

NAZIV PREDMETA		Analiza kompleksnih mreža				
Kod	PMM502	Godina studija	2. godina diplomskog studija Statističkog smjera			
Nositelj/i predmeta	doc.dr.sc. Tanja Vojković	Bodovna vrijednost (ECTS)	5 ECTS			
Suradnici		Način izvođenja nastave (broj sati u semestru)	P	S	V	T
			30		30	
Status predmeta	obavezni	Postotak primjene e-učenja	30%			
OPIS PREDMETA						
Ciljevi predmeta	Cilj ovoga predmeta je upoznati studente s relativno novim i zahvaljujući tehnološkom napretku brzorastućim područjem kompleksnih mreža. Gradivo se uvelike oslanja na područje teorije grafova jer je kompleksna mreža u svojoj matematičkoj strukturi graf. Kolegij je koncipiran kroz predavanja, na kojima će studenti učiti o osnovnim pojmovima vezanim uz mreže i njihovu analizu te vježbe na kojima će studenti kroz rad na satu i domaće zadaće samostalno provoditi analizu raznih aspekata kompleksnih mreža, od detekcije važnih vrhova i važnih putova, do detekcije zajednica i modela širenja epidemija.					
Uvjeti za upis predmeta i ulazne kompetencije potrebne za predmet	Uvjeti: Položeni kolegiji Teorija grafova i Strukture podataka i algoritmi. Poželjno poznavanje osnova složenosti algoritama.					
Očekivani ishodi učenja na razini predmeta (4-10 ishoda učenja)	<p>Od studenata/ica se nakon što polože ovaj predmet očekuje da mogu:</p> <ul style="list-style-type: none"> - objasniti značaj kompleksnih mreža i motivaciju njihovog proučavanja - nabrojati i objasniti osnovne mjerne veličine za analizu struktura kompleksnih mreža - programirati jednostavne algoritme za analizu strukture kompleksnih mreža - objasniti proces i važnost detektiranja zajednica u mrežama te poznavati osnovne algoritme za detekciju zajednica - poznavati osnovne modele širenja epidemija u mrežama 					
Sadržaj predmeta detaljno razrađen prema satnici nastave	<ul style="list-style-type: none"> - Uvod o kompleksnim mrežama, osnovni tipovi i svojstva, klasifikacija – 2 sata - Različiti prikazi kompleksnih mreža, Laplacian, svojstvene vrijednosti – 2 sata - Vrijednosti značajne za kvantificiranje strukture kompleksnih mreža (centralnost, važnost vrhova) – 4 sata - Grupiranje vrhova (klike, jezgre, komponente, tranzitivnost, klasteriranje) – 4 sata - Podstrukture mreže (komponente, zajednice) – 3 sata - Osnovni algoritmi na mrežama (distribucija stupnjeva, najkraći putevi, nezavisni putevi, međupoloženost) – 5 sati - Složeniji algoritmi na mrežama (svojstvene vrijednosti, detektiranje zajednica, modularnost) – 5 sati - Procesi na mrežama (epidemije, SI, SIR, SIRS model) – 5 sati 					
Vrste izvođenja nastave:	Predavanja i vježbe					
Obveze studenata	Pohađanje nastave, rješavanje domaćih zadaća					

Praćenje rada studenata (<i>upisati udio u ECTS bodovima za svaku aktivnost tako da ukupni broj ECTS bodova odgovara bodovnoj vrijednosti predmeta</i>):	Pohađanje nastave: 1 ECTS Domaće zadaće: 2 ECTS Kolokviji/ pismeni: 1 ECTS Usmeni ispit: 2 ECTS		
Ocjenjivanje i vrjednovanje rada studenata tijekom nastave i na završnom ispitu	Domaće zadaće i kolokviji		
Obvezna literatura (dostupna u knjižnici i putem ostalih medija)	Naslov	Broj primjeraka u knjižnici	Dostupnost putem ostalih medija
	1. M.E.J. Newman: Networks, An Introduction, Oxford University Press, London, 2010.		
Dopunska literatura	D. Veljan: Kombinatorna i diskretna matematika A. Golemac: Teorija grafova, skripta		
Načini praćenja kvalitete koji osiguravaju stjecanje utvrđenih ishoda učenja	Statistika ispitnih rezultata i studentsko evaluiranje putem anonimne ankete na kraju izvedbe predmeta. Anketa se provodi prema pravilniku Sveučilišta u Splitu.		
Ostalo (prema mišljenju predlagatelja)			

COURSE NAME		Introduction to Mathematics			
Code		Year of study	1st undergraduate study		
Course teacher	Snježana Braić	Credits (ECTS)	8,0		
Associate teachers		Type of instruction (number of hours)	L	S	E
			45		45
Status of the course	Compulsory course	Percentage of application of e-learning	30%		
COURSE DESCRIPTION					
Course objectives	<p>Course objective is to ease the student's transition from elementary mathematical knowledge to subjects of mathematical content which will be further studied through the courses of the program.</p> <p>Students will learn the basics of mathematical language and writing. Some already acquired knowledges about sets, relations and number sets will be systematically renewed and expanded, with precise defining and writing of basic concepts. Special attention will be given to elementary functions, their definitions and properties. Students will be introduced to axiomatic foundation of the set of natural numbers, and based on that they will learn to construct the sets of whole, rational, real and</p>				

	complex numbers. More complicated proofs will be shown through basic concepts and ideas, adapted to programme for teachers.
Course enrolment requirements and entry competences required for the course	None.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	<p>Students will be able to:</p> <ul style="list-style-type: none"> - use the mathematical language and writing; build their way of mathematical thinking - accurately state the theorems and basic idea of proof - precisely write and interpret the formulas of propositional logic and first-order logic - axiomatically define the set of natural numbers, and from that construct the sets of whole, rational, real and complex numbers - use sets and relations accurately - define relations and explore its properties; recognize an equivalence relation and relations of partial and total order - categorize a function and explore its properties - list and analyze basic elementary functions and elementary functions; use this knowledge to solve practical exercises
Course content broken down in detail by weekly class schedule (syllabus)	<ul style="list-style-type: none"> - Historical development of mathematics and basic mathematical disciplines – 1 hour - The building blocks of mathematics: axioms, theorems, proofs – 4 hours - Introduction to mathematical logic – 4 hours - Naive set theory: describing a set, Boolean operations on sets, Cartesian product – 3 hours - Homogenous binary relations, equivalence relations, relations of partial order – 6 hours - Binary relations, functions – 6 hours - Basic elementary functions and elementary functions – 6 hours - Axiomatic construction of the set of natural numbers, mathematical induction, operations of addition and multiplication and their properties – 3 hours - Construction of the set of whole numbers – 2 hours - Construction of the set of rational numbers – 2 hours - Construction of the set of real numbers; properties – 5 hours - The set of complex numbers – 3 hours
Format of instruction	Lectures, exercises.
Student responsibilities	Attendance.

Screening student work (<i>name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course</i>)	Attendance – 3 ECTS Colloquium – 2 ECTS Oral exam – 3 ECTS
Grading and evaluating student work in class and at the final exam	The exam which requires solving practical and theoretical problems is taken in written form and is followed by an oral theoretical exam. A passed written exam is a prerequisite for the oral exam. The written exam can be taken partialy, in two parts, during class.
Required literature (available in the library and via other media)	<ol style="list-style-type: none"> 1. M. Klaričić Bakula, S. Braić, textbook of PMF, Split 2. B. Pavković, D. Veljan, <i>Elementarna matematika</i> 1, Školska knjiga, Zagreb, 2003. 3. B. Pavković, B. Dakić, <i>Polinomi</i>, Školska knjiga, Zagreb, 1991. 4. S. Kurepa, <i>Uvod u matematiku</i>, Tehnička knjiga, Zagreb, 1984.
Optional literature (at the time of submission of study programme proposal)	<p>D. Blanuša, <i>Viša matematika</i>, I dio, Tehnička knjiga, Zagreb, 1965</p> <p>S. Mardešić, <i>Matematička analiza</i>, 1. dio, Školska knjiga, Zagreb, 1979.</p> <p>N. J. Vilenkin, <i>Priče o skupovima</i>, Školska knjiga, Zagreb, 1975.</p> <p>S. Lipschutz, <i>Schaum's Outline of Set Theory and Related Topics</i>, McGraw-Hill, New York, 1998.</p> <p>Š. Znam i dr., <i>Pogled u povijest matematike</i>, Tehnička knjiga, Zagreb, 1989.</p>
Quality assurance methods that ensure the acquisition of exit competences	Statistics of test results and student evaluation via anonymous questionnaires at the end of the course. The survey is conducted according to the rules of the University of Split.
Other (as the proposer wishes to add)	