



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Biological Database Applications

### Course

Field of study

Bioinformatics

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

5

### Lecturers

Responsible for the course/lecturer:

dr inż. Anna Leśniewska

Responsible for the course/lecturer:

Instytut Informatyki PP

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### Prerequisites

The student starting this course should have basic knowledge regarding basics of programming and operating systems.

The student should have the ability to build queries in SQL language in order to be able to communicate with the database. The student should understand the need to expand their competences and be ready to work in a team. The student should have skills that are necessary to acquire information from given sources of information. Moreover, the student should show such attitudes as honesty, responsibility, perseverance, curiosity, creativity, personal culture, and respect for other people.

### Course objective

Provide students with basic knowledge of database technology necessary for the correct design, use and implementation of database systems and application.

Develop students' skills in solving problems arising in the management of database systems.



## Course-related learning outcomes

### Knowledge

- The student has knowledge about the life cycle of database systems
- The student knows the tools and techniques in the field of data processing and analysis in databases used to solve bioinformatics tasks

### Skills

- is able to use materials in the form of literature, teaching materials and technical documentation of database systems in Polish and English
- is able to apply the known tools and techniques of advanced data analysis in the database to solve biological problems
- is able to perform research tasks under the guidance of the teacher, planning and using analytical methods on the data in the database
- is able to formulate and test hypotheses related to bioinformatics problems and verifies them during the analysis
- is able to use the acquired skills to create software, e.g. in the form of generating forms and reports, as well as software for managing and manipulating data in a database
- is able to programme in SQL and PL/SQL language

### Social competences

- is able to use his extended IT knowledge in practice by creating applications
- The concept and selection of appropriate tools in the implementation of the project affects its awareness for the decisions made
- understands that knowledge in the field of databases is changing very dynamically and systematically update your knowledge and skills is needed

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified by the test carried out during the 15 lecture, consisting of 10-15 questions (test and open), with diversified scores. Passing threshold: 50% of the total score. Topics, based on which the questions are developed, will be sent to students by university e-mail.

The skills acquired during the laboratory classes are verified on the basis of a list of grades given during the semester in the form of a weighted average (1/3 implementation of exercises in class) and preparation and presentation of a database application by the student (2/3 of the project grade).

## Programme content

Lectures cover the following topics:



- introduction to the database system and specificity of biological databases
- conceptual modeling
- relational model of data
- programming in PL/SQL language and using it in bioinformatics analysis
- user authentication methods
- principles of granting permissions and methods of authorization in the database
- index structures in databases
- algorithms for managing concurrent execution of transactions
- software interfaces
- research problems in working with biological databases
- visualization of biological data stored in a database

Laboratory exercises are a practical use of the content presented in the lecture and cover the following issues:

- SQL language for advanced bioinformatics analyzes (GROUP BY and HAVING grouping, ROLLUP and CUBE cube and semi-cube, transformation of row data to PIVOT and UNPIVOT column layout)
- programming in PL / SQL - selected elements (language concept, variables and constants, variable types, assigning values to variables, conditional statements, loops, program flow control, cursors, exceptions, stored procedures, functions and packages)
- user authentication methods
- principles of granting permissions and methods of authorizing database operations
- Indexes
- concurrency in the database (transactions, concurrent access anomalies, isolation levels, locks)
- selected software interfaces to relational databases (JDBC, JPA, PDO, R) and using it in working with biological databases
- Designing a database application in the Oracle APEX environment

### Teaching methods

1. Lecture: multimedia presentation augmented with additional examples given on the whiteboard.



2. Laboratory exercises: solving tasks, practical exercises, teamwork, multimedia presentation.

### Bibliography

#### Basic

1. Garcia-Molina H., Ullman J.D., Widom J., Implementacja systemów baz danych, WNT, 2003
2. Ullman J.D. , Widom J., Podstawowy wykład z systemów baz danych, WNT, W-wa, 2000
3. Elmasri R., Navathe S., Wprowadzenie do systemów baz danych, Helion, (4th Edition), 2005
4. Wrembel R., Wiczerzycki W., Projektowanie aplikacji baz danych Oracle. NAKOM.
5. Feuerstein S., Pribyl B., Dawes C., Język Oracle PL/SQL. Leksykon podstawowy, Helion
6. Matloff N., The Art of R Programming, No Starch Press, 2011

#### Additional

1. Braun, W., & Murdoch, D. (2007). A First Course in Statistical Programming with R. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511803642
2. Quick John M., Analiza statystyczna w środowisku R dla początkujących, Helion

### Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	65	2,5

<sup>1</sup> delete or add other activities as appropriate