1. **Course title:** FUNDAMENTALS OF DATABASE SYSTEMS

2. **Course code**

3. **Validity of course description:** 2018/2019

4. **Level of studies:** BSc programme

5. **Mode of studies:** intramural studies

6. **Field of study:** COMPUTER SCIENCE (FACULTY SYMBOL)

7. **Profile of studies:** COMPUTER SCIENCE

8. **Programme:**

9. **Semester:** 4

10. **Faculty teaching the course:** Institute of Informatics, RAu2

11. **Course instructor:** Paweł Kasprowski, PhD

12. **Course classification:**

13. **Course status:** compulsory

14. **Language of instruction:** English

15. **Pre-requisite qualifications:** Theory of Computer Science

16. **Course objectives:** The purpose of the subject is to teach students how to develop and use modern database systems.

17. **Description of learning outcomes:**

<table>
<thead>
<tr>
<th>Nr</th>
<th>Learning outcomes description</th>
<th>Method of assessment</th>
<th>Teaching methods</th>
<th>Learning outcomes reference code</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Student understands relational database model and the purpose of primary keys, foreign keys and relationships.</td>
<td>exam, reports, tests</td>
<td>lecture, laboratory</td>
<td>K1A_W12, K1A_W17</td>
</tr>
<tr>
<td>W2</td>
<td>Student understands the difference between procedural language and SQL language and knows the way that SQL may be used.</td>
<td>exam, reports, tests</td>
<td>lecture, laboratory</td>
<td>K1A_W12, K1A_W15</td>
</tr>
<tr>
<td>W3</td>
<td>Student knows how DBMS security system works and how it may be configured.</td>
<td>exam, reports, tests</td>
<td>lecture, laboratory</td>
<td>K1A_W15</td>
</tr>
<tr>
<td>W4</td>
<td>Student knows the purpose of transactions in DBMS and understands isolation levels.</td>
<td>exam, reports, tests</td>
<td>lecture, laboratory</td>
<td>K1A_W15, K1A_W17</td>
</tr>
<tr>
<td>U1</td>
<td>Student has skills to prepare the database schema with normalized relations using SQL DDL language.</td>
<td>exam, reports, tests</td>
<td>lecture, laboratory</td>
<td>K1A_U27</td>
</tr>
<tr>
<td>U2</td>
<td>Student is able to prepare SQL queries retrieving data using SELECT statement as well as SQL DML queries modifying data.</td>
<td>exam, reports, tests</td>
<td>lecture, laboratory</td>
<td>K1A_U27</td>
</tr>
<tr>
<td>K1</td>
<td>Student understands why the database should be normalized.</td>
<td>exam, reports</td>
<td>lecture, laboratory</td>
<td>K1A_K01</td>
</tr>
<tr>
<td>K2</td>
<td>Student understands how the database should be used in applications and how the database should be maintained by administrators.</td>
<td>exam, reports</td>
<td>lecture, laboratory</td>
<td>K1A_K04</td>
</tr>
</tbody>
</table>

18. **Teaching modes and hours**

- Lecture / BA / MA Seminar / Class / Project / Laboratory
- Lecture 30 h., Laboratory 45h
19. Syllabus description:

Lectures:
Usage of databases – functions and architecture of Database Management System (DBMS).
Relational model – relations, relationships, keys.
Relational algebra – selections, projections, joins.
Structured Query Language (SQL) - Data Definition Language (DDL), Data Manipulation Language (DML), Data Query Language (DQL).
Searching in relational database using SELECT phrase.
Advanced searching - grouping data, aggregations, views, outer joins, nested queries, correlations.
Preserving database referential integrity - primary and foreign keys.
Security in databases - users, roles, rights.
Developing databases – functional dependencies, normal forms, ERD diagrams.
Concurrent access to databases – locks, transactions, isolation levels.
Programming in databases – stored procedures, functions, triggers.
Architectures of modern database systems – client-server and 3-tier architectures.
Fundamentals of Object-Relational Mapping
Nonrelational models - NoSQL databases, data warehouses

Laboratory:
Basic and advanced SQL language – SELECT statements
SQL DDL/DCL – preparing users, rights, preserving referential integrity
Transactions and isolation levels
Constructing triggers and stored procedures
Preparing Entity Relationship Diagrams
Fundamentals of Object-Relational Mapping
Examples of Database Management Systems and their configuration

20. Examination: after 4th semester – written exam

21. Primary sources:
C.J. Date: Database Design and Relational Theory: Normal Forms and All That Jazz (Theory in Practice)

22. Secondary sources:
B.Forta: SQL in 10 Minutes, Sams Teach Yourself
S.M. Vasilik: SQL Practice Problems: 57 beginning, intermediate, and advanced challenges for you to solve using a "learn-by-doing" approach
Internet sources presented during the lectures and laboratories
23. **Total workload required to achieve learning outcomes**

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>30/30</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>/</td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>45/45</td>
</tr>
<tr>
<td>4</td>
<td>Project</td>
<td>/</td>
</tr>
<tr>
<td>5</td>
<td>BA/ MA Seminar</td>
<td>/</td>
</tr>
<tr>
<td>6</td>
<td>Other</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td><strong>Total number of hours</strong></td>
<td><strong>75/75</strong></td>
</tr>
</tbody>
</table>

24. **Total hours:** 150

25. **Number of ECTS credits:** 6

26. **Number of ECTS credits allocated for contact hours:** 4

27. **Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):** 4

26. **Comments:**

Approved:

_____________________________  ________________________________
(date, Instructor's signature)  (date, the Director of the Faculty Unit signature)