

Syllabus  
Applied Network Analysis  
(4 ECTS)

Professor Dmitry Zaytsev ([dzaytsev@hse.ru](mailto:dzaytsev@hse.ru), <https://www.hse.ru/en/org/persons/245076>)

International laboratory for Applied Network Research,  
School of Sociology / Department of Sociological Research Methods

## **1. Course Description**

### **a) Pre-requisites**

Basic knowledge of theories and quantitative methods of social sciences are required for this course. Also, this course requires prior knowledge in political science and political analysis and based on knowledge and competences that were provided by the disciplines: Theories and Methodology of Political Science, Quantitative methods and/or Applied Statistics. The following knowledge and competences are needed to study the discipline:

- Knowledge of political theory, methodology of political research, main directions of future development of political science research agenda, core political concepts (power, political system & regime, democracy, empire, state, civil society)
- Competences of conducting applied political analysis, using of quantitative and qualitative methods of data collection & analysis for different goals of applied political research.

### **b) Abstract**

This course is an introductory course in network analysis, designed to familiarize graduate students with the general concepts and basic techniques of network analysis in political research, gain general knowledge of major theoretical concepts and methodological techniques used in social network analysis (SNA), and get some hands-on experience of collecting, analyzing, and mapping network data with SNA software. In addition, this course will provide ample opportunities to include network concepts in students' master theses work.

## **2. Learning Objectives**

The goal of the course is to ensure that students understand topics and principles of network analysis.

The basics of this discipline should be used in the following courses and activities:

- Master thesis writing
- All other program related courses

The course is strongly related and complementary to other compulsory courses provided in the first year (e.g. Research Seminar) and sets a crucial prerequisite for later courses and research projects as well as for the master thesis. The course gives students an important foundation to develop and conduct their own research as well as to evaluate research of others.

### **3. Learning Outcomes**

As a result, students should:

- **Know:**
  - The basic principles of network analysis
  - The advantages and disadvantages of various network analytic tools and methods
  - The major network modeling programs
- **Be able to:**
  - Explore the advantages and disadvantages of various network analytic tools and methods
  - Correctly selects appropriate model / method of network analysis for a given problem
  - Confidently uses available data to test proposed network hypotheses
  - Develop a solid network theoretical foundation for the project at hand
  - Integrate network information found from various sources and compensate for lack of data by adjusting models
  - Master advanced research methods, including network methods, without direct supervision, and is capable of using these methods to analyze complex models
- **Have:**
  - The skill to process learned information, and integrate learned material into a cohesive research toolset

- The skills to express network research ideas in English in written and oral communication
- The skills to effectively present network research ideas to peers, instructors, and general audience

#### **4. Course Plan**

1. *Introduction*. Social network analysis: Methods or theory? Structural approach. Interdisciplinary interest in network analysis. Network theories most popular in social sciences. Key network concepts: network, structure, nodes, ties, sociogram, structural and compositional variables, etc. Types of network data. Sampling and data collection in network analysis.
2. *SNA methodology I*. Survey instruments for collecting network data. Network data collection and ethical issues. Basic measures of network characteristics. Graphic representation of network relations.
3. *SNA methodology II*. Network measures for dyads and triads. Identifying tightly connected groups and subgroups in social networks. Small-world phenomenon. Homophily principal in personal relationships. Cultural and historical differences in network connectivity. Personal ties and social support.
4. *SNA methodology III*. Centrality and Influence. Measures of Centrality. Two-mode networks: transformation, graphical representation, and analysis. Centrality and two-mode networks in the studies of power and influence.
5. *SNA models I*. The strength of weak ties. Social capital. Structural holes. Examples of social network analysis in political science. Political networks. Policy networks. Networks in International Relations.
6. *SNA models II*. Blockmodeling and clustering. Cluster analysis on networks. Principal component analysis.
7. *SNA models III*. Social influence model. Social selection model. Exponential random graph models (ERGM).
8. *Conclusion*. This session will bring all approaches to social network analysis together and apply it to the students' current projects.

#### **5. Reading List**

##### **a) Required**

Alhajj, Reda, and Jon Rokne. Encyclopedia of social network analysis and mining. Springer Publishing Company, Incorporated, 2018. URL <https://link.springer.com/referencework/10.1007/978-1-4939-7131-2>. Springer Link.

De Nooy, Wouter, Andrej Mrvar, and Vladimir Batagelj. Exploratory social network analysis with Pajek. Cambridge University Press, 2005. URL <https://ebookcentral.proquest.com/lib/hselibrary-ebooks/detail.action?docID=237594&query=Exploratory+social+network+analysis+with+Pajek>. Proquest.

Models and Methods in Social Network Analysis, edited by Peter J. Carrington, John Scott, and Stanley Wasserman. Cambridge University Press, 2005. ProQuest Ebook Central. URL <https://ebookcentral.proquest.com/lib/hselibrary-ebooks/detail.action?docID=228772#>. Proquest

Luke, Douglas A. A user's guide to network analysis in R. London, England: Springer, 2015. URL <https://link.springer.com/book/10.1007/978-3-319-23883-8>. Springer Link.

Kolaczyk, Eric D., and Gábor Csárdi. Statistical analysis of network data with R. Vol. 65. New York: Springer, 2014. URL <https://link.springer.com/book/10.1007/978-1-4939-0983-4>. Springer Link.

### **b) Optional**

Lazega, Emmanuel, and Tom AB Snijders, eds. Multilevel network analysis for the social sciences: theory, methods and applications. Vol. 12. Springer, 2015. URL <https://link.springer.com/book/10.1007%2F978-3-319-24520-1> Springer Link.

Kadry, Seifedine, and Mohammed Z. Al-Taie. Social Network Analysis : An Introduction with an Extensive Implementation to a Large-Scale Online Network Using Pajek, Bentham Science Publishers, 2014. ProQuest Ebook Central. URL <https://ebookcentral.proquest.com/lib/hselibrary-ebooks/detail.action?docID=1610031#>. Proquest.

Newman MEJ. Networks : An Introduction. Oxford: OUP Oxford; 2010. URL <http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=458550>. Ebsco.

## 6. Grading System

Course grades will be computed as follows:

Course Element	% Towards Final Grade
Course Project	<b>50%</b>
<i>Final Research Project</i>	50%
Participation and responsibility grade	<b>50%</b>
<i>Homework Assignments (5 x Varied points)</i>	20%
<i>In-Class Labs (9-10 x Varied points)</i>	20%
<i>Quizzes (Best 9 of 10, Varied points)</i>	10%
Extra credit	As assigned
Total	100%

### Homeworks

Homework assignments are handed out in class (during seminars) and will be available electronically. Late homeworks are not accepted. All homeworks should be submitted via LMS.

### Quizzes

Every seminar will have a quiz on the lecture material and all assigned readings for the week. This includes the very first seminar, which will focus on Lecture 1 material. All quizzes will be done online and submitted via SurveyMonkey (links will be given in class).

### In-class Labs

There will be a lab assignment in almost every seminar. Seminar labs should help with R. You can submit in-class assignment with the homework.

### Rounding and grade calculation

The final grade is an average of a cumulative grade and a final project grade. Grades earned as percentages will translate into point grades in 10% increments: 10% - 1 point. 20% - 2 points, etc. Grades will be assigned as whole grades only. Grade rounding follows the standard mathematical averaging rules: 34.9% is a 3; 34.99999% is a 3, and only 35.0% is a 4.

## 7. Examination Type

The examination for this course is an oral presentation of a final project.

Detailed information on topic presentations will be provided in class. Some example broader topics are listed below.

- The Dark Side of Social Capital
- Embeddedness and Firm's Financial Performance
- Social Capital in the Labor Market
- Homophily in Personal Ties
- Cultural Differences in Personal Networks
- Technology and Personal Networks
- Networks and Innovations
- Connections between Government and Corporations: Consequences for Democracy
- Network Analysis of International Trade Relations
- Deviant Behavior and Social Networks
- Social Networks and Crime
- Use of Social Network Analysis in Criminal Investigations
- Social Network Analysis of Social Networks
- Use of Centrality Measures in Identifying Powerful Individuals
- Graphic Representation of Network Connections
- The Role of Embeddedness in Times of Economic or Political Instability
- Small World Phenomenon
- Social Support and Health
- Are Weak Ties Always Strong?
- Social Isolation
- Current Topics in Social Network Theory
- Social Capital and Social Mobility
- Gender/Ethnic/Class Differences in Personal Networks

Students are able to choose their own topics for the final projects by notifying the teacher no later than the day of the last session,

## **8. Methods of Instruction**

Lectures, Seminars

## **9. Special Equipment and Software Support (if required)**

Classrooms for lectures on the discipline provide for the use and demonstration of thematic illustrations corresponding to the program of the discipline, consisting of:

- PC with Internet access (operating system, office software, antivirus software);
- multimedia projector with remote control.

Required software:

№	Name	Access conditions
1.	Microsoft Windows 7 Professional RUS Microsoft Windows 10 Microsoft Windows 8.1 Professional RUS	From the university's internal network (contract)
2.	Microsoft Office Professional Plus 2010	From the university's internal network (contract)
3.	R, R studio, R Markdown	From the university's internal network (contract)