Sveučilište u Rijeci • University of Rijeka
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COURSE CATALOGUE FOR INCOMING ERASMUS STUDENTS (IN ENGLISH)

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LIST OF MODULES/COURSES						
Semester: winter						
MODULE	COURSE	COURSE COORDINATOR	L	E	S	ECTS
	Statistics	Assist. Prof. Ivana Slamić	30	30	0	6
	Coding theory and cryptography	Assist. Prof. Marija Maksimović	30	15	15	6
	Algebra 2	Assist. Prof. Vera Tonić	30	30	0	6
	Probability theory	Assist. Prof. Danijel Krizmanić	30	30	0	6
	Artificial intelligence	Assist. Prof. Andrea Švob	30	30	0	6
	Computer-Based Math	Assoc. Prof. Bojan Crnković Assoc. Prof. Vedrana Mikulić Crnković	10	10	0	3

LIST OF MODULES/COURSES						
Semester: summer						
MODULE	COURSE	COURSE COORDINATOR	L	E	S	ECTS
	Statistics	Assist. Prof. Ivana Slamić	30	30	0	6
	Algebra 2	Assist. Prof. Vera Tonić	30	30	0	6
	Probability theory	Assist. Prof. Danijel Krizmanić	30	30	0	6
	Measure and Integral	Assist. Prof. Davor Dragičević	30	30	0	6
	Graph theory	Prof. Dean Crnković	30	15	15	6
	Computer-Based Math	Assoc. Prof. Bojan Crnković Assoc. Prof. Vedrana Mikulić Crnković	10	10	0	3

General information		
Lecturer	Assist. Prof. Ivana Slamić	
Course title	Statistics	
Program	Discrete mathematics and its applications	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students familiar with basic ideas and concepts of mathematical statistics. For that purpose, it is necessary within the course to:

- demonstrate basic ways of presentation of statistical dana,
- describe the classification of statistical variates,
- define parametres of a sequence of statistical dana,
- analyse continuous random variables and vectors that are important in statistics,
- define estimators and describe their properties,
- define confidence intervals,
- define and analyse statistical hypothesis testing,
- describe methods of hypothesis testing,
- enable students to independently use computer software for statistical data analysis.

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

- present statistical data in tabular and graphical form (A7, B7, E4, F5),
- explain the classification of statistical variables (A7, B7, E4, F5),
- analyse continuous random variables and vectors that are used in statistics (A7, B7, E4, F5),
- use and understand estimators and their properties within the specific statistical models (A7, B7, E4, F5),
- using a computer, construct confidence intervals and conduct a procedure of testing statistical hypotheses (A7, B7, E4, F5),
- using a computer, apply methods of statistical data analysis (A7, B7, E4, F5),
- mathematically prove validity of all procedures and formulas that are used within the course (A7, B7, E4, F5).

1.4. Course content

Descriptive statistics. Continuous random variables and vectors. Conditional distributions and mathematical expectation. Statistical structure. Estimations of parameters. Confidence intervals. Statistical hypothesis testing. ANOVA. Linear regression models.

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

1.7. Student requirements

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

1.8. Evaluation of assessment[1]

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

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

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

1.10. Required literature (when proposing the program)

1. Ž.Pauše, Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1993.
2. F.Daly, D.J.Hand, M.C.Jones, A.D.Lunn, K.J.McConway, Elements of Statistics, Addison Wesley, 1995.

1.11. Recommended literature (when proposing the program)

1. N.Sarapa, Vjerojatnost i statsistika, II dio, Školska knjiga, Zagreb, 1996.
2. R.C.Mittelhammer, Mathematical statistics for economics and business, Springer Verlag, New York, 1996.
3. J.E.Freund, Mathematical Statistics, Prentice Hall, New York, 1992.
4. D.Williams, Weighing the Odds, Cambridge University Press, 2001.
5. R.B.Ash, Lectures on Statistics, University of Illinois, 2007. (http://www.math.uiuc.edu/~r-ash/Stat.html)

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

Title	Number of copies	Number of students

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

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

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

General information		
Lecturer	Assist. Prof. Marija Maksimović	
Course title	Coding theory and cryptography	
Program	Discrete mathematics and its applications	
Course status	Compulsory	
Year	1.	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 15 + 15

1. COURSE DESCRIPTION

1.1. Course objectives

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 prerequisite

None.

1.3. Expected outcomes for the course

After completing this course students should be able to:

- differentiate and analyse cryptography systems and argumentedly apply adequate procedure in problem solving (A7,B7,C7,D7,E5,F7,G7),
- analyse and differentiate type codes and argumentedly apply adequate procedure in problem solving (A7,B7,C7,D7,E5,F7,G7),
- differentiate ways of detecting errors in data transfer with particular coding method and analyse the conditions under which it is possible to correct this error (A7,B7,C5,D5,E5,F5,G5),
- mathematically prove foundation of procedures and statements which they use within the course (B7, F4).

1.4. Course content

Basic terms of classical chriptography. Substitution chipers. Vigenere chiper. Playfair chiper. Hill's chiper. Enigma. History of DES. Description of the DES algorithm. Cryoanalysis DES. Some more modern block cryptosystems. The idea of a public key. RSA cryptosystem. Cryptoanalysis RSA cryptography. Other public key cryptosystems. Basic terms of coding theory. Hamming Distance. Code detection. Code correction. ISBN code. Length and weight of a code. Linear codes. Generator matrices and standard forms. Encoding. Nearest neighbour decoding. Dual code. Parity check matrix. Syndrome decoding. Finite fields. Cyclic codes. Reverse code. BCH and Reed-Solomon codes. Golay codes and perfect codes.

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

1.7. Student requirements

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

1.8. Evaluation of assessment[2]

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

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

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

1.10. Required literature (when proposing the program)

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

1.11. Recommended literature (when proposing the program)

1. Assmus, J.D. Key, Designs and their codes, Cambridge University Press, London, 1992.
2. 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.
9. D. Welsh, Codes and cryptography, Oxford: Clarendon Press, 1988.

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

Title	Number of copies	Number of students
Igor S. Pandžić, Alen Bažant, Željko Ilić, Zdenko Vrdoljak, Mladen Kos, Vjekoslav Sinković: Uvod u teoriju informacija i kodiranja, Element, 2009	2	5

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

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies
In the last week of the semester students will evaluate the quality of the lectures. At the end of each semester (March 1 and September 30 of the current academic year) results of the exams will be analyzed.

General information		
Lecturer	Assist. Prof. Vera Tonić	
Course title	Algebra 2	
Program	Discrete mathematics and its applications	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION		
1.1. Course objectives		
The main course objective is to get students acquainted with: • basic notions of ring theory, especially theory of polynomial rings, • basic notions of field theory and field extension theory, • basic notions of Galois theory.		
1.2. Course prerequisite		
None.		
1.3. Expected outcomes for the course		
After completing this course, the students are expected to: • define, give examples and recognise basic algebraic structures with two operations (A7, B7), • have knowledge of the concept of ring, ideal and ring homomorphism (A7, B7), • have knowledge of basic theorems of polynomial theory and be able to prove them (F3, B7), • have knowledge of various types of field extensions and properly apply them (A7, B7, C7), • successfully solve problems of determining Galois group (A7, B7), • have knowledge of basics of Galois theory (A7, B7).		
1.4. Course content		
Rings and ideals. Integral domains. Euclidean domains, principal ideal domains, unique factorisation domains. Polynomial rings. Field extensions (simple, algebraic, finite dimensional, normal, separable, radical). Field automorphisms and Galois groups, Galois field extensions and Fundamental Theorem of Galois theory. Splitting fields for polynomials and algebraic closure. Solvability of Galois group as a condition for solvability of an algebraic equation in radicals. Finite fields.		
1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☐multimedia and the internet ☐laboratory ☐tutorials ☐other
1.6. Comments		
1.7. Student requirements		
Students are required to attend classes and actively participate in them. They are required to achieve a certain		

number of points during the semester and to pass the final exam (details will be described in the course curriculum).number of points during the semester and to pass the final exam (details will be described in the course curriculum).number of points during the semester and to pass the final exam (details will be described in the course curriculum).

1.8. Evaluation of assessment[3]

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

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

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

1.10. Required literature (when proposing the program)

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

1.11. Recommended literature (when proposing the program)

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

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

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

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

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

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

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General information			
Lecturer	Assist. Prof. Danijel Krizmanić		
Course title	Probability theory		
Program	Discrete mathematics and its applications		
Course status	Compulsory		
Year	1		
Credit values and modes of instruction	ECTS credits / student workload	6	
	Hours (L+E+S)	30 + 30 + 0	

1. COURSE DESCRIPTION

1.1. Course objectives

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

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

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

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

1.4. Course content

Convex sets in R^n. Polyhedral sets. Gauss-Jordan method for solving system of equations. Basic linear programming problems. Fourier-Motzkin method and some graphical methods for solving linear programming problems. Simplex method. Degeneracy case. Dual simplex method. Parametric linear programming. Duality. Integer linear programming. Transportation problems. Basics of matrix game theory. Basics of convex programming.		
1.5. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work ☐practice ☐practicum	☒ independent work ☒multimedia and the internet ☐ laboratory ☐tutorials ☐consultations ☐other
1.6. Comments		
1.7. Student requirements		
Students are required to attend classes and actively participate in them. They are required to achieve a certain number of points during the semester and to pass the final exam (details will be described in the course curriculum).		
1.8. Evaluation of assessment[4]		

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

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

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

1.10. Required literature (when proposing the program)

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

1.11. Recommended literature (when proposing the program)

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

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

Title	*Number of copies*	*Number of students*

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

1.13. Quality assurance which ensure acquisition of knowledge, skills and competencies
In the last week of this course, the students will evaluate the quality of the lectures. Additionally, the analysis of the exam results will be conducted.

General information		
Lecturer	Assist. Prof. Andrea Švob	
Course title	Artificial intelligence	
Program	Discrete mathematics and its applications	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

The 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 prerequisite

None.

1.3. Expected outcomes for the course

After completing the course, students will be able to:

- analyse different perspectives on what are the problems of artificial intelligence, (A5, B5,C5,D3,E4,F7,G7),
- explain the basic knowledge representation, problem solving, and learning methods of artificial Intelligence, (A5, B5, C5, D3, E4,F7,G7),
- 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),
- develop intelligent systems through examples of concrete computational problems, (A7, B6, C6,D5,F7,G7),
- design basic problem solving methods based on artificial intelligence - based search, reasoning, planning, and learning algorithms, (A7,B7,C5,D5,E4,F7,G7),
- 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. Modes of instruction	☒lectures ☐seminars and workshops ☒exercises ☒e-learning ☐field work	☒independent work ☒multimedia and the internet ☐laboratory ☒tutorials ☐other
1.6. Comments		

1.7. Student requirements

Students are required to attend classes, actively participate in all forms of classes, earn a determined amount of points throughout semester and pass the final exam (details will be disclosed in the implementation plan of the course).

1.8. Evaluation of assessment[5]

Class attendance	1.5	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	2.1	Essay		Research work	
Project		Continuous assessment	2.4	Presentation		Practical work	
Portfolio							

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

Students' work will be evaluated and assessed during classes (e.g. exams, tests, seminars, online tests, homework, etc.) and at the final exam. The detailed elaboration of evaluating and assessing students' work will be disclosed in the implementation plan for the course.

1.10. Required literature (when proposing the program)

1. S. J. Russell, P. Norvig, Artificial Intelligence, A Modern Approach, Prentice Hall; 3rd edition, New Jersey,2010. (http://aima.cs.berkeley.edu/
2. P. Blackburn, J. Bos, K. Striegnitz: “LearnProlog Now!”, http://www.learnprolognow.org/

1.11. Recommended literature (when proposing the program)

1. G. F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving. Addison-Wesley, 2005.
2. S. Šegvić, Uvod u programski jezik Prolog, http://www.zemris.fer.hr/~ssegvic/pubs/prolog.pdf

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

Title	Number of copies	Number of students

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

Anonymous survey in which students will evaluate the quality of classes will be carried out during last week of classes. The analysis of students' success at final exams will be carried out at the end of semester.

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

General information		
Lecturer	Assist. Prof. Davor Dragičević	
Course title	Measure and Integral	
Program	Discrete mathematics and its applications	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 30 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

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

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

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing this course, the students are expected to:

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

1.4. Course content

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

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

1.7. Student requirements

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

1.8. Evaluation of assessment[6]

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

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

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

1.10. Required literature (when proposing the program)

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

1.11. Recommended literature (when proposing the program)

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

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

Title	Number of copies	Number of students

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

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

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

Sveučilište u Rijeci • University of Rijeka
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General information		
Lecturer	Prof. Dean Crnković	
Course title	Graph theory	
Program	Discrete mathematics and its applications	
Course status	Compulsory	
Year	1	
Credit values and modes of instruction	ECTS credits / student workload	6
	Hours (L+E+S)	30 + 15 + 15

1. COURSE DESCRIPTION

1.1. Course objectives

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

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

1.2. Course prerequisite

None.

1.3. Expected outcomes for the course

After completing the course, the students are expected to:

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

1.4. Course content

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

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

1.7. Student requirements

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

1.8. Evaluation of assessment[7]

Class attendance	1.5	Class participation		Seminar paper	0.7	Experiment	
Written exam	1.6	Oral exam	1.5	Essay		Research work	
Project		Continuous assessment	0.7	Presentation		Practical work	
Portfolio							

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

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

1.10. Required literature (when proposing the program)

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

1.11. Recommended literature (when proposing the program)

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

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

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

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

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

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

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General information		
Lecturer	Assoc. Prof. Bojan Crnković Assoc. Prof. Vedrana Mikulić Crnković	
Course title	Compute-Based Math	
Program		
Course status		
Year		
Credit values and modes of instruction	ECTS credits / student workload	3
	Hours (L+E+S)	10 + 10 + 0

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to get students acquainted with basic concepts in different fields of applied mathematics. For this purpose, it is necessary within the course to:
• present mathematical contents that have significant applications: introduction to differential equations, introduction to optimization, introduction to graph theory, introduction to numerical mathematics, ...
• create mathematical models of real-life situations and solve problems with the help of programming in Python,
• mentor student activities, i.e., student independent mathematical modelling and solving a given problem using a computer.

1.2. Course prerequisite

Basic knowledge in the areas of differential and integral calculus, linear algebra and programming.

1.3. Expected outcomes for the course

After completing this course, the student will be able to:

- master the fundamentals of writing Python scripts and use commands from specialized Python packages,
- use mathematical literature for independent mathematical modelling of simple problems from everyday life, from the field of technical but also social sciences,
- use the Python software package to solve the modelled problem and interpret the results.

1.4. Course content

This course will offer to students' mathematical content with strong applicability, such as introduction to differential equations, introduction to optimisation, introduction to graph theory, introduction to numerical mathematics. These methods will then be used for developing mathematical models and problem solving using a computer programme (Python).

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

1.7. Student requirements

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

1.8. Evaluation of assessment[8]							
Class attendance		Class participation	0,5	Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research work	
Project	1	Continuous assessment		Presentation		Practical work	1,5
Portfolio							

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

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

1.10. Required literature (when proposing the program)

1. Stefan Ivić, Jerko Škifić, Siniša Družeta, Bojan Crnković, Miran Tuhtan, Luka Grbčić, Ivana Hreljac, Marko Čavrak, Računarsko inženjerstvo uz programski jezik Python, online skripta
2. http://scipy-lectures.org/

1.11. Recommended literature (when proposing the program)

Python – online manuals

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

Title	Number of copies	Number of students

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

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

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