ЗАТВЕРДЖЕНО
на засіданні кафедри
інформаційних систем
Протокол № 1 від 22.08.2023 р.

ПОГОДЖЕНО
Проректор з навчально-методичної роботи

_____ Каріна НЕМАШКАЛО

БАЗИ ДАНИХ

робоча програма навчальної дисципліни (РПНД)

Галузь знань	**12 "Інформаційні технології"**
Спеціальність	**121 "Інженерія програмного забезпечення"**
Освітній рівень	**перший (бакалаврський)**
Освітні програми	**"Інженерія програмного забезпечення"**

Статус дисципліни	**обов'язкова**
Мова викладання, навчання та оцінювання	**англійська**

Розробник:
к.т.н., доцент   підписано КЕП   Володимир БРЕДІХІН

Завідувач кафедри
інформаційних систем   _____   Дмитро БОНДАРЕНКО

Гарант програми   _____   Олег ФРОЛОВ

Харків
2024

APPROVED
at the meeting of the department
information systems.
Protocol № 1 of 22.08.2023

AGREED
Vice-rector for educational and methodological
work

_____ Karina NEMASHKALO

DATABASES
Program of the course

Field of knowledge	**12 "Information technologies"**
Specialty	**121 "Software engineering"**
Study cycle	**first (undergraduate)**
Study programme	**"Software Engineering"**

Course status	**mandatory**
Language of teaching, learning and assessment	**English**

Developer:
Ph.D. (Technical sciences),   digital signature   Volodymyr BREDIKHIN
associate professor

Head of Information systems
department:
Ph.D. (Technical sciences),
associate professor   _____ Dmytro BONDARENKO

Head of Study Programme:
Ph.D. (Technical sciences),
associate professor   _____ Oleg FROLOV

Kharkiv
2024

INTRODUCTION

In the modern world, information has become one of the most important resources, and information systems have become a necessary tool in almost all spheres of activity.

Traditional information systems, which can be created and used without the use of technical means and, even more so, automated systems, complexes and devices, are used extremely rarely in modern society. The development of automated data processing systems is characterized by a change in emphasis from procedural data processing to the structure and storage of data, which leads to the need to use data banks (DB) in their framework. Data banks are becoming the most important part of information systems. Their main purpose is to provide storage and support in the integrated database (DB) system, which is a dynamic information model of the subject area, that is, some part of the real world. In this context, the course "Databases" is one of the most important. It belongs to mandatory courses and constitutes the foundation on which the design and direct creation of information systems in business is based.

In order to acquire practical competencies in the course, students must work with Visual Studio and SQL server.

The educational cours "Databases" is studied by students of the "Software Engineering" specialty of all forms of education in the second year during the fourth semester.

The purpose of teaching this educational cours is to form students a system-based basic understanding, skills and abilities in the basics of database organization as a scientific and applied cours, sufficient to obtain a basic level of work and programming in the SQL Server DBMS environment; theoretical training in the field of database design and DBMS use.

The tasks of the academic course are:

- mastering the skills of theoretical and practical preparation for working with relational databases and their management.

The object of the educational cours is database technology.

The subject of the educational cours is the study of database modeling and design.

In the process of training, students acquire the necessary knowledge during lectures and performing laboratory work. Self-studies is also of great importance in the process of studying and consolidating knowledge. All types of classes are developed in accordance with the transfer system of the organization of the educational process.

Learning outcomes and competence formed by the educational cours are defined in the table. 1.

Table 1

Learning outcomes and competencies formed by the course

Learning outcomes	Competencies
LO 10	GC5, GC6, SC1, SC2
LO 11	SC1, SC2
LO 13	SC2
LO 18	GC2, GC6, SC7, SC13
LO 21	SC7, SC10

where, LO10. Conduct a pre-design survey of the subject area, system analysis of the design object.

LO11. Select input data for design, guided by formal methods of requirements description and modelling.

LO13. Know and apply methods of developing algorithms, designing software and data and knowledge structures.

LO18. Know and be able to apply information technologies for data processing, storage and transmission.

LO21. To know, analyze, select, and competently apply information security (including cyber security) and data integrity tools in accordance with the applied tasks and software systems being developed.

GC02. Ability to apply knowledge in practical situations.

GC05. Ability to learn and master modern knowledge.

GC06. Ability to search, process and analyze information from various sources.

SC01. Ability to identify, categorize and formulate software requirements.

SC02. Ability to participate in the design of software, including modelling (formal description) of its structure, behaviour and processes of operation.

SC07. Knowledge of data information models, ability to create software for data storage, extraction and processing.

SC10. The ability to accumulate, process, and systematize professional knowledge about creating and maintaining software and recognize the importance of life long learning.

SC13. The ability to reasonably choose and master software development and maintenance tools

COURSE CONTENT

Content module I. Request languages

Topic 1. Database systems. Basic concepts and architecture. SQL and relational databases

1.1. The purpose and tasks of the course, its place in the educational process.

1.2. Basic concepts of databases.

1.3. Database architecture.

1.4. SQL and relational databases.

Topic 2. General characteristics of language means of communication with DBMS. Language DDL, SQL

2.1. Language means of communication with DBMS.

2.2. SQL language standards.

2.3. DDL SQL language.

Topic 3. The SQL DML language and an overview of its capabilities

3.1. The DML language is SQL.

3.2. Data retrieval tools.

3.3. Subqueries and their types.

3.4. Data manipulation tools.

3.5. Data presentation.

Topic 4. Peculiarities of SQL implementation in the DBMS MS SQL Server

4.1. Transact-SQL language.

4.2. Functions in Transact-SQL.

4.3. Constructs of the T-SQL language.

4.4. Working with cursors.

4.5. Stored procedures and triggers.

Content module II. Database design

Topic 5. Data models

5.1. Data modeling.

5.2. Hierarchical data model. Classification of models.

5.3. Network data model.

5.4. Basic concepts and definitions of the relational model.

5.5. Comparison of basic data models in domain modeling.

Topic 6. Relational data model

6.1. Codd's rules for relational databases.

6.2. Relational data structure.

6.3. Relational algebra

6.4. Relational computing.

Topic 7. Semantic modeling of the subject area

7.1. Model "essence - connection".

7.2. Attribute and identifier.

7.3. Connections between entities.

7.4. Types of relationships in the ER model.

Topic 8. Normalization of the relational data model

8.1. Anomalies when performing database operations.

8.2. Functional dependencies.

8.3. Normal forms and normalization of relations.

8.4. General normalization procedure.

8.5. Denormalization of relations.

Topic 9. Stages of database design. ER diagrams

9.1. Database design stages.

9.2. Basic notation for displaying ER diagrams.

9.3. ER modeling of the subject area using CASE tools.

Topic 10. Data integrity.

10.1. Constraints of integrity in the relational model.

10.2. Attribute level integrity constraints.

10.3. Tuple-level integrity constraints.

10.4. Relation level integrity constraints.

10.5. Database-level integrity constraints.

10.6. Means of ensuring data integrity in DBMS.

10.7. Support for declarative integrity constraints in SQL.

Topic 11. Transactions and data integrity. Transactions and data recovery

11.1. Concept of transaction.

11.2. Properties of transactions.

11.3. Problems of parallel operation of transactions.

11.4. Transactions and data recovery.

Topic 12. Database development technology

12.1. Stages of the life cycle of database applications.

12.2. Information and database design software.

12.3. Selection of DBMS.

12.4. Distribution of duties in DBMS.

The list of laboratory studies in the course is given in table 2.

Table 2

List of laboratory classes

Name of the topic and / or task	Content
Topic 1, 2. Task 1.	Creation and editing of database tables
Topic 3, 4. Task 2.	Construction of DML queries
Topic 5, 6. Task 3.	Study of the design features of SQL queries using the SQL Server DBMS.
Topic 7, 8. Task 4.	Normalization of relations in databases
Topic 9, 10. Task 5.	Construction of logical and physical database models by CASE tools

Topic 11, 12. Task 6.	Setting data integrity constraints

The list of self-studies in the course is given in table 3.

List of self-studies

Name of the topic and / or task	Content
Topic 1 - 12	Studying lecture material
Topic 1 - 12	Preparation for laboratory classes

The number of hours of lecture and laboratory studies and hours of self-study is given in the technological card of the course.

TEACHING METHODS

In the process of teaching an educational course, in order to acquire certain learning outcomes, to activate the educational process, it is envisaged to use such learning methods as:

Verbal (lecture (Topic 1, 2, 3, 5, 6, 7, 8, 10, 12), discussion lecture (Topic 4, 9), provocative lecture (Topic 11)).

In person (demonstration (Topic 1-12)).

Practical (laboratory work (Topic 1 - 12)).

FORMS AND METHODS OF ASSESSMENT

The University uses a 100-point cumulative system for assessing the learning outcomes of students.

Current control is carried out during lectures, laboratory classes and is aimed at checking the level of readiness of the student to perform a specific job and is evaluated by the amount of points scored:

− for courses with a form of semester control as an exam: maximum amount is 60 points; minimum amount required is 35 points.

The final control includes current control and an exam.

Semester control is carried out in the form of a semester exam.

The final grade in the course is determined:

− for course with a form of exam, the final grade is the amount of all points received during the current control and the exam grade.

During the teaching of the course, the following control measures are used:
Current control: protection of laboratory works (60 points).

More detailed information on the assessment system is provided in technological card of the course.

An example of an exam card and assessment criteria.

Semyon Kuznets Kharkiv National University of Economics
First (bachelor) level of higher education
Specialty "Software Engineering"
Educational and professional program "Software engineering"
Semester IV
Educational cours "Databases"

EXAMINATION TICKET No. 1

1. Create a database in the DBMS MS SQL Server/MySQL.
2. Create tables in the database and connect them.
3. Fill the tables with data.
4. Independently formulate a query to the database and implement it in the SQL language with the connection of two tables, with the condition of filtering and ordering.
Notes. 1. Tasks are performed in the Visual Studio environment.

Database: The information system of the assembly shop contains the following tables:
Device (Device_code, Name, Model, Release date, Manufacturer).
Node (Code, Name, Device_code, Release date, Purpose, Manufacturer, Compiler).
Details (Code, Node_code, Manufacturer, Date, Price).
Save the developed project (script) in a separate folder on the disk in the specified format.

Approved at a meeting of the "Information Systems" department
protocol No. __ of _____.2024

Chief department_____Assoc. Dmytro BONDARENKO

Examiner _____Assoc. Volodymyr BREDIKHIN

Assessment criteria

The exam ticket consists of a practical task to test knowledge of the basics of database technology related to the use of CRUD operations with any database table based on Code First technology.

The result is the solution of a stereotypical task using the specified technology in the Visual Studio environment.

The duration of the exam is 90 minutes.

The solution to the problem must contain program code; a screenshot with the code and test results of the program; database model; analysis of results; conclusions

The evaluation of the exam result is formed according to the following rule.

40 points - both tasks completed in full. Correct answers are received, there is an explanation for completing the task, conclusions are drawn. Formulated database model.

30 points - the task is completed in full. Correct answers were received, but explanations for the task and conclusions were not given. Formulated database model.

20 points - one task completed in full. Correct answers are received, there is an explanation for completing the task, conclusions are drawn. Formulated database model.

10 points - the task is not fully completed, no results were obtained, no explanations were given for the completion of the task and no conclusions. The database model is not formulated.

0 points - task not completed. The database model is not formulated.

As a result of such calculation, the applicant may receive from 0 to 40 points for two tasks on the exam.

RECOMMENDED LITERATURE

Main

1. Лосєв М. Ю. Бази даних [Електронний ресурс] : навч.-практ. посіб. для самостійної роботи студ. / М. Ю. Лосєв, В. В. Федько ; Харківський національний економічний університет ім. С. Кузнеця. – Х. : ХНЕУ ім. С. Кузнеця, 2018. – 232 с. http://repository.hneu.edu.ua/handle/123456789/21468

2. Технології баз даних [Електронний ресурс] : лабораторний практикум / В. В. Федько. – Харків : ХНЕУ ім. С. Кузнеця, 2020. – 344 с. http://repository.hneu.edu.ua/handle/123456789/24099

Additional

3. Доценко С. І. Організація та системи керування базами даних: Навч. посібник. – Харків: УкрДУЗТ, 2023. – 117 с. http://repository.hneu.edu.ua/handle/123456789/21468

4. Берко А.Ю., Верес О.М., Пасічник В.В. Системи баз даних та знань, книга 2: системи управління базами даних та знань. Навчальний посібник (рек. МОН України), – К. : Вид. Магнолія, 2021, – с.584

5. "Введення в сучасні бази даних": навч. посіб. / М.А. Демиденко; НТУ «Дніпровська політехніка». – Д. : 2020. – 38 с. https://ir.nmu.org.ua/bitstream/handle/123456789/154887/MA%20Demidenko%20INTRODUCTION%20TO%20MODERN%20DATABASES.pdf?sequence=1&isAllowed=y

Information resources

6. Visual Studio Community 2022 https://apps.microsoft.com/detail/xpdcfjdklzjlp8?hl=uk-UA&gl=IN

7. NetBeans IDE 8.2 Download : https://netbeans.org/downloads/8.2.

8. PL/SQL developer https://www.allroundautomations.com/products /pl-sql-developer/?gad_source=1&gclid=CjwKCAjwte-vBhBFEiwAQSv_xcAtW7GVbqqD0rqPhCMIIdMJNy96i9yE8zslY_elK9xb8NDueU9XBxoC5_UQAvD_BwE

9. Entity Framework Documentation Інформаційні ресурси в Інтернеті. Available at: https://docs.microsoft.com/en-us/ef/index.

10. Entity Framework 6. https://learn.microsoft.com/uk-ua/ef/ef6/.