National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Department of Descriptive Geometry, Engineering and Computer Graphics

SPECIAL SECTIONS OF INFORMATICS. DATABASES

Syllabus

Requisites of the Course

Cycle of Higher Education	***First cycle of higher education (Bachelor's degree)***
Field of Study	*10 Natural Sciences*
Speciality	*104 Physics and Astronomy*
Education Program	*Computer modelling of physical processes*
Type of Course	*Selective*
Mode of Studies	*full-time*
Year of studies, semester	*3 year, 5 semester*
ECTS workload	*4,5 credits (ECTS). Time allotment – 135 hours, including 36 hours of lectures, 18 hours of laboratory work*
Testing and assessment	*test*
Course Schedule	*http://rozklad.kpi.ua*
Language of Instruction	*Ukrainian*
Course Instructors	Lecturer: prof. Olena Gumen Teacher of laboratory work: prof. Olena Gumen gumens@ukr.net, viber/mob. +38(066)7442889
Access to the course	http://ng-kg.kpi.ua

Outline of the Course

1. Course description, goals, objectives, and learning outcomes

This course is aimed at familiarizing students with databases and providing a set of knowledge and skills in designing, creating databases and using them to solve problems.

As a result of studying the discipline, students acquire the following competencies:

- GC 1 Ability to abstract thinking, analysis and synthesis.
- GC 2 Ability to apply knowledge in practical situations.
- GC 3 Skills of using information and communication technologies.
- GC 4 Ability to be critical and self-critical.
- GC 5 Ability to make informed decisions.
- GC 6 Interpersonal skills.
- GC 7 Skills of performing safe activities.
- GC 8 Ability to evaluate and ensure the quality of performed works.
- GC 9 Determination and perseverance regarding the assigned tasks and assumed responsibilities.
- GC 10 Efforts to preserve the environment.
- GC 11 Ability to act socially responsibly and consciously.
- GC 12 Ability to communicate in the national language both orally and in writing.
- PC 9 Ability to work with sources of educational and scientific information.

- PC 10 Ability to study independently and acquire new knowledge in physics, astronomy and related fields.

- PC 11 A developed sense of personal responsibility for the reliability of research results and compliance with the principles of academic integrity along with professional flexibility.

- PC 14 Ability to acquire additional competencies through selective components of the educational program, self-education, non-formal and informal education.

Program learning outcomes:

- To know, understand and be able to apply at the basic level the main provisions of general and theoretical physics, in particular, classical, relativistic and quantum mechanics, molecular physics and thermodynamics, electromagnetism, wave and quantum optics, atomic and nuclear physics to establish, analyze, interpretation, explanation and classification of the essence and mechanisms of various physical phenomena and processes for solving complex specialized tasks and practical problems in physics and/or astronomy.

- To know the main current problems of modern physics and astronomy. Assess the influence of the latest discoveries on the development of modern physics and astronomy.

- To be able to present the received scientific results, participate in discussions about the content and results of one's own scientific research.

- To be able to work with modern computer technology, to be able to use standard packages of application programs and to program at a level sufficient for the implementation of numerical methods for solving physical problems, computer modeling of physical and astronomical phenomena and processes, and performing computational experiments.

- To be able to find the necessary information in printed and electronic sources, analyze, systematize, understand, interpret and use it to solve scientific and applied problems.

- To be able to speak national and foreign languages at a level sufficient for oral and written professional communication and presentation of the results of one's own research.

- Understand the basic principles of a healthy lifestyle and be able to apply them to support one's own health and work capacity.

- To be able to preserve and multiply moral, cultural and scientific values and achievements of society.

2. Prerequisites and post-requisites of the course (the place of the course in the scheme of studies in accordance with curriculum)

This discipline should use the knowledge and experience acquired during the study of the discipline "Informatics and programming".

3. Content of the course

Topic 1. Definition of the database.
Topic 2. Definition of relational databases.
Topic 3. Predecessors of relational databases.
Topic 4. Concept of primary key.
Topic 5. Examples of primary keys.
Topic 6. Relational relationships (connections) between database tables.
Topic 7. One-to-many relationship ("many-to-one").
Topic 8. One-to-one relationship.
Topic 9. Many-to-many relationship.
Topic 10. Referential integrity and cascading effects.
Topic 11. Normalization of tables during database design.

Topic 12. Concept of transactions.
Topic 13. Types of tables according to the type of data change.
Topic 14. DB architectures, functional levels.
Topic 15. Single-user architecture.
Topic 16. File-server architecture.
Topic 17. Remote databases and client-server architecture.
Topic 18. Multi-link architecture.
Topic 19. Using SQL in DELPHI databases. Definition of data. Basic DDL statements.
Topic 20. Concept of domain.
Topic 21. Basic tables. Creating a table. Primary key.
Topic 22. Selection operation - SELECT.
Topic 23. Using the WHERE clause.
Topic 24. Internal combination.
Topic 25. Use of table aliases.
Topic 26. ORDER BY clause - definition of sorting.
Topic 27. Elimination of duplicate values.
Topic 28. Calculation of the values of the resulting columns based on arithmetic expressions.
Topic 29. Aggregate functions.
Topic 30. Using groupings of records.
Topic 31. HAVING clause - imposing restrictions on the grouping of records.
Topic 32. Use of logical expressions AND, OR, NOT.
Topic 33. Comparing a column with the result of an expression calculation.
Topic 34. Use of BETWEEN.
Topic 35. Use of IN (list of values).
Topic 36. Use of LIKE.
Topic 37. Use of subqueries.
Topic 38. Use of EXISTS.
Topic 39. Use of SINGULAR.
Topic 40. Using subqueries that return multiple values (ALL, SOME, or ANY).

4. Coursebooks and teaching resources

Basic literature

1. Veres O.M., Rishniak I.V. Proektuvannia baz danykh u seredovyshchi MS Access 2010. — L.: Vydavnytstvo Lvivskoi politekhniky, 2016. — 232 s.
2. Shportko O.V. Rozrobka baz danykh v SUBD Microsoft Access: Praktykum dlia studentiv vyshchykh ta uchniv profesiino-tekhnichnykh navchalnykh zakladiv / O.V. Shportko, L.V. Shportko — K.: Vydavnychyi dim «Kondor», 2018. — 184 s.

Additional literature

3. Mary Anne Poatsy, Jerri Williams, Amy M Rutledge. Exploring Microsoft Office Access 2019 Comprehensive. — B.: Pearson, 2020. — 640 c.
4. Mary Anne Poatsy, Eric Cameron, Jerri Williams, Robert Grauer. Exploring Microsoft Office Access 2016 Comprehensive. — B.: Pearson, 2016. — 763 c.
5. Microsoft Official Academic Course Microsoft Access 2016. — H.: Wiley, 2016. — 322 c.

Educational content

5. Methodology

The planned types of training sessions are lectures and laboratory works, homework assignments.

Active and collective learning strategies are applied, which begin with the following methods and technologies:

- information and communication technologies that ensure the problem-research nature of the learning process and the activation of students' independent work;
- development and application of creative tasks based on computer and multimedia tools.

Contents of lectures

Lecture	Name of the lecture topic and list of main questions (references to the literature and tasks on the self-study)
1	*Introduction. Database definition. Relational databases.* Tasks on self-study: *Predecessors of relational databases.* Literature: [1], [2].
2	*Concept of primary key. Examples of primary keys.* Tasks on self-study*: Primary key.* Literature: [1], [2].
3	*Relational relationships between database tables. "One-to-many" relationship ("many-to-one").* Tasks on self-study: *Connections between tables.* Literature: [1], [2].
4	*"One-to-one" relationship. "Many-to-many" relationship.* Tasks on self-study: *Relational relationships.* Literature: [1], [2].
5	*Normalization of tables during database design.* Tasks on self-study: *Referential integrity and cascading effects.* Literature: [1], [2].
6	*The concept of transactions.* Tasks on self-study: *Types of tables according to the type of data change.* Literature: [1], [2].
7	*DB architectures, functional levels. Single-user architecture.* Tasks on self-study: *File-server architecture.* Literature: [1], [2].
8	*Remote databases. Multi-link architecture.* Tasks on self-study: *Client-server architecture.* Literature: [1], [2].
9	*Using SQL in DELPHI databases. Definition of data.* Tasks on self-study: *Basic DDL statements*. Literature: [1], [2].
10	*Concept of domain. Basic tables. Primary key.* Tasks on self-study: *Creating a table.* Literature: [1], [2].
11	*Selection operation - SELECT. Using the WHERE clause.* Tasks on self-study: *Internal combination.* Literature: [1], [2].
12	*Use of table aliases.* Tasks on self-study: *ORDER BY clause - definition of sorting.* Literature: [1], [2].
13	*Elimination of duplicate values.* Tasks on self-study: *Calculation of the values of the resulting columns based on arithmetic expressions.* Literature: [1], [2].
14	*Aggregate functions. Using groupings of records.* Tasks on self-study: *HAVING clause - imposing restrictions on the grouping of records.* Literature: [1], [2].
15	*Use of logical expressions AND, OR, NOT.* Tasks on self-study: *Comparing a column with the result of an expression calculation.* Literature: [1], [2].
16	*Use of BETWEEN. Use of IN (list of values).* Tasks on self-study: *Use of LIKE.* Literature: [1], [2].
17	*Subqueries. Use of EXISTS.* Tasks on self-study: *Use of SINGULAR.* Literature: [1], [2].

18	*Using subqueries that return multiple values (ALL, SOME, or ANY).* Tasks on self-study: *Use of subqueries.* Literature: [1], [2].

Contents of labs

Lab	Name of the lab subject, a list of didactic support, references to the literature and tasks on the self-study
1	*Introduction to Access. Creation of a single-table database.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Learning database methods and working with tables.*
2	*Implementation of relational communication between tables. Multi-table database.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Learning to work with a multi-table database.*
3	*Multi-table database. Implementation of control of the correctness of data entry and referential integrity.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Mastering the implementation of data entry correctness control and referential integrity.*
4	*Use of SQL. Design of basic reports.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Mastering the design of basic reports*.
5	*Use of SQL. Obtaining the resulting values using aggregate functions.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Mastering the use of aggregate functions.*
6	*Use of SQL. Subqueries.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Mastering subqueries.*
7	*Use of SQL. Data modification requests.* Didactic support: electronic course of lectures, work samples. Literature: [1], [2]. Tasks on self-study: *Learning to work with data modification requests*
8	Performance of laboratory works.
9	Test.

6. Self-study

Type of student's self-study	Number of works	Time norm for work, hours	Time limit, hours
Learning questions additional to lectures	18	1	18
Preparation for laboratory work and processing of results	7	4	28
Preparation for homework assignments	1	35	35
Total			81

Policy and Assessment

7. Course policy

The study of this academic discipline requires the student to:

- observance of educational and academic ethics;
- compliance with the schedule of the educational process;
- be balanced, attentive in classes;
- systematically study theoretical material;
- compliance with the schedule for the defense of laboratory works and homework;
- answers should demonstrate signs of independent performance of the assigned task, absence of signs of repetition and plagiarism.

The key measures of control in teaching the discipline are those points that form the student's semester rating. Therefore, students have the opportunity to quickly pass the planned laboratory works.

Attending classes is free, points for attendance at lectures and laboratory classes are not added. However, a significant part of the student's rating is formed through active participation in control measures and surveys during classes. Therefore, missing a class does not give the student the opportunity to receive the appropriate incentive points in the semester rating.

8. Monitoring and grading policy

The student's rating is calculated on a 100-point scale.

1. The student's credit module rating consists of the points received for:
   - performance and defense of laboratory works (7 works);
   - performance and defense of homework assignments.
2. Scoring criteria:
   2.1. Performance of laboratory works No. 1-No. 7:
   - impeccable preparation and performance of laboratory work - 9-10 points;
   - there are minor shortcomings in the preparation and/or performance of laboratory work - 8-7 points;
   - there are certain errors in the preparation and/or performance of laboratory work - 6 points;
   - the laboratory work is not counted (the task is not completed or there are gross errors in the preparation and/or performance of the laboratory work) - 5-0 points.
   2.2. Performing homework assignments:
   - impeccable preparation and execution of the DKR - 27-30 points;
   - there are minor shortcomings in the preparation and/or performance of the work - 23-26 points;
   - there are certain errors in the preparation and/or performance of the work - 18-22 points;
   - the work is not counted (the task is not completed or there are gross errors in the preparation and/or performance of the work) - 17-0 points.

Current control: defense of laboratory works, homework assignments.

Calendar control: carried out twice a semester as a monitoring of the current state of fulfillment of the syllabus requirements.

The condition of the first calendar control is to obtain at least 20 points and perform and defend three laboratory works. The condition of the second calendar control is obtaining at least 40 points and performing and defending six laboratory works. The condition for obtaining a credit is the completion of all laboratory work from the course and homework for at least 60 points in total.

The final performance score or the results of the Pass/Fail are adopted by KPI grading system as follows:

Score	**Grade**
100-95	*Excellent*
94-85	*Very good*
84-75	*Good*
74-65	*Satisfactory*
64-60	*Sufficient*
Below 60	*Fail*
Course requirements are not met	*Not Graded*

9. Additional information of the course

The main purpose of homework assignment is to consolidate the knowledge gained by students while studying the main part of this discipline. The individual tasks are selected in such a way that the completion of the work requires the actualization of students' knowledge both from the lecture course and obtained in the process of performing tasks in laboratory classes. The homework assignments are performed by students on the basis of the laboratory works they have completed.

Tasks of the work:

Design and create a database that will contain:

1. Hierarchy from the parent table, at least one child and two reference tables.
2. Search function using the SQL language, and perform the following tasks:

- add data;
- edit data;
- delete data;
- search according to the specified conditions.

Students should also prepare an explanatory note for the homework test, which should include the following sections:

1. Title page.
2. Contents.
3. Tasks.
4. Database scheme.
5. Theoretical information.
6. Description of database tables and relationships between them.

7. Project description.

8. Request text.

9. Image of the tables with the entered data and the result of the query.

10. List of used literature.

*Below is a **list of topics**:*

1. Relational databases.

2. Concept of primary key. Examples of primary keys.

3. Relational relationships between database tables. "One-to-many" relationship.

4. Relational relationships between database tables. "One-to-one" relationship.

5. Relational relationships between database tables. "Many-to-many" relationship.

6. Link integrity and cascading actions.

7. Normalization of tables during database design.

8. Concept of transactions. Definition of reference, operational and transactional database tables.

9. Database architectures. Local databases.

10. Database architectures. File-server architecture.

11. Database architectures. Client-server architecture.

12. Use of SQL. Definition of data.

13. Use of SQL. Selection operation SELECT.

14. Use of SQL. Operator WHERE.

15. Use of SQL. Operator WHERE: the assignment of complex search conditions.

16. Use of SQL. Use of table aliases, operator ORDER BY.

17. Use of SQL. Exclusion of repeating values, aggregate functions.

18. Use of SQL. Using record groupings.

19. Use of SQL. Operator HAVING.

20. Use of SQL. Subqueries.

Syllabus of the course is designed by prof. Olena Gumen

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