МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ ЕКОНОМІЧНИЙ УНІВЕРСИТЕТ
ІМЕНІ СЕМЕНА КУЗНЕЦЯ

БАЗИ ДАНИХ

робоча програма навчальної дисципліни

Галузь знань	**12 "Інформаційні технології"**
Спеціальність	**усі**
Освітній рівень	**перший (бакалаврський)**
Освітня програма	**усі**

Статус дисципліни	**базова**
Мова викладання, навчання та оцінювання	**англійська**

Завідувач кафедри інформаційних систем Ірина Ушакова

Харків
2020

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

DATABASES

Syllabus of the academic discipline

Field of knowledge	**12 "Information Technology"**
Speciality	**All**
Grade level	**The first (Bachelor's level)**
Academic Program	**All**

Type of discipline	**basic**
Teaching, studying and evaluating language	**English**

Kharkiv
2020

APPROVED
at the session of the Information Systems Department.
Protocol № 1 from 20.08.2020.

Drafters:
Victor FEDKO, Candidate of Sciences, Associate Professor of the Information Systems Department

The list of renewal and re-approval of academic discipline program

Academic year	Data of the session of the Department – Drafter of SDAD	Protocol Number	Signature of Head of Department

Annotation for the academic discipline

In the modern world, information has become one of the most important resources, and information systems have become a necessary tool in almost all areas of activity. Traditional information systems that can be created and used without the use of technical means and automated systems, complexes, and devices are very rarely used 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 them in their own contour databases. Databases have become the most important part of information systems. Their main purpose is to provide storage and support in an integrated database system, which is a dynamic information model of a domain, that is, some part of the real world.

Modern economic conditions require professionals, regardless of their specialization, the comprehensive use of the latest information technology, computerized means of collecting, processing and providing the necessary information. The purpose of these technologies is to significantly improve the quality and efficiency of economic calculations, attempts to make the process of substantiation of economic decisions much more efficient, and so on. In addition, the widespread use of information technology has brought to the fore the task of creating a user-friendly interface. Leading computer companies have begun to fight for the end user of their products. In this context, the discipline of "Database" is one of the most important. It belongs to the main disciplines and is the basis on which the design and direct creation of information systems in business is based.

The Purpose of the academic discipline:

Developing students' skills in the practical application of existing database management systems; the use of effective models for providing data based on the study of the subject area, methods of analysis, search and use of existing database management systems; familiarity with existing database management systems of relational and non-relational types; providing theoretical and engineering training in the design and use of database management systems.

Characteristics of the discipline

Course	2
Semester	4
Number of ECTS credits	7
Form of final control	Exam

Structural and logical scheme of studying the discipline

Prerequisites	Postrequisites
Introduction to Computer Science	System analysis and design of information systems
Mathematical analysis	Modelling of information systems
Discrete Math	Information protection
Programming	Data Mining Databases
Algorithms and data structures	Data mining
Fundamentals of object-oriented programming	Database technologies
Operating Systems	Complex course project: Design
Complex course project: Programming	

Competence and results of studying a discipline

Competence	Learning outcomes
Ability to develop, analyze and apply effective algorithms for solving professional problems for a DBMS	Define the scope of databases
	Master the concept of non-procedural programming languages
	Perform database operations using SQL
	Perform operations with MS SQL Server database using Transact-SQL (T-SQL)
Ability to analyse subject areas (domains), formulate requirements, identify, classify and describe tasks, find methods and approaches to their solution	Use basic knowledge in the field of systems research in the management of IT projects, system modelling, system analysis of information objects, decision making
	Make an informed choice of the data model for database design
	Own the apparatus of the relational database model
	Perform database design using the ER modelling method
	Normalize the relational data model
Ability to apply modern theories of database organization, methods and technologies of their development. Ability to design logical and physical models of databases. Ability to provide data protection in information systems based on the concept of databases	Use the knowledge of theoretical and practical foundations of the methodology of systems analysis for the study of complex interdisciplinary problems of different nature, methods of formalizing systemic tasks with conflicting goals, uncertainties and risks
	Use tools to develop client-server applications, design conceptual, logical and physical models of databases, develop and optimize queries to them
	Define design integrity constraints and implement them when creating a database
	Perform operations with the database in conditions when many users access it simultaneously
	Implement database design in a given subject area
Ability to apply modern theories of database organization, methods and technologies of their development, ability to design logical and physical models of databases	Identify the areas of application of different types of databases
	Use modern database management systems and data access technologies to create data processing and analysis systems
	Identify the advantages and disadvantages of NoSQL databases
	Make informed database choices when designing a database

Program of the discipline

Content module 1. Query languages

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

1.1. The goals and tasks of the discipline, its place in the educational process.
1.2. Database and files.
1.3. The Database Management System (DBMS).
1.4. Roles in the Database Environment.
1.5. History of Database Management Systems.
1.6. SQL and relational databases.

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

2.1. Language communication with DBMS.
2.2. SQL Language Standards.
2.3. SQL DDL Language.
2.4. DDL commands for create tables.
2.5. Modifying and deleting tables.
2.6. Views.

Topic 3. DML SQL language

3.1. Data input.
3.2. Data delete.
3.3. Data change.
3.4. Data retrieval.
3.5. Join.
3.6. Aggregate functions.
3.7. Grouping results.
3.8. Subqueries.
3.9. Predicates with subqueries.

Topic 4. Features of SQL implementation in MS SQL Server DBMS

4.1. Transact-SQL language.
4.2. Batches.
4.3. Flow control.
4.4. Statement WHILE.
4.5. Cursors.
4.6. Stored procedures.
4.7. User-defined functions (UDF).
4.8. Triggers.

Content module 2. Database design

Topic 5. Data models

5.1. Data modelling.
5.2. Classification of models.
5.3. Advantages and Disadvantages of Various Data Models.
5.4. Degrees of data abstraction.

Topic 6. Relational data model

6.1. Data modelling.
6.2. Classification of models.
6.3. Advantages and Disadvantages of Various Data Models.

6.4. Degrees of data abstraction.

Topic 7. Normalization of the relational data model

7.1. Anomalies when performing operations with the database.

7.2. Functional dependencies.

7.3. Normal forms and normalization of relations.

7.4. Denormalization of relations.

Topic 8. Semantic data modelling

8.1. Model "entity - relationship".

8.2. Relationships between entities.

8.3. Attributes and keys.

8.4. Strong and weak types.

8.5. Selection of primary keys.

8.6. Extended entity-relationship modelling (EERM).

Topic 9. Stages of database design. ER charts

9.1. The stages of database design.

9.2. The main notation for representation ER-diagrams.

9.3. ER-modelling of the subject area using CASE-tools.

Topic 10. Data integrity

10.1. Integrity constraints 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. DBMS integrity tools.

10.7. Support for declarative integrity constraints in SQL.

Topic 11. Database NoSQL

11.1. Database NoSQL and their types.

11.2. Comparison of databases SQL And NoSQL.

11.3. Purpose and main properties of MongoDB databases.

11.4. MongoDB Database Design.

Topic 12. Prospects for the development of databases

12.1. Database lakes.

12.2. Data factories.

12.3. Data virtualization.

The list of laboratory classes, as well as questions and tasks for independent work is given in the table "Rating-plan of the discipline".

Teaching and learning methods

The disciplines "Databases" provide such types of classes as lectures and laboratory work. And the second type has a more significant impact on the formation of competencies in the field of Information technology.

The study of the material of the academic discipline should take place in the following order: first, master the theoretical material that is presented in the lecture, in the presentation, and also in the recommended literature. After studying the theoretical material on the topic, perform laboratory work. During work, you should pay attention to the selection of tasks.

The tasks of laboratory work should be feasible for the student to understand. To this end, each student independently chooses the level of difficulty from the following:

1) frontal;

2) individual;

3) competence.

If the frontal level is selected, the student performs the basic level task, which is described in detail in the instructions.

In order to test their strengths and increase their grades, the student can solve several other tasks, which are presented in the section "Tasks for independent implementation". It ends the description of each laboratory work. Some tasks are reproductive and others are creative.

If the student has chosen an individual level, he/she reads the instructions for the basic level task and solves a similar problem from the set of options given in the instructions. He/she can adapt to the subject area of the selected version of the problem, which are presented in the instructions, and solve them. Like the frontal level, the student can formulate and solve an original problem on the topic being studied.

The procedure of evaluation of the learning results

The system of evaluation of the developed competencies of students considers the types of occupations, which according to the curriculum program include lectures, laboratory classes, as well as independent work. Assessment of the developed competencies in students is carried out using a 100-point accumulation system. In accordance with the Provisional Regulations "On the Procedure for Assessing the Results of Students' Learning Based on the Accumulated Bulletin-Rating System" S. Kuznets KhNEU, control measures include:

current control over the semester during lectures and laboratory classes and is estimated by the sum of the points scored (the maximum amount is 60 points; the minimum amount that allows the student to take the exam – 35 points);

modular control as an intermediate test in the form of control works and aims to integrate the assessment of student learning outcomes after studying the material from the logically complete part of the discipline - the content module;

final / semester control, conducted in the form of a credit, according to the schedule of the educational process.

The procedure for carrying out the current assessment of students' knowledge. Assessment of students' knowledge during lecture and laboratory classes.

Lectures: at the end of each lecture, student write small tests. This is for 15 minutes. The test is rated at a maximum of 1.5 points.

Here is an example of such a test.

1. Describe the concept of "database".
2. Write down the Trade database creation and deletion statements.
3. Write down the statement for creating the Manufacturers (ManufacturerId, Name, Address, Telephone) table.

Laboratory work: the defence of each laboratory work is estimated at a maximum of 5 points. It is calculated as follows. If the front level is selected, the student receives 3 points for its performance. For the correct decision of each reproductive task 0,1 more points are added, and competence – to 2 points. To the received sum of points the student can add 1 more point if independently suggests and solves an original problem on a subject studied. This task should be from the subject area of study or the future profession of the student. The overall score at this level does not exceed four points. For such an individual task the student receives 3 points. He can get another 1 point if he adapts the tasks presented in the instructions to the subject area of the selected variant and solves them. Similar to the frontal level, a student can add another 1 point to the amount of points obtained if he formulates and solves an original problem on the topic being studied.

Final control: a student can receive a maximum of 40 points for successfully passing the exam.

Below is an example of an exam ticket.

The Hotel database contains the following tables:
Clients (ClientId, Surname, Name, Patronymic, Passport data, Comment).
Rooms (RoomId, Room, Number of seats, Comfort, Price).
Settlement (SettlementId, ClientId, RoomId, Settlement date, Release date, Note).
For a given database you need:
1. Provide conditions for maintaining integrity in the database of the following levels:
    1.1. (1) attribute;
    1.2. (1) the motorcade;
    1.3. (1) relationship;
    1.4. (1) databases.
2. (8) Build a logical ER-model (IDEF1X notation).
3. (1) Create a database in the database of MS SQL Server as an mdf-file.
4. (9) Create tables in the database and merge them.
5. (9) Fill in the tables with the data of the control example.
6. (9) Independently formulate a query to the database and implement it in SQL with the connection of two tables, with the condition of filtering and ordering.

Notes 1. Tasks are performed in Visual Studio and ERWin environments, and the results are formatted in Word according to the template provided in the file Answer Form.docx.
2. Before each task in parentheses indicates the maximum number of points that can be obtained for a properly completed and designed task.

The number of points for individual components can be reduced under the following conditions:

1. The given conditions of integrity do not correspond to the specified level – 1 point per level.
2. Used incorrect type of relationship between tables – 2 points.
3. Used the wrong data type – 1 point.
4. The table is filled with the data of the control example, which does not correspond to the real subject area – 1 point per table.
5. When independently formulating a query, the task does not correspond to the real subject area –2 points, as well as if there are errors in the script that implements the formulated task – 1 point per error.

The final score in the discipline is calculated on the basis of the points obtained during the exam and the points obtained during the current control over the accumulation system. The total score in the points for a semester is: "60 and more points -" enrolled "," 59 and less points - not taken into account "and entered in the" Record of success "of the academic discipline.

The final grade is set according to the scale given in the table "Grade scale: national and ECTS".

Forms of assessment and distribution of points are given in the table "Rating-plan of the discipline".

Scale: national and ECTS

The amount of points for all types of educational activities	Rating ECTS	Score on a national scale	
		for exam, course project (work), practice	for the offset
90 – 100	A	perfectly	Accepted
82 – 89	B	well	
74 – 81	C		
64 – 73	D	satisfactorily	
60 – 63	E		
35 – 59	FX	unsatisfactorily	Not accepted
1 – 34	F		

Rating plan of the academic discipline

Topic	Forms and types of education		Forms of evaluation	Max point
Topic 1.	***Classroom work***			
	Lecture	Introduction. Database systems. Basic concepts and architecture. SQL and relational databases	Test	1,5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic		
Topic 2.	***Classroom work***			
	Lecture	General characteristics of linguistic means of communication with DBMS. DDL SQL language	Test	1,5
	Laboratory classes	Laboratory work 1. Creating a database and tables in SQL Server	Report	5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks		
Topic 3.	***Classroom work***			
	Lecture	DML SQL language	Test	1,5
	Laboratory classes	Laboratory work 2. Building DML queries	Report	5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks		
Topic 4	***Classroom work***			
	Lecture	Features of SQL implementation in MS SQL Server DBMS	Test	1,5

	Laboratory classes	Laboratory work 3. Exploring the design features of SQL queries using SQL Server DBMS	Report	5
		Control work 1	Test	3,5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks. Preparation for control work		
Topic 5.	***Classroom work***			
	Lecture	Data models	Test	1,5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic		
Topic 6.	***Classroom work***			
	Lecture	Relational data model	Test	1,5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic		
Topic 7.	***Classroom work***			
	Lecture	Normalization of the relational data model	Test	1,5
	Laboratory classes	Laboratory work 4. Normalization of relationships in databases	Report	5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks		
Topic 8.	***Classroom work***			
	Lecture	Semantic data modelling	Test	1,5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic		
Topic 9.	***Classroom work***			
	Lecture	Stages of database design. ER charts	Test	1,5
	Laboratory classes	Laboratory work 5. Building a logical and physical database model by CASE tools	Report	5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks		
Top i:	***Classroom work***			
	Lecture	Data integrity	Test	1,5

	Laboratory classes	Laboratory work 6. Setting data integrity constraints	Report	5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks		
Topic 11.	***Classroom work***			
	Lecture	Database NoSQL	Test	1,5
	Laboratory classes	Laboratory work 7. Performing CRUD operations in the MongoDB database	Report	5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Execution of laboratory work tasks		
Topic 12.	***Classroom work***			
	Lecture	Prospects for the development of databases	Test	1,5
	Laboratory classes	Control work 2	Test	3,5
	Individual work			
	Questions and tasks for self-study	Search, selection and review of literary sources on a given topic. Preparation for control work		
Exam				40

Recommended Books

Main

1. Database Systems: Design, Implementation, and Management. 13th Edition / Carlos Coronel, Steven Morris. – Cengage Learning, Inc., 2017. – 837 p.

2. Database Systems: A Practical Approach to Design, Implementation, and Management. Sixth Edition / Thomas Connolly, Carolyn Begg. – Pearson, 2015. – 1442 p.

3. Fundamentals of Database Systems. Seventh edition / Ramez Elmasri, Shamkant B. Navathe. – Pearson, 2016. – 1273 p.

Additional

4. T-SQL fundamentals. Third edition / Itzik Ben-Gan. – Microsoft Press, 2016. – 1361 p.

5. Hands-on database: An introduction to database design and development / Steve Conger. – Pearson Education, Inc., 2012. – 214 p.

6. The New Relational Database Dictionary / C. J. Date. – O'Reilly Media, Inc., 2016. – 452 p.

Information resources of the Internet

7. SQLServerCentral. [Electronic resource]. – Access mode : http://www.sqlservercentral.com/.

8. MSSQLTips. [Electronic resource]. – Access mode : https://www.mssqltips.com/.

9. Oracle Database. [Electronic resource]. – Access mode : https://www.oracle.com/database/index.html.

10. MongoDB. [Electronic resource]. – Access mode : https://www.mongodb.com/.

11. Databases. [Electronic resource]. – Access mode : https://pns.hneu.edu.ua/course/view.php?id=6072