SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Undergraduate**
1.6 Study programme / Qualification	**Artificial Intelligence**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	**Intelligent techniques for processing structured and large data** **Tehnici inteligente de prelucrare a datelor structurate și mari**						
2.2 Course coordinator			**Prof. dr. Camelia Chira**				
2.3 Seminar coordinator			**Prof. dr. Camelia Chira**				
2.4. Year of study	**3**	2.5 Semester	**6**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**
2.8 Code of the discipline		**MLE5210**					

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2 lab
3.4 Total hours in the curriculum	48	Of which: 3.5 course	24	3.6 seminar/laboratory	24
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					36
Additional documentation (in libraries, on electronic platforms, field documentation)					32
Preparation for seminars/labs, homework, papers, portfolios and essays					40
Tutorship					5
Evaluations					14
Other activities:					-

3.7 Total individual study hours	127
3.8 Total hours per semester	175
3.9 Number of ECTS credits	7

4. Prerequisites (if necessary)

4.1. curriculum	• Algorithms and Programming, OOP
4.2. competencies	• Good programming skills

5. Conditions (if necessary)

5.1. for the course	• Projector
5.2. for the seminar /lab activities	• Computers, Network visualization tools, Python/Java/C++ programming environment

6. Specific competencies acquired

Professional competencies	C3.4 Analysis of data and models CE1.4 Identification and explanation of Artificial Intelligence techniques and algorithms and their use for solving specific problems CE1.5 Using models and solutions from Artificial Intelligence in dedicated applications
Transversal competencies	CT1. Application of efficient work rules and responsible attitudes towards the scientific domain, for the creative exploitation of one's own potential according to the principles and rules of professional ethics CT2. Efficient conduct of activities organized in an interdisciplinary group and development of empathic capacity of interpersonal communication, networking and collaboration with diverse groups CT3. Use of efficient methods and techniques for learning, information, research and development of abilities for knowledge exploitation, for adapting to the needs of a dynamic society and for communication in a widely used foreign language.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Introduce the interdisciplinary academic field of network science and the modern theory and applications of complex networks
7.2 Specific objective of the discipline	• Describe the concepts and methods used in social network analysis, define network models (random, small-world, scale-free) and processes on networks, theory and modelling of complex networks, analysis of real-world network datasets.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Network Science and Social Networks Analysis. Real-world networks 2. Network properties and basic definitions 3. Network metrics and centrality measures 4. Random networks 5. Small world networks 6. Scale-free networks 7. Growth and preferential attachment 8. Community detection in networks 9. Spreading phenomena 10. Epidemic models over networks 11. Social networks in the real world 12. Applications	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	

Bibliography

1. Albert-Laszlo Barabasi, Network Science, Cambridge University Press, 2016.
2. Mark Newman, Networks: An Introduction, Oxford University Press, 2010.
3. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
4. Ernesto Estrada, The Structure of Complex Networks Theory and Applications, Oxford University Press, 2011.
5. Melanie Mitchell, Complexity: A Guided Tour, Oxford University Press, 2009.
6. Robert A. Hanneman, Mark Riddle. 2005. Introduction to social network methods. Riverside, CA: University of California, Riverside (published in digital form at http://faculty.ucr.edu/~hanneman)
7. D. J. Watts, P. S. Dodds, M. E. J. Newman. Identity and Search in Social Networks. Science, 296, 1302-1305, 2002.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Introduction - Data modelling. - Familiarize with the representation of networks. 2. Creation and analysis of networks - Explore network analysis tools 3. -4. Network analysis and visualization - Investigate network properties such as node degree distribution, clustering coefficient, and centrality in network datasets. - Discover ways to visualize social networks. 5. -6. Network models - Investigate network models (random	• Interactive exposure • Explanation • Conversation • Didactical demonstration	

graphs, small worlds, power-law) - Work with real-world social network data. 7 – 8. Social network analysis project I - Specify a theme for the project. - Define your own social networks from fiction and/or non-fiction. 9 – 10. Social network analysis project II - Network visualization - Explore the properties of the social networks analysed e.g. node degree distribution, clustering coefficient, centrality, communities. 11 – 12. Social network analysis project III - Analyse results - Prepare project presentation		

Bibliography

1. Albert-Laszlo Barabasi, Network Science, Cambridge University Press, 2016.
2. Mark Newman, Networks: An Introduction, Oxford University Press, 2010.
3. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
4. Ernesto Estrada, The Structure of Complex Networks Theory and Applications, Oxford University Press, 2011.
5. Jure Leskovec, Andrej Krevl, SNAP Datasets: Stanford Large Network Dataset Collection, http://snap.stanford.edu/data, 2014.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course exists in the studying program of all major universities abroad;

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Know basic concepts, models and theories from the domain of social networks; Apply known concepts to perform social network analysis	Written exam / research paper and presentation	50%
10.5 Seminar/lab activities	Specify, design, implement and test social network analysis	Project implementation and presentation	50%

	methods		

10.6 Minimum performance standards
Each student should obtain minimum 5 for the written exam /research paper and presentation, as well as for the final grade.

Date	Signature of course coordinator	Signature of seminar coordinator
26.04.2023	Prof. dr. Camelia Chira	Prof. dr. Camelia Chira

Date of approval	Signature of the head of department
.....	Prof. dr. Laura Dioşan