinj.
2. Lacković-Grgin, K. (2006). Psihologija adolescencije. Jastrebarsko: Naklada Slap.
3. Lebedina Manzoni, M. (2006): Psihološke osnove poremećaja u ponašanju, Jastrebarsko: Naklada Slap
4. Siegel, D. (2017). Oluja u mozgu: snaga i svrha tinejdžerskog mozga. Split: Harfa.
5. Vizek-Vidović, V., Rijavec, M. Vlahović-Štetić, V., Miljković, D. (2003). Psihologija obrazovanja, Zagreb: IEP-Vern (41-140)
6. Woolfolk, A. (2016). Edukacijska psihologija. Jastrebarsko: Naklada Slap (25-103)
7. mrežne stranice i radovi iz časopisa po preporuci uz određenu temu

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	General pedagogy	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	5
	Number of hours (L+P+S)	30+0+15

COURSE DESCRIPTION

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

None.

1.3. Expected course learning outcomes

On completion of the course, students should be able to:

O1. describe, define and explain the aspects and essential determinants of the phenomenon and process of education;
O2. identify, explain and compare the basic dimensions of education;
O3. analyse the phenomenon of education using examples and cases from school practise;
O4. describe and explain the characteristics of the educational styles of different educator profiles (teacher, class teacher, etc.);
O5. identify and explain the characteristics of interpersonal relationships in a pedagogical context;
O6. list the forms of communication and explain the characteristics of successful pedagogical communication;
O7. analyse aspects of interaction and communication in the classroom;
O8. name and analyse the main features of modern educational approaches.

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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☐ multimedia and network
	☐ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

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1.6. Students' obligations

Regular course attendance and active partake in class:
- 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.

A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation	X	Seminar paper	X	Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the 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.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Mušanović, M., Lukaš, M. (2011). *Osnove pedagogije.* Rijeka: Hrvatsko futurološko društvo	20	10
Bratanić, M. (1990/1991/1993). *Mikro-pedagogija. Interakcijsko-komunikacijski aspekt odgoja.* Zagreb: Školska knjiga	15	10

1.10. Additional reading

1. Giesecke, h. (1993). *Uvod u pedagogiju.* Zagreb: Educa
2. Gudjons, H. (1994). *Pedagogija – temeljna znanja.* Zagreb: Educa
3. Vujčić, V. (2013). *Opća pedagogija. Novi pristup znanosti o odgoju.* Zagreb: Hrvatski pedagoško-književni zbor
4. Mrnjaus, K. (2008). *Pedagoška promišljanja o vrijednostima.* Rijeka: Filozofski fakultet
5. Mrnjaus, K., Rončević, N., Ivošević, L. (2013). *(inter)kulturalna dimenzija u odgoju i obrazovanju.* Rijeka: Filozofski fakultet

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Educational psychology I – Psychology of studying and teaching	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	5
	Number of hours (L+P+S)	30+15+0

COURSE DESCRIPTION

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

None.

1.3. Expected course learning outcomes

After passing the course students will be able to:

O1. describe and understand learning through classical and operant conditioning in schools
O2. describe and understand learning by observation in school
O3. describe and understand theory of information processing i constructive theory of learning and their appliance in teaching
O4. describe and understand possibilities in use of theory of studying in teaching
O5. plan teaching class using constructive principles of learning
O6. apply effective learning strategies (mnemonic strategies, summarising, questioning)
O7. describe factors of quality knowledge assessment
O8. describe and apply various methods in student's knowledge assessment
O9. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☐ field-based learning	☒ other: consultation

1.6. Students' 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.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')							
Course attendance	X	Activity / Participation	X	Seminar paper		Experimental work	
Written exam	X	Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Kolić-Vehovec, S. (1999). *Edukacijska psihologija.* Rijeka: Filozofski fakultet.	13	10
Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). *Psihologija obrazovanja.* Zagreb: IEP.	22	10

1.10. Additional reading

1. Anderson, J.R. (1995). *Learning and memory: an integrated approach*. NY: John Wiley and Sons, Inc.
2. Brdar, I. i Rijavec, M. (1998). *Što učiniti kada dijete dobije lošu ocjenu?* Zagreb: IEP.
3. Desforges, C. (2001). *Uspješno učenje i poučavanje: psihologijski pristupi*. Zagreb: Educa.
4. Howe, M.J.A. (2002). *Psihologija učenja: priručnik za nastavnike*. Jastrebarsko: Naklada Slap.
5. Mackintosh, N.J. i Colman, A.M. (1995). *Learning and skills*. London: Longman.
6. Slavin, R.E. (2012). *Educational psychology: Theory and practice*. Boston: Allyn & Bacon.
7. Zarevski, P. (2007). *Psihologija pamćenja i učenja*. Jastrebarsko: Naklada Slap.
8. Woolfolk, A. (2016). *Edukacijska psihologija*. Jastrebarsko: Naklada Slap.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Introduction to linguistic culture	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	3
	Number of hours (L+P+S)	15 + 0 + 15

COURSE DESCRIPTION

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

None.

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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☐ practicals	☐ laboratory

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	☐ distance learning ☐ field-based learning	☐ mentoring work ☒ other: consultation

1.6. Students' obligations

Students are required to attend classes, actively participate in all forms of classes and achieve a certain number of points throughout the semester (details will be presented in the course syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

The student's work on the course will be evaluated during classes.
Procedure and examples of evaluation of learning outcomes:

- Written exercise 1 (O2, O3) - worksheet - 5 points
- Written exercise 2 (O1, O2, O3, O5) – 30 points (the exercise is made up of different types of tasks, and the achievement of at least 40% of the achieved grade points is positively evaluated).
- Written exercise 3 (O3, O4, O5) – 40 points (the exercise is made up of different types of tasks, and the achievement of at least 40% of the achieved grade points is positively evaluated).
- Homework (O2, O4) – 10 points (written work on a given topic from the teacher's discourse (e..g report, invitation to parents' meeting, resume, etc.).
- There is no final exam.

A detailed elaboration of the method of monitoring and evaluating the students' work will be presented in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Frančić, Anđela –Hudeček, Lana – Milica Mihaljević, *Normativnost i višefunkcionalnost u hrvatskome standardnom jeziku*, Hrvatska sveučilišna naklada, Zagreb, 2005. ili 2007.	3	10
Hudeček, Lana – Mihaljević, Milica, Hrvatska školska gramatika, IHJJ, 2017.	https://gramatika.hr/	10
Pravopis Instituta za hrvatski jezik i jezikoslovlje	http://pravopis.hr/	10
Silić, Josip, *Funkcionalni stilovi hrvatskoga jezika*, Disput, Zagreb, 2006.	6	10
Težak, Stjepko – Babić, Stjepan, *Gramatika hrvatskoga jezika*, Školska knjiga, Zagreb (od) ^{7}1992.	7	10

1.10. Additional reading

1. Anić, Vladimir, *Rječnik hrvatskoga jezika*, Novi Liber, Zagreb, ^{3}1998. (ili koje ranije izdanje).
2. Anić, Vladimir – Goldstein, Ivo, *Rječnik stranih riječi*, Novi Liber, Zagreb, 1999.
3. Barić, Eugenija – Lončarić, Mijo – Malić, Dragica – Pavešić, Slavko – Peti, Mirko – Zečević, Vesna – Znika, Marija, *Hrvatska gramatika*, Školska knjiga, Zagreb, 1995.
4. Frančić, Anđela – Petrović, B., *Hrvatski jezik i jezična kultura*, Visoka škola za poslovanje i upravljanje „Baltazar Adam Krčelić", Zaprešić, 2013.
5. *Govorimo hrvatski* (jezični savjeti), www.hrt.hr.

6. *Hrvatski jezični portal*, Novi Liber, http://hjp.novi-liber.hr/index.php?show=baza.
7. *Hrvatski na maturi*, Institut za hrvatski jezik i jezikoslovlje, Zagreb, 2014., http://matura.ihjj.hr/
8. *Rječnik hrvatskoga jezika*, ur. Jure Šonje, Leksikografski zavod - Školska knjiga, Zagreb, 2000.
9. Silić, Josip i Pranjković, Ivo, *Gramatika hrvatskoga jezika*, Zagreb, 2005.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Methodology of teaching mathematics II	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 0 + 30

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. analyse the mathematical curriculum in higher grades of elementary schools and in secondary schools (A6, B6, C5, D6, E5, F5),
O2. differ and valorise different methods of teaching mathematics, especially methods according to the mathematical topics (A7, B6, C6, D6, E7, F7),
O3. 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),
O4. 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),
O5. 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),
O6. independently create teaching materials in mathematics with or without using the advanced tools of ICT (A6, B6, C6, D6, E7, F7),
O7. 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),
O8. use relevant and recent professional literature independently and critically (A6, B6, C6, D5, E7, F7),
O9. 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),
O10. 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).

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1.4. Course content
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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations
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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')							
Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Current textbooks for elementary and secondary schools and teachers' manuals	20	5
Curriculum for the subject of Mathematics for elementary schools and high schools in the Republic of Croatia	https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_146.html	5
Matematika bez suza, ed. Ilona Posokhova, Ostvarenje, Lekenik, 2000.	6	5
Kurnik: Oblici matematičkog mišljenja, Element, Zagreb, 2013.	1	5
Kurnik: Posebne metode rješavanja matematičkih problema, Element, Zagreb, 2010.	2	5
Kurnik: Znanstveni okvir nastave matematike, Element, Zagreb, 2009.	2	5

1.10. Additional reading

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)

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Using computers in teaching mathematics	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	**1.**	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	15 + 15 + 0

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 enrolment requirements

None.

1.3. Expected course learning outcomes

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

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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.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☐ field-based learning	☒ other
		Consultations and practical teaching

1.6. Students' obligations

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).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.). The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
M. Pavleković, Metodika nastave matematike s informatikom I, Element, Zagreb, 1997.	5	10
M. Pavleković, Metodika nastave matematike s informatikom II, Element, Zagreb, 1999.	5	10

1.10. Additional reading

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Additional teaching of Mathematics	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30 + 30 + 0

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 enrolment requirements

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

1.3. Expected course learning outcomes

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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam		Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
D., George, Obrazovanje darovitih: kako identificirati i obrazovati darovite i talentirane učenike, Educa, Zagreb, 2005.	5	10
Kurikulum nastavnog predmeta matematika za osnovne škole i gimnazije u Republici Hrvatskoj	https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_146.html	10

1.10. Additional reading

1. V., Vlahović – Štetić, Daroviti učenici: teorijski pristup i primjena u školi, IDZ, Zagreb, 2005.
2. N. Lukač i dr., Matematičko natjecanje Klokan bez granica 1999.-2004., HMD, Zagreb, 2005.
3. V. Stošić, Matematička natjecanja učenika osnovnih škola, Mala matematička biblioteka, HMD i Element, Zagreb, 1994.
4. Dujella, M. Bombardelli, S. Slijepčević, Matematička natjecanja učenika srednjih škola, HMD i Element, Zagreb, 1996.
5. Z. Kurnik, Zabavna matematika u nastavi matematike, Element, Zagreb, 2009.
6. Neven Elezović, Matematička natjecanja i rad s darovitim učenicima, Element, Zagreb, 2007.
7. Dostupni popularizacijski i metodički časopisi (tiskani ili elektronički oblik)
8. ostala stručno – metodička literatura kao pomoć za pripremu nastavnog sata

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Educational psychology II – Individual differencies and class interaction	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30+15+0

COURSE DESCRIPTION

1.1. 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.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After completing the final exam the students will be able to:

- O1. explain intelligence and its effect on school achievement
- O2. plan a teaching class with consideration to various intelligence
- O3. explain relationship between self-concept and school achievement
- O4. describe and compare different theories about relation between motivation and school achievement
- O5. differentiate categories of social status in classroom and plan methods for social status improvement
- O6. understand components on student-teacher relationship
- O7. apply social skills in order to establish positive social interactions in classroom and change undesirable students' behaviours
- O8. understand different approaches to discipline management and to apply principles of operant conditioning in clasroom

1.4. 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.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' 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.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation	X	Seminar paper		Experimental work	
Written exam	X	Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the 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.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Kolić-Vehovec, S. (1999). Edukacijska psihologija. Rijeka: Filozofski fakultet.	13	10
Vizek-Vidović, V., Vlahović-Štetić, V., Rijavec, M., Miljković, D. (2003). Psihologija obrazovanja. Zagreb: IEP.	22	10

1.10. Additional reading

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.
8. Woolfolk, A. (2016). Edukacijska psihologija. Jastrebarsko: Naklada Slap.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Didactics I	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30 + 15 + 0

COURSE DESCRIPTION

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

None.

1.3. Expected course learning outcomes

It is expected that students will improve these generic competencies after fulfilling all the commitments set out in the programme:
- the ability to think critically and creatively;
- the ability to analyse, synthesise and evaluate;
- planning and organisational skills;
- learning skills through teamwork and individual work;
- the ability to manage and present information.

After fulfilling all the obligations set out in the programme, the student is expected to develop the following specific competences, i.e. to be able to:

O1. identify and explain didactics as a pedagogical discipline and its relationship to other scientific disciplines,
O2. identify and explain the relationship between didactics and methodology,
O3. define and explain basic didactic concepts,
O4. differentiate between types of teachers and compare their influence on the teaching process,
O5. list and explain the elements of the teaching process,
O6. explain and differentiate the phases, approaches and aspects of the planning and developing process,
O7. correctly define and formulate learning objectives and learning outcomes,
O8. list and explain didactic principles in the teaching and learning process,
O9. create and analyse the subject curriculum for a subject class,
O10. create and analyse the preparation of the teaching unit.

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, programme 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. Types of teaching (add an 'X')	☒ lectures ☐ seminars and workshops ☒ practicals ☒ distance learning ☐ field-based learning	☒ independent tasks ☐ multimedia and network ☐ laboratory ☐ mentoring work ☒ other : consultations

1.6. Students' obligations

Student's obligations include: regular attendance and active participation in all forms of teaching and learning; preparation and analysis of the implementation programme (subject curriculum) for a subject; preparation of the lesson plan for a lesson - preparation of new teaching content; reading and studying of compulsory literature and materials from lectures and exercises, etc. (details will be presented in the course curriculum).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the 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 course curriculum.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

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

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1.10. Additional reading
1. Bezić, K., Strugar, V. (1998). Učitelj za treće tisućljeće. Zagreb: HPKZ. 2. Jensen, E. (2003). Super-nastava. Zagreb: Educa. 3. Kyriacou, C. (1995). Temeljna nastavna umijeća. Zagreb: Educa. 4. Meyer, H. (2002). Didaktika razredne kvake.Rasprave o didaktici, metodici i razvoju škole. Zagreb: Educa. 5. Pastuović, N. (1999). Edukologija. Zagreb: Znamen. 6. Pratt, D.D. and Associates (1998). Five Perspectives on Teaching in Adult and Higher Education, Malabar, FL: 7. Krieger Publishing. 8. Pratt, D.D. (1992) Conceptions of teaching. Adult Education Quarterly, 42(4), 203-220. 9. Terhart, E. (2001), Metode poučavanja i učenja. Zagreb: Educa
1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies
At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Teaching the children with special needs	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30 + 15 + 0

COURSE DESCRIPTION

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.
Programme of this course correlates with the programme of courses Developmental psychology and Educational psychology.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

O1. Distinguish between the basic characteristics of pupils with different types of developmental disabilities and gifted pupils.
O2. Explain the possibilities of support for students with special needs entering the educational system.
O3. Describe appropriate methods for working with students with different categories of special needs.
O4. Create an example of an individualised education programme for a student with developmental difficulties.

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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

Students are required to attend class, actively participate in all forms of activities, and achieve a certain number of points during the semester (details will be presented in the course curriculum).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	

Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

The student's work is assessed and evaluated during the course. A detailed elaboration of the method for monitoring and evaluating students' work will be presented in the course curriculum

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Ivančić. Đ. (2010). *Diferencirana nastava u inkluzivnoj školi – procjena, poučavanje i vrednovanje uspješnosti učenika s teškoćama.* Zagreb: Alka script.	5	10
Kiš-Glavaš, L. (Ur.) (2012). *Studenti s invaliditetom – opće smjernice*. Zagreb: Sveučilište u Zagrebu.	1	10
Woolfolk, A. (2016). *Edukacijska psihologija*. Jastrebarsko: Naklada Slap (poglavlje: Razlike među učenicima i potrebe učenja)	5	10

1.10. Additional reading

1. Bouillet, D. (2010). *Izazovi integriranog odgoja i obrazovanja*. Zagreb: Školska knjiga.
2. Davis, R.D., Braun, E.M. (2001). *Dar disleksije: zašto neki od najpametnijih ljudi ne znaju čitati i kako mogu naučiti*. Zagreb: Alinea.
3. Cvetković-Lay, J., Sekulić-Majurec, A. (1998). *Darovito je, što ću s njim?* Zagreb: Alinea.
4. Igrić, Lj. (2015). *Osnove edukacijskog uključivanja*. Zagreb: Školska knjiga.
5. Kirk, S., Gallagher, J.J., Coleman, M.R.., Anastasiow, N. (2009). *Educating exceptional children*. Boston: Houghton Mifflin Company.
6. Krampač-Grljušić, A., Marinić, I. (2007). *Posebno dijete – priručnik za učitelje u radu s djecom s posebnim obrazovnim potrebama*. Osijek: Grafika.
7. Mićanović. M. (2008). *Poučavanje učenika s autizmom – školski priručnik.* Zagreb: Agencija za odgoj i obrazovanje.
8. Velki, T. (2018). *Priručnik za rad s hiperaktivnom djecom u školi*. Jastrebarsko: Slap.
9. Vicić. M. (1996). *Metodika odgojno obrazovnog i rehabilitacijskog rada za djecu i mladež s mentalnom retardacijom.* Zagreb: Hrvatsko društvo defektologa.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Seminar III – Foundations of mathematics	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	0 + 0 + 30

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. describe and analyse some axiomatic systems (A6, B7),
O2. 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),
O3. use different communication types and forms, including information and communication technology (A6, B6, C6, E7, F7),
O4. use relevant and recent professional literature independently and critically (A6,B7,E6),
O5. 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. Types of teaching (add an 'X')		
	☐ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☐ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

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1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment		Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students are required to attend classes and actively participate in them. The total number of points that a student can achieve during classes is 100. Details will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Frege, G., 1995, Osnove Aritmetike i drugi spisi, Kruzak, Zagreb.	https://www.informationphilosopher.com/solutions/philosophers/frege/Frege_Begriffsschrift.pdf	5
Stanford Encyclopedia of Philosophy	http://plato.stanford.edu/entries/intuitionism/	5
Nelson, E. Understanding intuitionism, 1997.	https://web.math.princeton.edu/~nelson/papers/int.pdf	5
van Garrel, M., On The Hilbert-Frege controversy on the Foundations of Mathemathics, 2007. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=75c3a96683b21acf91903bb8eaf9c9407cdbfe9a	http://www.philosophie.ch/philipp/teaching/papers/vanGarrel_FregeHilbert.pdf	5

1.10. Additional reading

1. Moore, A.W., 1990, The Infinite, Routledge, London
2. Wittgenstein, L., 1937-44/1972, Remarks on the Foundations of Mathematics, The M.I.T. Press, Cambridge.
3. Benacerraf, P. i Putnam, H., 1983, Philosophy of Mathematics-Selected Readings, second edition, Cambridge University Press, Cambridge.
4. Boolos, G., 1998, Logic, Logic and Logic, Harvard University Press.
5. Nagel, E. i Newman, J.R., 2001, Gödelov dokaz, Kruzak, prevedeno iz Nagel, Newman, 1993, Gödel's Proof, Routledge
6. Brown, J.R., 1999, An Introduction to the World of Proof and Pictures, Routledge

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Methodical practice in mathematics I	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	2.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	0 + 60 + 0

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 enrolment requirements

Methodology of teaching mathematics I, Methodology of teaching mathematics II

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. 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),

O2. 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),

O3. 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),

O4. 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),

O5. 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),

O6. 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),

O7. 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. Types of teaching (add an 'X')		
	☐ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Current textbooks in mathematics for elementary and secondary schools and teachers' manuals	20	10
Kurikulum za nastavni predmet Matematike za osnovne škole i gimnazije u Republici Hrvatskoj	https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_146.html	10

1.10. Additional reading

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Vector spaces I	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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 and finding the Jordan form of the operator matrix ,
- define bilinear form and unitary space,
- define and describe properties of a normal operator.

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. know basic examples of vector spaces and linear operators (A6, B6, C6, D4, E4, F3),
O2. solve problems related to the calculation of the rank (A6, B6, C6, D4, E5, F3),
O3. solve problems related to adjoint spaces (A6, B6, D4, E5, F3),
O4. construct Jordan basis (A6, B6, C6, D4, E5, F3),
O5. apply and understand the procedure of reduction of an operator on finite dimensional vector spaces in particular problems of determining the Jordan form (A6, B6, D4, E5, F3),
O6. know bacis examples of unitary spaces (A6, B7, D4, E5, F3),
O7. classify main properties of bilinear forms (A6, B6, D4, E5, F3),
O8. classify main properties and examples of normal operators (A6, B6, D4, E5, F3),
O9. 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 examples. Quotient space. Linear operators, basic notions and examples. The space L(X,Y). Algebra. Characteristic and minimal polynomial. Adjoint space and adjoint operator. Invariant subspaces and eigenvalues. Nilpotent operator. Reduction of operators on finite dimensional vector spaces. Jordan form of the operator matrix. Operator functions. Geometry of unitary spaces. The structure of bilinear forms. Normal operators.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☐ multimedia and network

	☒ practicals ☐ distance learning ☐ field-based learning	☐ laboratory ☐ mentoring work ☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
G. Muić, M. Primc, *Vektorski prostori*, skripta, Matematički odsjek, PMF, Zagreb	https://www.pmf.unizg.hr/_download/repository/vp%5B1%5D.pdf	10

1.10. Additional reading

1. S. Kurepa, Konačno dimenzionalni vektorski prostori i primjene, Sveučilišna naklada Liber, Zagreb, 1976.
2. H. Kraljević, Vektorski prostori, skripta, Odjel za matematiku, Sveučilište u Osijeku
3. P.R. Halmos, Finite Dimensional Vector Spaces, Van Nostrand, New York, 1958.
4. K. Horvatić, Linearna algebra, Golden marketing Tehnička knjiga, Zagreb, 2004.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Didactics II	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	2.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30 + 15 + 0

COURSE DESCRIPTION

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

None.

1.3. Expected course learning outcomes

After passing the Didactics II exam, students are expected to be able to:

O1. Analyse and adequately apply various didactic-methodological decisions in practical situations of a range of educational processes;

O2. Analyse and adequately apply a range of knowledge from didactics (planning and programming of lessons; micro and macro organisation of lessons; use of modern teaching technology; assessment and evaluation of student performance; training and improvement of teachers for educational processes);

O3. Carry out and interpret simpler research tasks in the field of didactics and interpret the possibilities of improving direct didactic practise.

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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other : _____

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1.6. Students' obligations

Students are required to actively participate in all forms of class activities; seminar paper, practical exercise and final exam. Students will receive points following discussions and research in didactics.
Students are required to read titles from the assigned literature and at least two titles from the elective literature. A prerequisite for the final exam is the fulfilment of all due exercises, tests and proof that they have read a research or discussion in the field of didactics in the form of a seminar paper.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students will be assesed during classes and on final exam.
Detailed list of evaluating and assesing the student will be presented in the course curriculum.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Bognar, L. i Matijević, M. (2002). *Didaktika*. Zagreb: Školska knjiga.	10	10
Grgin, T. (2001). *Školsko ocjenjivanje znanja*. Jastrebarsko: Naklada Slap	10	10
Lavrnja, I. (1998). *Poglavlja iz didaktike*. Rijeka: Pedagoški fakultet u Rijeci	10	10
Poljak, V. (1991). *Didaktika*. Zagreb: Školska knjiga	10	10

1.10. Additional reading

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). *Praćenje i ocjenjivanje školskog uspjeha*. Zagreb: HPKZ

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Probability theory	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	1.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	45 + 30 + 0

COURSE DESCRIPTION

1.1. Course objectives

The main objective of this course is to acquaint the students with the basic notions, methods and results of the probability theory. In that aim it is necessary to:

- define measures and describe basic examples of measure spaces,
- define Lebesgue measure and analyse its properties,
- define an integral of a function over a measure space and analyse its properties,
- define random variables and analyse their basic properties,
- define distribution functions and describe classification of random variables,
- define expected value and variance, and prove limit theorems for expected value,
- describe basic types of convergence of random variables and their relations,
- prove weak and strong laws of large numbers,
- describe convergence of series of random variables,
- define characteristic functions of random variables and analyse their basic properties.

1.2. Course enrolment requirements

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1.3. Expected course learning outcomes

After completing this course students should be able to:

O1. argumentedly apply properties of measures and integrals (A7, B7, C7),
O2. analyse examples of measures with particular emphasis on the Lebesgue measure (A7, B7, C7),
O3. argumentedly use random variables and their properties in problem solving (A7, B7, E4, F5),
O4. explain classification of random variables (A7, B7, E4, F5),
O5. argumentedly apply limit theorems for expected value (A7, B7, E4, F5),
O6. list basic types of convergence of random variables and describe their relations (A7, B7, E4, F5),
O7. describe weak and strong laws of large numbers and convergence of series of random variables (A7, B7, E4, F5),
O8. argumentedly apply properties of characteristic functions in problem solving (A7, B7, E4, F5),
O9. argumentedly apply central limit theorems (A7, B7, E4, F5),
O10. mathematically prove foundation of procedures and formulae which they use within the course (A7, B7, E4, F5).

1.4. Course content

Ring, algebra, sigma-algebra. Borel sets. Measure, Outer measure, Lebesgue measure. Random variables. Distribution functions. Classification of random variables. Expected value. Limit theorems for expected value. Convergence of random variables. Independence of random variables. Laws of large numbers. Convergence of series of random variables. Characteristic functions. Central limit theorems.

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1.5. Types of teaching (add an 'X')	☒ lectures ☐ seminars and workshops ☒ practicals ☒ distance learning ☐ field-based learning	☒ independent tasks ☒ multimedia and network ☐ laboratory ☐ mentoring work ☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
N. Sarapa, Teorija vjerojatnosti, Školska knjiga, Zagreb, 2002.	23	10
A. Gut, Probability: A Graduate Course, Springer, New York, 2013.	1	10
D. L. Cohn, Measure theory, Birkhäuser, New York, 2013.	2	10
S. Mardešić, Matematička analiza II, Školska knjiga, Zagreb, 1989.	5	10

1.10. Additional reading

1. R. Durrett, Probability: theory and examples, Duxbury Press, Belmont, 1996.
2. S. I. Resnick, A Probability Path, Birkhäuser, New York, 2014.
3. S. Axler, Measure, Integration & Real Analysis, Springer Open, 2020. Link: https://measure.axler.net/MIRA.pdf
4. N. Antonić, M. Vrdoljak, Mjera i integral, PMF-Matematički odjel, Zagreb, 2001.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Algebra I	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. construct free groups, formulate, analyse and argumentatively apply the properties of free groups in solving problems (A7, B7, C7, D7, E5, F7, G7),
O2. differentiate and analyse different categories, and argumentatively apply cathegorical constructions in solving problems (A7, B7, C7, D7, E5, F7, G7),
O3. formulate and analyze the properties of the module and argumentatively apply the properties of modules in solving problems (A7, B7, C7, D7, E5, F7, G7);
O4. distinguish and analyze the properties of solvable groups and argumentatively apply the properties of solvable groups in solving problems (A7, B7, C7, D7, E5, F7, G7);
O5. distinguish and analyze the properties of nilpotent groups and argumentatively apply the properties of nilpotent groups in solving problems (A7, B7, C7, D7, E5, F7, G7);
O6. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
T.W. Hungerford: Algebra, Reinhart and Winston, NY, 1989.	2	10
S. Lang, Algebra, Addison-Wesley Publishing Company, cop. 1967.	1	10

1.10. Additional reading

1. H. J. Rose: A Course on finite groups, Springer-Verlag London, 2009.
2. D. S. Dummit, R. M. Foote, Abstract algebra, 3rd edition, Wiley, 2003.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Number theory	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. 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),
O2. calculate using modular arithmetics, solve congruency equations and systems of congruencies (A6, B7, D6, E6, F6),
O3. apply and understand the quadratic law of reciprocity and formulas for calculating the Legendre symbol, to solve quadratic congruencies (A6, B7, D6, E6, F6),
O4. describe the display of integers by using quadratic forms in simple cases, compare and classify different quadratic forms (A6, B7, D6, E6, F6),
O5. show and analyse basic multiplicative functions and their properties, check and show connections between them (A6, B6, D6, E6, F6),
O6. define basic types of Diophantine equations and describe the methods of solving them (A6, B7, D6, E6, F6),
O7. define elliptic curves, analyse their basic properties and describe important open problems (A6, B6, D6, E6, F6),

O8. apply and understand the methods in the number theory in analysis of the public-key cryptosystem (A6, B7, D6, E6, F6),
O9. describe and analyse algebraic and analytical methods in the number theory and apply them to important problems.

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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).
Remark: 50% of exercises are held on computers, and 50% are auditory exercises.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus).

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Dujella, A., Number Theory, Školska knjiga, Zagreb, 2021.	2	10
Dujella A., Teorija brojeva, Školska knjiga, Zagreb, 2019.	6	10
Baker: A Concise Introduction to the Theory of Numbers, Cambridge University Press, Cambridge, 1994.	1	10
Dujella A., Maretić M.: Kriptografija, Element, Zagreb, 2007.	3	10

1.10. Additional reading

1. Niven, H. S. Zuckerman, H. L. Montgomery: An Introduction to the Theory Numbers, Wiley, New York, 1991.
2. K. H. Rosen: Elementary Number Theory and Its Applications, Addison-Wesley, Reading, 1993.

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Graph theory	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 15 + 15

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing the course, the students are expected to:

O1. differentiate the concepts and graphs properties and apply and understand appropriate properties and statements in solving exercises (A7, B7, C7, D7, E5, F7, G7),
O2. analyse problems of graph connectivity and related properties (A7, B7, C7, D7, E5, F7, G7),
O3. analyse Eulerian and Hamiltonian graphs and apply and understand the definitions and properties in solving exercises (A7, B7, C7, D7, E5, F7, G7),
O4. solve problems related to a matching of graphs (A7, B7, C7, D7, E5, F7, G7),
O5. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory

	☒ distance learning ☐ field-based learning	☐ mentoring work ☒ other: consultations, practicum strategies

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
D.Veljan: Kombinatorika i diskretna matematika, Algoritam, Zagreb, 2001.	5	10
D.Veljan: Kombinatorika s teorijom grafova, Školska knjiga, Zagreb, 1989.	5	10

1.10. Additional reading

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.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	**Computer Networks**	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30+30+0

COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is for students to master basic knowledge about computer networks, Internet, web applications and protocols, as well as to acquire skills for using such knowledge.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After fulfilling all the obligations anticipated by the course, students are expected to be able to:

O1. Classify and compare reference models of computer system network architecture and name the role of each layer within these reference models.
O2. Explain the method of operation of chosen services and protocols from individual layers of reference network architecture models.
O3. Analyse major Internet protocols using protocol documentation and software tools.
O4. Name challenges in the domain of computer network security and describe solutions for responding to such challenges.
O5. Apply protocols of Internet application layer using the appropriate software tools.
O6. Recognise and express development trends in the information and communications technology in the domain of computer networks.

1.4. Course content

- Basic terminology related to computer networks and the Internet. Network edge and network core. Basic properties of networks. History of computer networking and Internet development.
- Application layer. Web. Electronic mail. Domain Name System. Peer-to-peer applications. Web application development.
- Transport layer. Multiplexing and demultiplexing. Connectionless data transfer. Reliable data transfer. Connection-oriented data transfer. Congestion management.
- Network layer. Virtual circuit and datagram. Router. Packet forwarding and Internet addressing. Routing. Broadcast and multicast.
- Data link layer. Troubleshooting. Multiple access links and protocols. Switches and local area networks.
- Wireless and mobile networks. Wireless connections. Wireless local area networks. Internet access through mobile networks. Mobility.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☐ multimedia and network
	☒ practicals	☒ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

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1.6. Students' obligations

Student responsibilities for this course are as follows:

- Regularly follow course activities within the distance learning system and attend classes taking place in the form of lectures, auditory and/or laboratory exercises.
- Complete problem-solving tasks as part of homework and hand in the solutions within the deadline.
- Answer questions and complete problem-solving tasks during auditory and/or laboratory exercises.
- Score at least 50% on the final exam.

A detailed scoring system for the course and passing scores for individual activities will be specified in the course syllabus.

Comment: Classes are held by combining classroom work and computer laboratory work, with the application of a learning management system (LMS). When they enrol into this course, students will be instructed to use the distance learning system. A detailed schedule with lectures and exercises will be defined in the syllabus.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

- As part of their homework, in the form of online assessment, students are required to hand in their files with solutions to problem-solving tasks, demonstrating their ability to set up a network model and/or required network service configuration by using a network simulator, network emulator and server and client applications (I3, I5).
- In laboratory exercises, students are required to take written or online assessment, in which they demonstrate their understanding of theoretical concepts necessary to complete programming tasks, e.g. through multiple choice questions, fill in the blank questions and essay questions (I2, I4). Following the written or online assessment, students are required to solve problem-solving tasks and hand in the files with solutions through online assessment, thus demonstrating their ability to set up a network model and/or required network service configuration by using a network simulator, network emulator and server and client applications (I3, I5).
- Written or online assessment in which students demonstrate their understanding of theoretical concepts related to computer networks and the Internet, e.g. through multiple choice questions, fill in the blank questions and essay questions (I1, I2, I4, I6).

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Kurose, J. F. & Ross, K. W. Computer networking: a top-down approach. (Pearson, 2013).	2	5
Peterson, L. L. & Davie, B. S. Computer networks: a systems approach. (Morgan Kaufmann, 2012).	4	5

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1.10. Additional reading
1. Bažant, A., Gledec, G., Ilić, Ž., Ježić, G., Kos, M., Kunštić, M., Lovrek, I., Matijašević, M., Mikac, B. & Sinković, V. Osnovne arhitekture mreža. (Element, 2014). 2. Halsall, F. Computer networking and the Internet. (Addison-Wesley, 2006). 3. Tanenbaum, A. S. & Wetherall, D. Computer networks. (Pearson/Prentice Hall, 2011). 4. Sterbenz, J. P. G. & Touch, J. D. High speed networking: a systematic approach to high-bandwidth low-latency communication. (Wiley, 2001). 5. Comer, D. Computer networks and Internets. (Pearson, 2015). 6. Comer, D. Internetworking with TCP/IP. (Pearson/Prentice Hall, 2013).
1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies
At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	E-learning for Education and Business	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30+30+0

COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is the acquisition of basic knowledge and the development of skills necessary for analysing, planning, and creating e-learning in educational and professional institutions. Students will be familiar with the possibilities of applying modern digital technologies for e-learning and the possibilities of digital transformation of e-learning. They will actively use the e-learning system and be able to plan to acquire additional knowledge, skills and abilities through lifelong e-learning.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After fulfilling all the responsibilities prescribed by the course, students are expected to be able to:

O7. Discuss the concepts and theories in the field of e-learning, their connection and relevance to solving the complex current and future challenges of the digital transformation of e-learning.
O8. Identify the possibilities of modern digital technologies for e-learning (LMS, digital tools, MOOCs, new technologies – AR, VR, digital games) and recommend suitable technologies for e-learning in the organization and educational institution.
O9. Design innovative e-learning approaches and models for successful application in the organization and educational institution.
O10. Develop a plan to improve e-learning in the organization and educational institution by applying modern approaches and models of e-learning as well as technological innovations.
O11. Analyse, identify the need, plan activities, resources, methods, techniques, and tools as well as design, implement and evaluate e-learning models in an organization or educational institution based on the instructional design standards.

1.4. Course content

- E-learning, blended learning, and distance education: definition, advantages, disadvantages, forms, technology, work methods. Online courses. Evaluation in e-learning. E-tivities.
- Application of modern digital technologies for e-learning (LMS, digital tools, MOOC, new technologies – AR, VR, digital games).
- The role of computer experts in the digital transformation of e-learning in the organization and educational institution.
- Instructional design models for planning, implementing, and evaluating e-learning in an organization or educational institution.
- Application of the learning system (LMS), digital tools and other technologies for the preparation of e-learning in the organization and educational institution.

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1.5. Types of teaching (add an 'X')	☒ lectures ☐ seminars and workshops ☒ practicals ☒ distance learning ☐ field-based learning	☒ independent tasks ☒ multimedia and network ☐ laboratory ☐ mentoring work ☐ other _____

1.6. Students' obligations

Student responsibilities for this course are as follows:

- Regularly follow course activities within the distance learning system and attend classes taking place in the form of lectures and auditory and/or laboratory exercises.
- Participate in continuous assessment activities (theoretical preliminary exams) and successfully complete them.
- Complete an individual or group assignment (seminar paper) on a given topic and present it to the course instructor and other students.
- Prepare a project, as the final exam. This activity requires the student to achieve at least 50% of the overall number of points for this activity.

A detailed scoring system for the course as well as passing scores for each activity will be given in the course syllabus.

Comment:

The course is organised in blended form, which combines classroom work, individual work outside the classroom, and distance learning by using an e-learning system. A detailed class schedule as well as lecture and exercise topics will be given in the course syllabus. Students will be instructed to use the distance learning system immediately after enrolling into this course.

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam		Oral exam		Essay		Research	
Project	X	Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

- Written or online test (theoretical preliminary exam) in which students demonstrate their understanding of the basic theoretical concepts related to e-learning and the process of digital transformation of e-learning (O1), and which may include recall type-tasks, multiple choice tasks, matching tasks, essay questions, and extended response items.
- Forum discussion in which students discuss on the topics related to the e-learning e.g. about advantages and disadvantages of particular digital technologies for e-learning with some recommendations how to use it successfully (O2)
- Group assignment (using wiki or similar tool) in which students collaboratively analyse e-learning approaches and models and propose solutions for successful application in the organization and educational institution (O3, O4). Students will receive in advance instructions for creating and criteria for evaluating the seminar.
- Group or individual practical project assignment in the form of an e-course in a suitable learning management system (e.g. Moodle) on a selected topic in the field of informatics prepared by students following the instructional design model. Based on previously prepared analysis and design (project documentation), they create and evaluate the e-course. Students will receive in advance instructions for creating and criteria for evaluating the project (O5).

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Hoić-Božić, N., Holenko Dlab, M. (2021). „Uvod u e-učenje: obrazovni izazovi digitalnog doba“, Sveučilište u Rijeci, Odjel za informatiku, Rijeka	20	5
Hoić-Božić, N., Holenko Dlab, M. (2021). „Uvod u e-učenje: obrazovni izazovi digitalnog doba“, Sveučilište u Rijeci, Odjel za informatiku, Rijeka	https://repository.inf.uniri.hr/islandora/object/infri:768	5

1.10. Additional reading

1. Bates, A. W. (2019). Teaching in a Digital Age – Second Edition. Vancouver, B.C., Tony Bates Associates Ltd. Dostupno online: https://pressbooks.bccampus.ca/teachinginadigitalagev2/ (9.5.2020.)
2. Ćukušić, M., Jadrić, M. (2021). „E-učenje: koncept i primjena“, Školska knjiga, Zagreb, 2012.
3. Horton, W. (2012). E-Learning by Design. New York: John Wiley & Sons, Inc.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Measure and integral	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with some possibilities of the applied Discrete mathematics through the acquaintance of the real system in the economy and some problem from the system which can be solved using Discrete mathematics. In addition, the course objective is to develop an ability of mathematical modelling of such problems, and communication and presentation skills while presenting problems, their models and solutions.

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

After completing the course, the students are expected to:

O1. express themselves accurately and fluently in speech communication in the language of teaching and the correct official language (D6),

O2. use a variety of communication means and forms (D5),

O3. mathematically model a problem of the economy using Discrete mathematics (A6, B6, C4, D5, E4, F4),

O4. apply and understand the methods of Discrete mathematics while modeling and simulating real problems, and analyse obtained results (A6, B5, C5, D6, E4, F5).

1.4. Course content

Seminar is based on the previously attended courses in the field of Discrete mathematics and represents their expansion. The content of the seminar is the application of Discrete mathematics in problems related to the management of business entities (e.g. optimization of business/production processes).

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	

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Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Sibe Mardešić: Matematička analiza II, Školska knjiga , Zagreb, 1977	3	5
Donald L.Cohn: Measure theory, Birkhäuser Boston, 1994	2	5

1.10. Additional reading

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	History of mathematics	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	2.	
ECTS credits and form of instruction	ECTS credits	3
	Number of hours (L+P+S)	15 + 0 + 30

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:
O1. indicate problems from the everyday life that can be solved using mathematics and point out a relation with other subjects (A7,B5,E5, F5),
O2. present used mathematical knowledge in the historical and mathematical context (A7, B5, C7, D5, E7, F7, G7),
O3. 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),
O4. use different types and forms of communication including information and communication technology (A3,B3, C3, E7, F7),
O5. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☐ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam		Oral exam	X	Essay		Research	
Project		Continuous assessment		Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Ž. Dadić, Razvoj matematike. ideje i metode egzaktnih znanosti u njihovu povijesnom razvoju, Školska knjiga, Zagreb, 1975.	3	5
Ž. Dadić, Povijest ideja i metoda u matematici i fizici, Školska knjiga, Zagreb, 1992.	3	5
L. Hogben, Sve o matematici, Mladost, Zagreb, 1970.	2	5
Z. Šikić, Kako je stvarana novovjekovna matematika, Školska knjiga, Zagreb, 1989.	1	5

1.10. Additional reading

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. 3.V. Devide, Matematika kroz kulture i epohe, Školska knjiga, Zagreb, 1979.

J. Stillwell, Mathematics and its history, Springer Verlag, 2001.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Selected topics in teaching mathematics	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	2.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	30 + 15 + 15

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:
O1. analyse the most important documents governing the way of teaching mathematics and work related to it (A6, B5, C4, D4, E4, F5)
O2. independently create a written exam with the aim to check learning outcomes (A6, B6, C6, D6, E7, F7)
O3. evaluate the written exam in accordance with the established objective criteria for valorization of the learning outcomes (A6, B6, C6, D6, E7, F7)
O4. critically analyse relevant and recent professional literature using it independently (A6, B6, C5, D6, E5, F5)
O5. carry out a researchin task in the field of mathematics education (A7, B7, C8, D7, E7, F8)
O6. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	

Written exam		Oral exam		Essay		Research	X
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students' work will be evaluated and assessed during the semester. The total number of points that a student can achieve during classes is 100. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
e-literature available in the online course of the distance learning system		5

1.10. Additional reading

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Methodical practice in mathematics II	
Study programme	Mathematics – Teacher Training	
Course status	Compulsory	
Year	2.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	0 + 60 + 0

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 enrolment requirements

Methodology of teaching mathematics I, Methodology of teaching mathematics II

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O8. 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),

O9. 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),

O10. 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),

O11. 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),

O12. 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),

O13. 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),

O14. 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. Types of teaching (add an 'X')		
	☐ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students' work will be evaluated and assessed during the semester (e.g. preliminary exams, tests, seminars, online tests, homework etc.) The detailed elaboration of monitoring and evaluation of students' work will be described in the course curriculum.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Current textbooks in mathematics for elementary and secondary schools and teachers' manuals	20	10
Kurikulum za nastavni predmet Matematike za osnovne škole i gimnazije u Republici Hrvatskoj	https://narodne-novine.nn.hr/clanci/sluzbeni/2019_01_7_146.html	10

1.10. Additional reading

3. Popularization articles and methodological magazines
4. Professional and methodological literature

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Seminar / M.Sc. thesis	
Study programme	Mathematics - Teacher Training	
Course status	Compulsory	
Year	2.	
ECTS credits and form of instruction	ECTS credits	4
	Number of hours (L+P+S)	0 + 0 + 30

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:
O1. present mathematical concepts using teaching aids and facilities (B7, C6, D6, E6, F6),
O2. express correctly and fluently in speaking communication in the language of teaching and official language (D6),
O3. use different communication types and forms (D5),
O4. 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. Types of teaching (add an 'X')		
	☐ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☐ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam		Oral exam		Essay		Research	

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Project		Continuous assessment		Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students' work will be evaluated and assessed during the semester. The total number of points that a student can achieve during classes is 100. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
Literature for each seminar will be proposed by the mentor - proponent of the topic.		

1.10. Additional reading

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Coding theory and cryptography	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 15 + 15

COURSE DESCRIPTION

1.1. Course objectives

Main course objective is to get students acquainted with basic cryptography systems and basic methods in coding theory. For that purpose, it is necessary within the course to:

- describe, compare and apply different cryptography systems,
- analyse the basic principles of cryptanalysis,
- analyse the basic principles of coding theory,
- define, differentiate and apply coding methods,
- analyse error detection methods in coding,
- describe methods of correcting errors in coding.

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course students should be able to:

O1. differentiate and analyse cryptography systems, apply and understand adequate methods while solving problems (A7, B7, C7, D7, E5, F7, G7),

O2. analyse and differentiate different types of codes, apply and understand adequate methods while solving problems (A7, B7, C7, D7, E5, F7, G7),

O3. 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),

O4. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')							
Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
A. Dujella: Kriptografija, skripta	http://web.math.hr/~duje/kript/kriptografija.html	15
J.I. Hall, Notes on Coding Theory, 2010	http://www.math.msu.edu/~jhall/classes/codenotes/coding-notes.html)	15
Igor S. Pandžić, Alen Bažant, Željko Ilić, Zdenko Vrdoljak, Mladen Kos, Vjekoslav Sinković: Uvod u teoriju informacija i kodiranja, Element, 2009	5	15

1.10. Additional reading

1. E.F. Assmus, J.D. Key, Designs and their codes, Cambridge University Press, London, 1992.
2. A. 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 of error-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.

D. Welsh, Codes and cryptography, Oxford: Clarendon Press, 1988.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Algebra II	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:
O1. define, give examples and recognise basic algebraic structures with two operations (A7, B7),
O2. have knowledge of the concept of ring, ideal and ring homomorphism (A7, B7),
O3. have knowledge of basic theorems of polynomial theory and be able to prove them (F3, B7),
O4. have knowledge of various types of field extensions and properly apply them (A7, B7, C7),
O5. successfully solve problems of determining Galois group (A7, B7),
O6. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☐ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course	X	Activity /		Seminar		Experimental work	

attendance		Participation		paper			
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
T.W. Hungerford : Algebra, Reinhart and Winston, NY, 1989.	2	10
H. Kraljević : Algebra, Skripta za predavanja održana 2006/07 na Sveučilištu u Osijeku	https://web.math.pmf.unizg.hr/~hrk/nastava/2006-07/algebra_Osijek_2006_7.pdf	10

1.10. Additional reading

1. I.Stewart : Galois Theory, Chapmann and Hall, London, 1973.
2. B. Širola : Prsteni, polja i algebre, Skripta za Algebarske Strukture na PMF-u u Zagrebu

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Vector spaces II	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. formulate examples of topological vector spaces (A6, B6, C6, D4, E4, F3),
O2. analyse the connection between linear and topological structure (A6, B6, C6, D4, E5, F3),
O3. formulate examples of normed spaces (A6, B6, C6, D4, E4, F3),
O4. analyse local convexity, metrizability and completeness of spaces (A6, B6, C6, D4, E4, F3),
O5. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☐ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	

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Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
S.Kurepa, Funkcionalna analiza, Školska knjiga, Zagreb, 1984.	12	5

1.10. Additional reading

1. W.Rudin, Functional analysis, McGraw-Hill, 1972.
2. K.Yoshida, Functional analysis, Springer -Verlag, New York, 1985.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Harmonic analysis	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 0 + 15

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 enrolment requirements

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1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. understand and determine the properties of Hilbert spaces, analyse linear independence, orthogonality, orthonormality, completeness of the sets in them (A7, B7, C7),
O2. calculate and understand Fourier series and analyse their connection with the original functions (A7, B7, C7, F7),
O3. apply and understand the above mentioned theorems about the Banach spaces and analyse their consequences related to Fourier series (A7, B7, C7, F7),
O4. calculate and understand the Fourier transform (A7, B7, C7),
O5. analyse the inversion theorem and compare Fourier transform with the original function (A7, B7, C7, F7),
O6. analyse and apply Plancherel theorem (A7, B7, C7, F7),
O7. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☒ seminars and workshops	☒ multimedia and network

	☐ practicals ☒ distance learning ☐ field-based learning	☐ laboratory ☒ mentoring work ☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper	X	Experimental work	
Written exam	X	Oral exam		Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
W. Rudin, Real and Complex Analysis, McGraw-Hill, New York, 1987.	2	5
Anton Deitmar: A First Course in Harmonic Analysis, 2nd edition, Springer, 2005	1	5
George Bachmann, Lawrence Narici, Edward Beckenstein: Fourier and Wavelet Analysis, Springer, New York, 2000	2	5

1.10. Additional reading

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Partial differential equations	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30 + 30 + 0

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing this course, the students are expected to:

O1. analyse partial differential equations in the sense of their classifications (A7, B7, E4, F5),
O2. differentiate boundary and initial conditions (A7, B7, E4, F5),
O3. apply different theorems in analizing eliptic, hiperbolic and parabolic equations (A7, B7, E4, F5),
O4. solve Laplace equation, analyse Dirichle's and Neumann's problem and apply maximum principle (A7, B7, E4, F5),
O5. apply Poisson's formula and Green's function (A7, B7, E4, F5),
O6. solve the heat equation with different initial-boundary conditions (A7, B7, E4, F5),
O7. solve the wave equation and analyse Cauchy's problem (A7, B7, E4, F5),
O8. apply Fourier's method in solving partial differential equations (A7, B7, E4, F5),
O9. 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. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☐ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam	X	Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

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 syllabus).

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
D. Gilber, S. Trudinger: Eliptic partial differential equations of second order, Springer, 1977.	1	5
L. C. Evans: Partial Differential Equations, American Mathematical Society, 2002.	1	5
H. Levine: Partial Differential Equations, American Mathematical Society, 1997.	1	5

1.10. Additional reading

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

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Popularization of mathematics	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	3
	Number of hours (L+P+S)	15 + 15 + 0

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 enrolment requirements

/

1.3. Expected course learning outcomes

After completing the course, the students are expected to:

O1. describe and analyse the need and importance of the science popularization, especially mathematics popularization
O2. differentiate and analyse the methods for the science popularization,
O3. describe types of popularization activities and their extent, scope, advantages and disadvantages,
O4. describe the influence of public media on the promotion of scientific activities,
O5. describe and analyse the interaction between scientific institutions and the community (local government, entrepreneurship, education system, civil society, etc.),
O6. design popular science activities and create a plan for the implementation of the activities,,
O7. implement the plan and evaluate the implementation of planned activities as part of field work (e.g. Rijeka Science Festival, Mathematics Evening, Open Day, etc.).

1.4. Course content

An introduction to the popularization of science with an emphasis on the popularization of mathematics and natural sciences. Methods of popularizing science (popular science lecture, workshop for children and young people, popular science exhibition, short interactive demonstration,...). Examples of popular science activities in mathematics and natural sciences. Popular literature and scientific storytelling. Modern technology in the popularization of science. Science and the media. An interdisciplinary approach to the popularization of mathematics. Mathematics in everyday life.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☒ field-based learning	☒ other: consultation

1.6. Students' obligations

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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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an '')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	X	Continuous assessment		Report		Practice	X
Portfolio							

1.8. Assessment and evaluation of student work during classes and at the final exam

Students' work will be evaluated and assessed during the semester. The total number of points that a student can achieve during classes is 100. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
B.Jergović (ur.): Znanost i javnost, Izvori, Zagreb, 2002.	2	5
Znanstveno-popularne radio emisije «Baltazar», CD	2	5
InAMath - An interdisciplinary approach to mathematical education (mod.srce.hr platform)	open access	5

1.10. Additional reading

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. J. Walker: The Flying Circus of Physics, J.Willey and Sons, New York, 1977.
6. W.R. Wood: FUNtastic Science activities for Kids, McGrow Hill, New York, 1997.
7. Wilson, J. Gregory, S. Miller; S. Earl: Handbook of science communication, Institute of Physics Publishing, 1998

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.

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GENERAL INFORMATION		
Course coordinator		
Course title	Mathematical foundations of artificial intelligence	
Study programme	Mathematics - Teacher Training	
Course status	Elective	
Year	2.	
ECTS credits and form of instruction	ECTS credits	6
	Number of hours (L+P+S)	30+30+0

COURSE DESCRIPTION

1.1. Course objectives

The objective of this course is to get students acquainted with some some basic issues and algorithms in artificial intelligence. For this aim it is needed to:

- approach to artificial intelligence from an algorithmic, computer science perspective,
- provide some basic tools and algorithms required to produce artificial intelligence systems in the form of representing and reasoning with knowledge, planning and learning,
- introduce logic programming language associated with artificial intelligence.

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

After completing the course, students will be able to:

O1. analyse different perspectives on what are the problems of artificial intelligence, (A5, B5,C5,D3,E4,F7,G7),
O2. explain the basic knowledge representation, problem solving, and learning methods of artificial Intelligence, (A5, B5, C5, D3, E4,F7,G7),
O3. assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular problems, (A5, B5,C5,D5,E4,F7,G7),
O4. develop intelligent systems through examples of concrete computational problems, (A7, B6, C6,D5,F7,G7),
O5. design basic problem solving methods based on artificial intelligence - based search, reasoning, planning, and learning algorithms, (A7,B7,C5,D5,E4,F7,G7),
O6. describe logic programming language associated with artificial intelligence. (A5,B5,C4,E3,F4).

1.4. Course content

Perspectives and issues in artificial intelligence. History of development. Basic methods and theories. Problem solving. Knowledge representation and reasoning. Learning. Logic programming language associated with artificial intelligence.

1.5. Types of teaching (add an 'X')		
	☒ lectures	☒ independent tasks
	☐ seminars and workshops	☒ multimedia and network
	☒ practicals	☐ laboratory
	☒ distance learning	☒ mentoring work
	☐ field-based learning	☐ other _____

1.6. Students' obligations

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 syllabus).

1.7. Monitoring students' work (indicate the relevant form of monitoring by adding an 'X')

Course attendance	X	Activity / Participation		Seminar paper		Experimental work	
Written exam		Oral exam	X	Essay		Research	
Project		Continuous assessment	X	Report		Practice	
Portfolio							

1.8. Assessment and evaluation of student work during classes and at 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. A detailed elaboration of monitoring and evaluation of students' work will be described in the course syllabus.

1.9. Essential reading and the number of copies provided in relation to the current number of course participants

Title	Number of copies	Number of students
S. J. Russell, P. Norvig, Artificial Intelligence, A Modern Approach, Prentice Hall; 3rd edition, New Jersey,2010. http://aima.cs.berkeley.edu/	9	10

1.10. Additional reading

G. F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving. Addison-Wesley, 2005.

1.11. Quality monitoring methods ensuring the acquisition of expected knowledge, skills and competencies

At the end of the semester, an anonymous survey will be conducted in which students will evaluate the quality of the classes held. After the end of the semester, an analysis of the performance of the students in the exams held in that semester will be conducted.