

Study programme(s): Applied Mathematics (MAP)			
Course title: NETWORKS: MODELS AND ANALYSIS (P111)			
Lecturer(s): Dušan Jakovetić			
Course status: elective			
ECTS points: 5			
Requirements:			
Learning Objectives			
<ul style="list-style-type: none"> - Understanding the basic models of networks, basic metrics for analyzing networks and basic processes on networks. - Understanding the pros and cons of different mathematical network models in real applications. 			
Learning Outcomes			
The student is familiar with basic mathematical metrics and real-network models, modeling and analysis principles of real-networks, as well as relevant software packages with built-in sampling, analysis, and network modeling features.			
Syllabus			
<i>Theoretical instructions</i>			
Network metrics and notions of connectivity, density, distance, centrality, transitivity and similarity. Mathematical network models: random graphs (Erdős-Rényi, Gilbert, etc.), small-world networks (Watts-Strogatz, Kleinberg) and scale-free networks (Barabási-Albert model and modifications). Basic processes and algorithms on networks (voting/election models, virus proliferation models). Generating network models and understanding network model parameters.			
<i>Practical instructions</i>			
Introduction to relevant software packages for network analysis. Students will use built-in features for network analyzing and network sampling on a given network, as well as to generate instances of networks by various mathematical models.			
Literature			
<ol style="list-style-type: none"> 1. Albert-László Barabási, Network science, available at http://networksciencebook.com 2. E. D. Kolaczyk: Statistical Analysis of Network Data: Methods and Models, Springer, 2009 3. M. E. J. Newman: Networks - An introduction, Oxford University Press, 2010. 			
Number of active classes	Lectures: 2	Exercises: 2	
Teaching methods			
Lectures; repetition; active participation of students in problem solving. Knowledge tests, homework. Application of relevant software packages to real networks small to moderate scale from various domains.			
Grading (maximum number of points 100)			
Pre-exam obligations	Points	Final exam	Points
Homework, mini project	30	final exam	70