Specification for the book of courses

Study program	Electrical Engineering and Computer Science		
Module	Computing and Informatics		
Type and level of studies	Undergraduate Academic Studies		
The name of the course	Data and Knowledge engineering		
Lecturer (for lectures)	Stoimenov V. Leonid, Stanimirović S. Aleksandar		
Lecturer/associate (for exercises)	Stanimirović S. Aleksandar, Frtunić-Gligorijević B. Milena		
Lecturer/associate (for OFE)	Frtunić-Gligorijević B. Milena		
Number of ECTS	5	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	Giving students insight into principles of data data and knowledge engineering. The aim of this course is for students to become familiar with the basics of data science and with various techniques used in data processing. Pointing out to the students the need for collecting and storing data in different organizations. The goal is for students to notice the actuality of the problem of knowledge representation and discovery and its significance inside different organiyations and institutions.		
Course outcomes	The aim of the course is for the students to be able to recognize the basic problems, possible solutions and research directions in the field of data and knowledge engineering. The student will be capable of understending the problems and need for a knowledge discovery. Also, the students will capable to use existing tools for data processing, data warehousing and knowledge discovery.		
Course outline			
Theoretical teaching	Basic concepts of data and knowledge engineering. Introduction to Data Science. Concepts, algorithms and techniques for data processing. Concepts, algorithms, techniques and systems for data storage and knowledge discovery. Traditional data warehouse models. Data Warehouse Architecture. Dimensional design. Data Warehouse implementation: data extraction, data celansing, transformation, data cube and data loading. OLAP query processing. Big Data. Big Data charactestics (4V). Modern Data Warehouse approaches. Lambda and Kappa architecture. Modern Data Warehouses models: Data Lake and Data Vault. Modern and traditional data warehouses comparison. Real time data processing (event based and micro batch processing). The Knowledge Discovery process. Knowledge discovery system architecture. Connection between Data Mining systems and Data Warehouses and OLAP systems. Data preprocessing. Data mining techniques. Classification and prediction. Regression. Cluster analysis. Data Mining Applications and modern approaches.		
Practical teaching (exercises, OFE, study and research work)	Dimensional modeling and Data Warehouse system implementation. Modern tools for creating and using Data Warehouse systems (example Pentaho). Different algorithms and approaches for knowledge discovery (example Weka Machine Learning Workbench). Designing a knowledge discovery system. Examples of knowledge discovery systems for semi-structured and unstructured data (text, multimedia data, etc.). Data processing in real time. Using modern real-time data processing environments (example Apache Spark and Apache Storm examples).		
Textbooks/references			
1	T. Connoly, C.Begg, Database Systems, A Practical Approach to Design, Implementation, and Management, 4th edition, Pearson Education Ltd, Addison Wesley, 2005		
2	W. H. Inmon, Building the Data Warehouse, 3rd Edition, Willey, 2005.		
3	R. Kimbal, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd edition, Wiley, 2013		
4	R. Sherman, Business Intelligence Guidebook: From Data Integration to Analytics, 1st edition, Morgan Kaufmann, 2014.		
5	J. Han, M. Kamber, Data Mining: Concepts and Tecniques, 3rd edition, Morgan Kaufmann, 2011		

Number of classes of active education per week during semester/trimester/year				
Lectures	**Exercises**	**OFE**	**Study and research work**	**Other classes**
2	2	1	0	0
Teaching methods	Lectures, auditory exercises, laboratory exercises. Individual work for homework and projects, student seminars (presentation of student work with discussion).			

Grade (maximum number of points 100)			
Pre-exam duties	**Points**	**Final exam**	**Points**
Activity during lectures	10	**Written exam**	
Exercises	30	**Oral exam**	30

Colloquia			
Projects	30		