

## Specification for the book of courses

|   |  |   |  |                      |
|---|--|---|--|----------------------|
| <b>Study program</b>  |  | Electrical Engineering and Computer Science     |  |                      |
| <b>Module</b>   |  | Computing and Informatics                       |  |                      |
| <b>Type and level of studies</b>  |  | Undergraduate Academic Studies                  |  |                      |
| <b>The name of the course</b>   |  | Advanced Databases                              |  |                      |
| <b>Lecturer (for lectures)</b>  |  | Stanimirović S. Aleksandar                      |  |                      |
| <b>Lecturer/associate (for exercises)</b>   |  | Stanimirović S. Aleksandar, Bogdanović D. Miloš |  |                      |
| <b>Lecturer/associate (for OFE)</b>   |  | Bogdanović D. Miloš                             |  |                      |
| <b>Number of ECTS</b>   |  | 5   | <b>Course status (obligatory/elective)</b> | Elective             |
| <b>Prerequisites</b>  |  |   |  |                      |
| <b>Course objectives</b>  |  |   |  |                      |
| Giving students insight into advanced databases and current technologies in this field. Pointing out to students current problems of using distributed databases and multilayered architectures. One of the goals is for students to recognize the actuality of the information integration problem and to show them potential solutions of this problem. The goal is also to notice basic characteristics of NoSQL databases, their purpose and ways of usage through examples.  |  |   |  |                      |
| <b>Course outcomes</b>  |  |   |  |                      |
| As the outcome of the course the student will be able to recognize the basic problems, possible solutions and directions of research in the field of advanced databases. The student will be able to define the problem of information integration, distributed systems, as well as to present the properties of other types of advanced databases. The student will be capable to understand properties of No SQL databases and to design systems based on NoSQL databases.  |  |   |  |                      |
| <b>Course outline</b>   |  |   |  |                      |
| <b>Theoretical teaching</b>   |  |   |  |                      |
| Introductory topics: traditional relational databases, transactions, ACID properties, recovery and concurrency control. Distributed databases, modern trends and problems, scalability and problems of ACID property realization in these systems. Object and object-relational databases - notion and basic principles. Databases as a part of modern Web applications. NoSQL databases: taxonomy and examples. Key-value databases: notion, basic principles and examples (Redis, Dynamo). Column store databases: notion, basic principles and examples (Google BigTable, Cassandra database). Document oriented databases: notion, basic principles and examples (MongoDB). Graph databases: notion, basic principles and examples (Neo4J). Interoperability and information integration. Mediators, data warehouses, federated databases. Semantic Web and databases - notion, basic concepts, ontologies. |  |   |  |                      |
| <b>Practical teaching (exercises, OFE, study and research)</b>  |  |   |  |                      |
| NoSQL databases: taxonomy and examples. Key-value databases: notion, basic principles and examples (Redis). Column store databases: notion, basic principles and examples (Cassandra database). Document oriented databases: notion, basic principles and examples (MongoDB). Graph databases: notion, basic principles and examples (Neo4J). RDF, OWL, SPARQL, triple store solutions.   |  |   |  |                      |
| <b>Textbooks/references</b>   |  |   |  |                      |
| 1   | R. Emasri, S. Navathe, Fundamentals of Database Systems, Addison-Wesley; 6 edition (2010), ISBN-10: 0136086209, ISBN-13: 978-0136086208                    |   |  |                      |
| 2   | T. Connolly, C.Begg, Database Systems: A Practical Approach to Design, Implementation, and Management, 5th edition, Pearson, 2009, ISBN-13: 978-0321523068 |   |  |                      |
| 3   | G. Harrison, Next Generation Databases: NoSQLand Big Data, 1st edition, Apress, 2015, ISBN-13: 978-1484213308  |   |  |                      |
| 4   | Different papers to discuss modern trends regarding database systems.  |   |  |                      |
| 5   |  |   |  |                      |
| <b>Number of classes of active education per week during semester/trimester/year</b>  |  |   |  |                      |
| <b>Lectures</b>   | <b>Exercises</b>   | <b>OFE</b>                                      | <b>Study and research work</b>             | <b>Other classes</b> |
| 2   | 2  | 1   | 0  | 0                    |
| <b>Teaching methods</b>   |  |   |  |                      |
| Lectures, auditory exercises, laboratory exercises. Individual work for homework and projects, student seminars (presentations of student work with discussion).  |  |   |  |                      |
| <b>Grade (maximum number of points 100)</b>   |  |   |  |                      |
| <b>Pre-exam duties</b>  |  | <b>Points</b>                                   | <b>Final exam</b>                          | <b>Points</b>        |
| <b>Activity during lectures</b>   |  | 10  | <b>Written exam</b>                        |                      |
| <b>Exercises</b>  |  | 30  | <b>Oral exam</b>                           | 30                   |
| <b>Colloquia</b>  |  |   |  |                      |
| <b>Projects</b>   |  | 30  |  |                      |