COURSE DESCRIPTION

General information		
Lead instructor	Associate Professor Biljana Mileva Boshkoska Associate Professor Zoran Levnajić Associate Professor Leo Mršić Associate Professor Mislav Balković Assistant Professor Drago Cmuk	
Course name	**CDS-02: Modeling, Analysis, and Learning from Data**	
Study programme	**Computer and Data Science, third cycle Doctoral Study Programme**	
Course status	Mandatory	
Year	First	
Number of credits and mode of delivery	ECTS student workload coefficient	10
	Number of hours (L+P+S)	40/-/260

Course description
1.1. Course goals
Goal of this course is for students to learn: - Data transformations and data pre-processing - Machine learning tasks. - Overview of supervised learning and main classification approaches - Overview of unsupervised learning and main clustering algorithms - Concept of semi-supervised learning - Anomaly detection - Text mining and sentiment analysis - Network analysis. Concepts of centrality and Community detection - Data visualization and the concept of 'shape' of data. - Topological data analysis - Modelling time series data - Applications of data modelling in various domain sciences (physics, biology, etc.)
1.2. Course enrolment requirements
Enrolment in the first year of studies
1.3. Intended course learning outcomes
Knowledge and understanding: The student: - becomes familiar with a vast array of methods and approaches pertaining to data science and diverse aspects of computer science

- understands the range of applications of each considered method, especially in relation to his or her doctoral research work
- understands the state-of-the-art in data and computer science methodologies and is able to propose upgrades and improvements
- has a clearer picture of what methods he or she wants to use or develop in the doctoral work

1.4. Course content

Learning unit contributes to development of the following general competencies:

- Ability to create new knowledge, which represents a contribution to science
- Mastery of standard research methods, procedures and processes in diverse scientific fields

and subject-specific competencies:

- Ability to solve concrete research problems in individual scientific fields
- Development of skills and abilities in usage of knowledge in the scientific field of doctoral dissertation
- Ability to design and implement original solutions of given scientific problems
- Ability of a complex systemic view and interdisciplinary approach, which shows as understanding of the connections between specific disciplines and subdisciplines
- Mastery of a wide range of methodological approaches from the fields of data and computer sciences and the ability to apply them
- Familiarity with realistic limitations of considered methods and skills for identification of possibilities for improvements

1.5. Modes of delivery (mark the appropriate boxes with an X)	☒ *lectures* ☐ *seminars and workshops* ☒ *practicals* ☐ *remote learning* ☐ *field work*	☒ *independent work* ☐ *multimedia and network* ☐ *laboratory* ☐ *supervision* ☐ *other* _____

1.6. Student obligations

1.7. Monitoring student work (mark the appropriate boxes with an X)

Class attendance		Participation in class		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment of knowledge		Student report		Practical work	
Portfolio		Schoolwork		Homework			

1.8. Assessment and evaluation of student work during classes and the final exam

Type (examination, oral, coursework, project):

- written exam, 100%

1.9. Required readings and number of copies relative to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Newman, M. (2018). Networks: An introduction. Oxford University Press.		
Leskovec, J., Rajaraman, A., & Ullman, J. (2022). Mining of Massive Datasets. Cambridge University Press.		
James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). An Introduction to Statistical Learning. Springer Texts in Statistics.		
1.10. Supplementary readings		
1.11. Methods of quality monitoring that ensure the acquisition of knowledge, skills and competences.		