

DESIGN AND DEVELOPMENT OF DATABASES

COURSE SYLLABUS

Code and name of specialty	121 Software Engineering	Institute / faculty	Faculty of Computer Science and Software Engineering
Program name	“Software Engineering”	Department	Software Engineering and Management Information Technologies
Type of program	Educational and Professional	Language of instruction	Ukrainian, English

LECTURER

Full name, e-mail

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Ph.D., Associate Professor at the Department of Software Engineering and Management Information Technologies of NTU «KhPI». Prepared and published more than 60 research papers and textbooks (Google Scholar: <https://scholar.google.com/citations?user=B8fggLEAAAJ>; ORCID: <https://orcid.org/0000-0002-3189-5623>; Scopus: <https://www2.scopus.com/authid/detail.uri?authorid=57202887287>; Publons: <https://publons.com/researcher/2967953/andrii-kopp/>).

Leading lecturer of courses: *Data Models and Structures (in Ukrainian and English), Design and Development of Databases (in Ukrainian and English).*

GENERAL DESCRIPTION OF THE COURSE

Summary	The course “Design and Development of Databases” is a course in the cycle of professional compulsory training of the specialty 121 “Software Engineering”. It is taught in the fourth semester in the amount of 90 hours (3 ECTS credits), in particular: lectures – 32 hours, laboratory classes – 32 hours, independent work – 26 hours. Course works are considered as individual tasks. The study of the discipline ends with the exam.
Course objectives	Formation of students’ theoretical and practical knowledge necessary for the design and development of databases (DB) in solving problems related to the development, maintenance and quality assurance of software
Types of classes and control	Lectures, laboratory classes. Continuous assessment – laboratory works, intermediate modular assessment, course work. Final assessment – exam.
Term	4

Student workload (credits) / Type of course

3 / Mandatory

Lectures (hours)

32

Laboratory classes (hours)

32

Self-study (hours)

26

Program competences

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.
 PC13. Ability to identify, classify and formulate software requirements.
 PC14. Ability to participate in software design, including modelling (formal description) of its structure, behavior and functioning processes.
 PC15. Ability to develop architectures, modules and components of software systems.
 PC19. Knowledge of information data models, the ability to create software for data storage, retrieval and processing.
 PC25. Ability to reasonably select and master software development and maintenance tools.

Learning outcomes

Teaching and learning methods

Forms of assessment

		(continuous assessment CAS, final assessment FAS)
<p>PLO01. Analyze, purposefully search for and select the necessary information and reference resources and knowledge to solve professional problems, taking into account modern advances in science and technology.</p> <p>PLO07. Know and apply in practice the fundamental concepts, paradigms and basic principles of operation of language, tools and computing software engineering.</p> <p>PLO10. Conduct a pre-project survey of the subject area, systematic analysis of the design object.</p> <p>PLO12. Put effective approaches to software design into practice.</p> <p>PLO13. Know and apply methods of algorithm development, software design and data and knowledge structures.</p> <p>PLO14. Put into practice the tools of domain analysis, design, testing, visualization, measurement and documentation of software.</p> <p>PLO18. Know and be able to apply information technology processing, storage and transmission of data.</p> <p>PLO21. Know, analyze, select, skillfully apply the means of information security (including cybersecurity) and data integrity in accordance with the applied tasks and software systems.</p> <p>PLO23. Be able to document and present the results of software development.</p>	<p>Interactive lectures with presentations, discussions, laboratory classes, teamwork, case method, student feedback method, problem-based learning</p>	<p>Written individual assignments for laboratory works (CAS), assessment of knowledge in laboratory classes (CAS), express surveys (CAS), online tests (CAS), final/semester control in the form of a semester exam, according to the schedule of the educational process (FAS)</p>

ASSESSMENT AND GRADING

Range s of points corres pondi ng to grades	core (points) for all types of learning activities	ECTS grading scale	The national grading scale	Allocation of grade points
	90-100	A	excellent	
82-89	B	good		
74-81	C	satisfactory		
64-73	D			
60-63	E	Unsatisfactory (with the exam retake option)		
35-59	FX			
0-34	F	Unsatisfactory (with mandatory repetition of the course)		

Laboratory work №5 (3%)
 Laboratory work №6 (3%)
 Laboratory work №7 (3%)
 Laboratory work №8 (1%)
 Laboratory work №9 (1%)
 Laboratory work №10 (1%)
 Laboratory work №11 (3%)
 Course work (35%)

Course policy

Students must attend all classes according to the study schedule and adhere to the norms of academic ethics. To study the course, students need to have their personal computer and (or) use computers of the computer center at the department. Students must work with compulsory and recommended reading, including Internet resources. Students must complete and submit all laboratory works during the semester in which the course is taught, before the examination session. The final assessment is not carried out without the personal presence of students.

COURSE STRUCTURE AND CONTENT

Topic 1	Client-server DBMS architecture <i>Innovation Campus: WebFullstack-Sprint08, WebFullstack-chronos</i>	Laboratory work 1	Learning essentials of work with client-server DBMS.	Self-study	DBMS components. Database Manager (DM) components.	
	Topic 2	Database design <i>Innovation Campus: WebFullstack-Sprint08, WebFullstack-chronos</i>	Laboratory work 2		Domain analysis, formulation of the business rules system, and their translation into the database structure.	ER diagram development.
	Topic 3	Creating a database using SQL language <i>Innovation Campus:</i>	Laboratory work 3		Creating a database using SQL language (on the example of MySQL).	UNIQUE and INDEX indexes in MySQL. DDL tools in Microsoft SQL Server, PostgreSQL and Oracle DBMS.
		Laboratory work 4	Data manipulation with SQL language tools: adding, updating and deleting data (on the example of MySQL).			

	<i>WebFullstack-Sprint08</i>	Laboratory work 5	Data manipulation with SQL language tools: SELECT queries and their main features (on the example of MySQL).	
Topic 4	Implementation of business logic in the database <i>Innovation Campus: WebFullstack-Sprint08, DB-Sprint02, DB-Sprint07</i>	Laboratory work 6	Creating and using views (on the example of MySQL).	Create, delete, modify and work with functions in MySQL. Built-in functions. Business logic objects in Microsoft SQL Server, PostgreSQL, and Oracle.
		Laboratory work 7	Creating and using stored procedures and triggers (on the example of MySQL).	
Topic 5	Integrity. Transactions. Users <i>Innovation Campus: WebFullstack-Sprint08, DB-Sprint02, DB-Sprint08</i>	Laboratory work 8	Basics of using data integrity controls (on the example of MySQL).	ACID requirements. Dirty reading, non-repeatable reading, phantom reading. Transaction isolation levels in MySQL. Work with transactions and users in Microsoft SQL Server, PostgreSQL and Oracle.
		Laboratory work 9	Working with transactions (on the example of MySQL).	
		Laboratory work 10	User rights management (on the example of MySQL).	
Topic 6	Building applications to work with the database <i>Innovation Campus: WebFullstack-Sprint08, WebFullstack-chronos, WebFullstack-uevent, WebFullstack-webster, DB-</i>	Laboratory work 11	Development of software application (PHP mysqli library, PHP Data Objects (PDO) framework, Java JDBC library, technologies from the unit of self-study) for working with the database (on the example of MySQL).	Python PyMySQL library for working with MySQL databases. Using ADO.NET and C # to develop software application for DBMS. Creating software for working with databases in DBMS Microsoft SQL Server, PostgreSQL and Oracle. Creating software to work with NoSQL DBMS on the example of MongoDB.

RECOMMENDED READING

Compulsory

1. Saurabh Shrivastava, Neelanjali Srivastav. (2020). Solutions Architect's Handbook: Kick-start your solutions architect career by learning architecture design principles and strategies. Packt Publishing Ltd.
2. Alan Dennis, Barbara Haley Wixom, Roberta M. Roth. (2019). Systems Analysis and Design. John Wiley & Sons.
3. Gladys S.W. Lam. (2020). Business Rules: Management and Execution. Future Strategies Inc.
4. Preston Zhang. (2017). Practical Guide for Oracle SQL, T-SQL and MySQL. CRC Press.
5. Ryan Turner. (2020). SQL: The Ultimate Intermediate Guide to Learn SQL Programming Step by Step. Publishing Factory.
6. Chintan Mehta. (2018). MySQL 8 Administrator's Guide: Effective guide to administering high-performance MySQL 8 solutions. Packt Publishing Ltd.
7. Adrian W. West, Steve Prettyman. (2018). Practical PHP 7, MySQL 8 and MariaDB Website Databases: A Simplified Approach to Developing Database-Driven Websites. Apress.
8. Karthik, P. (2019). Web Applications using JSP (Java Server Page): Develop a fully functional web application. BPB Publications.
9. Berko, A. Yu., Veres, O.M., Pasichnyk, V. V. (2006). Database and knowledge systems. Book 2: Database and knowledge management systems: textbook. Magnolia.
10. Mulesa, O. Yu. (2018). Information systems and relational databases: Electronic edition.
11. Khairova, N. F., Petrasova, S. V. (2019). Methodical instructions for laboratory work on the course "Modern technologies for the development of Internet applications": for students. special "Applied and Computational Linguistics". Kharkiv: NTU "KhPI".
12. Khairova, N. F., Petrasova, S. V. (2020). Modern technologies of Web-programming: textbook. manual. Kharkiv: Panov AM.

Recommended

13. Mukesh Negi. (2019). Fundamentals of Database Management System: Learn essential concepts of database systems. BPB Publications.
14. Lisa Friedrichsen. (2020). Concepts of Database Management. Cengage Learning.
15. Rex Hogan. (2018). A Practical Guide to Database Design. CRC Press.
16. Jesper Wisborg Krogh. (2020). MySQL 8 Query Performance Tuning: A Systematic Method for Improving Execution Speeds. Apress.
17. Ashwin Pajankar. (2020). Learn SQL with MySQL: Retrieve and Manipulate Data Using SQL Commands with Ease. BPB Publications.
18. Karthik Appigatla. (2018). MySQL 8 Cookbook: Over 150 recipes for high-performance database querying and administration. Packt Publishing Ltd.
19. Malhar Lathkar. (2019). Python Data Persistence: With SQL and NOSQL Databases. BPB Publications.
20. Guidelines for laboratory works: Electronic resource. Retrieved from https://iiii-my.sharepoint.com/:f/g/personal/andrii_kopp_khpi_edu_ua/EiLLRTf7k_pNs7kLqLzYQBBrdA_Ll4C8o7fOZZeUWhpg?e=10zN1H
21. Guidelines for the course work: Electronic resource. Retrieved from https://iiii-my.sharepoint.com/:f/g/personal/andrii_kopp_khpi_edu_ua/EiLLRTf7k_pNs7kLqLzYQBBrdA_Ll4C8o7fOZZeUWhpg?e=10zN1H
22. Orlovskiy, D. L. (Ed.) (2017). Methodical instructions for performance of course work on discipline "Design and operation of databases": for the students studying for special. "Computer Science and Information Technology". Kharkiv: NTU "KhPI".
23. Orlovskiy, D. L., Kopp, A. M., Cherednichenko, O. Yu. (2020). Methodical instructions for the course work on the discipline "Practical seminar on the design and use of databases": electronic resource: for special students. 121 "Software Engineering", 122 "Computer Science", 126 "Information Systems and Technologies". Kharkiv.
24. Jack Johnson. (2020). Practice C#. NET and SQL SERVER with Accounting System Project: FULL Source Code C# and Database-Advanced Level. Amazon Digital Services LLC - KDP Print US.

Academic integrity

Students must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to show discipline, politeness, friendliness, honesty, responsibility

The content of this syllabus is consistent with the course program.