

1.	Course Title	Introduction to network science
2.	Code	F18L3S087
3.	Study program	Software engineering and information systems
4.	Study Program Organizer	Faculty of Computer Science and Engineering
5.	Degree (first, second, third cycle)	first cycle
6.	Academic year / semester 3 / summer / mandatory	7. ECTS credits 6
8.	Teacher	full professor Ljupcho Kocarev, assistant professor Miroslav Mirchev
9.	Course enrollment prerequisites	Веројатност и статистика или Основи на теорија на информации
10.	<p>Course program goals (competencies):</p> <p>Students will be introduced to concepts in Network Science on real data. At the end of the course the student would be able to analyze different properties and dynamical processes in real complex networks, and they would be able to model and visualize networks and dynamical processes on networks. Students throughout the course will learn the basic methods for community detection, robustness evaluation, network optimization, data mining and prediction in networks.</p>	
11.	<p>Course program content:</p> <p>Introduction to Network Science. Properties in complex and real-data networks: small-world phenomenon, node transitivity, preferential attachment. Real-data network models. Social, information, biological and technological networks. Community detection and graphlets in complex networks. Node and edge analysis of network robustness. Centrality measures and ranking algorithms. Social network paradoxes: status homophily, value homophily, social influence, external influence. Dynamical processes in complex networks: influence spreading, information and virus spreading, consensus and synchronization. Game theory in social networks: monetization in social networks, social network formation, bidding and target set selection. Multilayer and temporal complex networks: models, algorithms and dynamical processes. Flow optimization, resource distribution, packing and routing in real networks. Data mining and prediction in massive complex networks. Link and topology prediction. Prediction of the dynamical processes' outcome and traversing of complex networks..</p>	
12.	<p>Learning methods:</p> <p>Lectures using presentations, interactive lectures, exercises (using equipment and software packages), teamwork, case studies, invited guest lecturers, independent preparation and defense of a project assignment and seminar work.</p>	

13.	Total available time	6 ECTS x 30 hours = 180 hours		
14.	Distribution of the available time	30 + 45 + 15 + 15 + 75 = 180 hours		
15.	Teaching activity forms	15.1.	Lectures – theoretical teaching	30 hours
		15.2.	Exercises (laboratory, auditory), seminar papers, teamwork	45 hours
16.	Other activity forms	16.1.	Project Tasks	15 hours
		16.2.	Independent Learning Tasks	15 hours
		16.3.	Home learning	75 hours
17.	Assessment methodology			
	17.1.	Tests		10 points
	17.2.	Seminar paper/project (presentation: written and oral)		10 points
	17.3.	Activity and learning		10 points
	17.4.	Final exam		70 points
18.	Assessment criteria (points/grade)	up to 50 points		5 (five) (F)
		51 to 60 points		6 (six) (E)
		61 to 70 points		7 (seven) (D)
		71 to 80 points		8 (eight) (C)
		81 to 90 points		9 (nine) (B)
		91 to 100 points		10 (ten) (A)
19.	Course completion and final exam requirements	Realized activities 15.1 and 15.2		
20.	Teaching Language	Macedonian and English		
21.	Teaching quality evaluation method	Internal evaluation mechanisms and questionnaires		
22.	Course Material			
	22.1.	Mandatory course material		

No	Author	Title	Publisher	Year
1	Barabási, Albert-László	Network science	Cambridge university press	2016
2	Lewis, Ted G.	Network science: Theory and applications	John Wiley & Sons	2011
3	Newman, Mark	Networks: an introduction	Oxford university press	2010
4	David Easley and Jon Kleinberg	Networks, Crowds, and Markets: Reasoning About a Highly Connected World	Cambridge University Press	2010
5	Guido Caldarelli, Alessandro Chessa	Data Science and Complex Networks: Real Cases Studies with Python	Oxford University Press	2014
22.2.	Additional course material			
No.	Author	Title	Publisher	Year