#### card of course

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| Subject name | Graph databases |

1. The placement of the subject in the study system

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| 1.1. Field of study | Computer science |
| 1.2. Form and path of study | Full-time/Part-time |
| 1.3. Level of education | First-cycle studies |
| 1.4. Study profile | Practical |

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| 1. 5. Specialty | Databases |
| 1.6. Subject Coordinator | Dr inż. Monika Kaczorowska |

2. General characteristics of the subject

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| 2.1. Belonging to a subject group | Optional/Practical |
| 2.2. Number of ECTS | 5 |
| 2.3. Language of lectures | Polish |
| 2.4. Semesters in which the subject is taught | IV |
| 2.5.Criteria for selecting course participants | For students who have chosen the Databases specialization |

1. Learning outcomes and course delivery
   1. Subject Objectives

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| No. | Subject Objectives |
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| C1 | Learning the basics of graph mechanisms. |
| C2 | Familiarization and acquisition of practical skills in the selection of models and tools dedicated to graph databases and solving database problems in specialized software. |
| C3 | Learning the query language for graph databases. |
| C4 | Acquiring the ability to define the graph structure of a database. |
| C5 | Acquiring skills in managing data stored in a graph database. |
| C6 | Learn about typical management activities performed on a graph database. |

* 1. Subject-specific learning outcomes, divided into knowledge , skills and competences , with reference to the directional learning outcomes

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| No. | Description of subject  learning outcomes | Reference to  directional effects  learning (symbols) | Method of implementation (mark "X") | | | |
| ST | | NST | |
| Classes at the University | Activities on  the platform | Classes at the University | Activities on  the platform |
| After passing the course, the student knows and understands **the knowledge** | | | | | | |
| W1 | The student knows the types of graphs and their elements. | INF\_W02  INF\_W03 |  | X |  | X |
| W2 | The student has knowledge about the types of graph databases and the mechanisms used in them. |  | X |  | X |
| W3 | The student knows the criteria for designing graph databases and the terminology related to them. |  | X |  | X |
| W4 | The student has knowledge of the basics of programming in Python |  | X |  | X |
| After passing the course, the student is **able** to: | | | | | | |
| U1 | Define the structure of a graph database | INF\_U14 | X |  | X |  |
| U2 | Manage data stored in a graph database | X |  | X |  |
| U3 | Take advantage of multi-user access to a graph database | X |  | X |  |
| U4 | Transfer data from/to a graph database | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** | | | | | | |
| K1 | critically assess the quality of your work and search for alternative solutions in the field of graph databases | INF\_K01  INF\_K04 | X |  | X |  |
| K2 | using knowledge and skills in the field of graph databases to solve specific tasks | X |  | X |  |

3.3. Forms of teaching and their number of hours - Full-time studies (ST), Part-time studies (NST)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Path | Lecture | Exercises | Design | Workshop | Laboratory | Seminar | Lecturer | Classes conducted using distance learning methods and techniques in the form of a lecture | Other | **ECTS points** |
| **ST** |  |  |  |  | 30 |  |  | 20 |  | 5 |
| **NST** |  |  |  |  | 15 |  |  | 10 |  | 5 |

3.4. Content of education (separately for each form of classes: (W, ĆW, PROJ, WAR, LAB, LEK, OTHER). It should be marked (X) how the given content will be implemented (classes at the university or classes on the e-learning platform conducted using distance learning methods and techniques)

TYPE OF CLASS: LECTURE

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| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Python Programming Basics | W4 |  | X |  | X |
| 2. | Graph Basics | W1, W2 |  | X |  | X |
| 3. | Implementing graphs in Python using the networkx library | W1, W2, W4 |  | X |  | X |
| 4. | Graph databases as an example of non-relational databases | W1, W2, W3 |  | X |  | X |
| 5. | Creating and designing graph databases in Neo4j | W1, W2, W3 |  | X |  | X |
| 6. | Querying Graph Databases Using Cypher in Neo4j | W1, W2, W3 |  | X |  | X |
| 7. | Graph database management in Neo4j: creating users, importing, exporting data, creating backups, restoring backups | W1, W2, W3 |  | X |  | X |
| 8. | Summary of classes and discussion of grades. |  |  | X |  | X |

TYPE OF CLASS: LABORATORY

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| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Defining and modifying the graph structure of a database. | U1, U3, K1, K2 | X |  | X |  |
| 2. | Queries that select data from a graph database. | U2, U4, K1 | X |  | X |  |
| 3. | Queries manipulating data in a graph database. CRUD operations. | U2, K1 | X |  | X |  |
| 4. | Moving data from/to a graph database. | U4, K1, K2 | X |  | X |  |
| 5. | Working with multiple users in a graph database. | U3, K2 | X |  | X |  |
| 6. | Summary of classes and discussion of grades |  | X |  | X |  |

3.5. Methods of verifying learning outcomes (indication and description of methods of conducting classes and verification of achievement of learning outcomes and method of documentation)

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| Subject Effects | Teaching methods | Methods of verifying learning outcomes | Documentation methods |
| KNOWLEDGE | | | |
| W1-W4 | Lecture, multimedia presentations | Passing the lectures - exam:  Test containing a set of 14 questions - 10 closed questions, 2 points each, and 4 open questions, 5 points each = 40 points.  Grade 3 (sufficient): 21 – 24 points  Grade 3.5 (sufficient plus): 25 – 28 points  Rating 4 (good): 29 – 32 points  Rating 4.5 (good plus) 33 – 36 points  Rating 5 (very good): 37 – 40 points | Graded Test Sheet |
| SKILLS | | | |
| U1-U4 | discussion, group work, project preparation, live coding, practical tasks | Lab credit: task of designing and creating a graph database, agreed with the instructor, and then filling it with sample data. The database is then subject to data operations, as well as multi-user access. Students document in a written paper (and optional accompanying files) the scope of work and database operations performed. | Graded task |
| SOCIAL COMPETENCES | | | |
| K1-K2 | discussion, group work, project preparation | Lab credit: task of designing and creating a graph database, agreed with the instructor, and then filling it with sample data. The database is then subject to data operations, as well as multi-user access. Students document in a written paper (and optional accompanying files) the scope of work and database operations performed. | Graded task |

3.6 . Criteria for assessing the achieved learning outcomes

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| Learning effect | For a grade of 3 or "pass."  the student knows and understands/is able to/is ready to | For a grade of 3.5, the student knows and understands/is able to/is ready to | For a grade of 4, the student knows and understands/is able to/is ready to | For a grade of 4.5, the student knows and understands/is able to/is ready to | For a grade of 5, the student knows and understands/is able to/is ready to |
| W | 51-60% of knowledge indicated in learning outcomes | 61-70% of knowledge indicated in learning outcomes | 71-80% of knowledge indicated in learning outcomes | 81-90% of knowledge indicated in learning outcomes | 91-100% of knowledge indicated in learning outcomes |
| U | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |
| K | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |

3.7. Literature

**Basic**

1. Graph Databases. New Opportunities for Connected Data. 2nd Edition. Ian Robinson, Jim Webber, Emil Eifrem. O'Reilly Media, 2015.
2. Python Data Structures and Algorithms. Improve application performance with graphs, stacks, and queues. Benjamin Baka. Packt Publishing, 2017

**Supplementary**

1. Dokumentacja bazy danych neo4j: https://neo4j.com/

4. Student workload - ECTS points balance

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| --- | --- | --- |
| **Types of student activity** | **Student Load** | |
| **ST** | **NST** |
| **Classes requiring direct contact between the student and the academic teacher at the university premises** | **50** | **25** |
| Classes included in the study plan | 50 | 25 |
| **Student's own work** | **75** | **100** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 35 | 50 |
| Preparation for passing classes | 40 | 50 |
| **TOTAL STUDENT HOURLY LOAD** | **125** | **125** |
| **Number of ECTS points** | **5** | **5** |

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| Last change date | 30/09/2024 |
| The changes were introduced | INF Education Quality Team |
| The changes were approved | Arkadiusz Gwarda, M.A. |