

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

**ЗАТВЕРДЖЕНО**

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



**ПОГОДЖЕНО**

Проректор з навчально-методичної роботи

Каріна НЕМАШКАЛО

**ПРОГРАМНЕ ЗАБЕЗПЕЧЕННЯ ХМАРНИХ ПЛАТФОРМ І СЕРВІСІВ**  
**робоча програма навчальної дисципліни (РПНД)**

Галузь знань 12 "Інформаційні технології"  
Спеціальність 121 "Інженерія програмного забезпечення"  
Освітній рівень перший (бакалаврський)  
Освітня програма "Інженерія програмного забезпечення "

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

Розробник:  
д.т.н., професор підписано КЕП Сергій МІНУХІН

Завідувач кафедри  
інформаційних систем \_\_\_\_\_ Дмитро БОНДАРЕНКО

Гарант програми \_\_\_\_\_ Олег ФРОЛОВ

Харків  
2024

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

**APPROVED**

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



**AGREED**

Vice-rector for educational and methodical work

Karina NEMASHKALO

**CLOUD PLATFORM AND SERVICES SOFTWARE**

**Program of the course**

Field of knowledge      **12 "Information Technology"**  
Specialty                 **121 "Software engineering"**  
Study cycle              **first (bachelor)**  
Study programme       **"Software engineering"**

Course status  
Language

**Selective**  
**English**

Developers:  
Doctor (Technical sciences),  
Professor

digital signature

Serhii MINUKHIN

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

*Handwritten note at the bottom right: 'Курсовий проект - 2024'*

## INTRODUCTION

The development of cloud computing technologies, as well as the availability of powerful cluster solutions that are publicly available for commercial and research organizations, allow efficient processing of large data flows.

The conditions for the growth of data volumes and the increase in the dependence of business processes of enterprises on data flows determine the need for the creation of distributed information systems of various levels, which must ensure a sufficient level of operational efficiency of data processing in conditions of scalability of processing system resources and an increase in the intensity and volume of data. These tasks are solved on the basis of modern world trends in the use of distributed computing systems, the main direction of which is the development and implementation of modern cloud platforms, their services and corresponding software.

The course "Cloud Platform and Services Software" is studied by students of specialty 121 "Software engineering" of all forms of education in the 3rd year during the 6th semester. Studying the course "Cloud Platform and Services Software" involves acquiring theoretical knowledge and mastering practical skills related to the use of technologies for performing labor-intensive computing processes using cloud platform services.

The purpose of teaching the course "Cloud Platform and Services Software" is the formation of a system of theoretical knowledge and the acquisition of practical skills and abilities in the application of software, virtualization technologies, high-performance computing and the development of applications and deployment of databases based on cloud platform services.

The tasks of the course are:

familiarization with the standards, construction principles and technologies of cloud platforms;

formation of competences in the use of standards and technologies for the use of resources of cloud platforms, which are provided by order, for conducting scientific research and solving engineering tasks in order to increase the efficiency of the computing environment of organizations;

acquisition of competencies regarding the selection of a certain service model and software architecture of the cloud platform, tools and technologies for deployment of private, hybrid and public clouds;

selection, justification and configuration of appropriate software for working with applications, storage and databases in the environment of cloud platforms;

installing and configuring software and gaining practical skills to implement services related to the processes of deploying applications and databases on cloud platforms.

The subject of the course is modern technologies, tools and software for the development of software applications and databases using cloud platform services.

The object of the course is the creation of applications and databases using the software of cloud platform services.



Learning outcomes and competence, which are formed by the the course, are presented in the table 1.

Table 1

**Learning outcomes and competencies formed by the course**

<b>Learning outcomes</b>	<b>Competencies</b>
LO 06	SK 13
LO 15	SK 05

where, LO 06. The ability to choose and use a software development methodology appropriate to the task.

LO 15. Motivated to choose programming languages and development technologies to solve the tasks of creating and maintaining software.

SK 05. Ability to adhere to specifications, standards, rules and recommendations in the professional field when implementing life cycle processes.

SK 13. The ability to reasonably choose and master software development and maintenance tools.

**COURSE CONTENT**

**Content module 1. Cloud platform concepts, classification and standards.**

**Topic 1. Basic concepts and classification of cloud computing systems.**

1.1. Classification of service types of providers of information and communication resources: dedicated server, virtual hosting, virtual dedicated server.

1.2. Classification of cloud platform service models.

1.3. Classification of cloud deployment organization methods: public, private and hybrid clouds.

**Topic 2. Basic technologies and standards of cloud platforms.**

2.1. Virtualization technologies.

2.2. Definition of application level and operating system virtualization. Virtualization of operating systems. Application virtualization. Determination of technical and economic advantages of server virtualization. Server virtualization. Conversion of a server solution to a virtual machine, migration of virtual machines and "live migration". Definition of software and hardware platform for effective use of server virtualization.

2.3. Reference model of information systems built with the use of Cloud Computing Technologies (CCT). NIST Cloud Reference Architecture.

2.4. Standards and architectures of cloud platforms of major vendors. Description and principles of their functioning.

**Topic 3. Service models of cloud platforms.**

3.1. The architecture of the IaaS cloud service model.

3.2. The architecture of the PaaS cloud service model.

3.3. SaaS cloud service model architecture.

**Topic 4. Models and principles of organizing the deployment of cloud platforms.**

4.1. Public Cloud: Available to any user or industry group.

4.2. Private cloud: Available only for the needs of a specific organization.

4.3. Hybrid cloud: combines types of cloud deployments (public and private) that remain separate clouds linked together to provide application access and data portability.

**Content module 2. Cloud platforms of major vendors: principles of operation, construction and software composition.**

**Topic 5. General characteristics of Microsoft Azure. Basic concepts, definitions, composition of components and features of functioning.**

5.1. The main components of the platform. Windows Azure components and their purpose.

5.2. Application deployment software. Web App service.

5.3. Database deployment and testing software. Azure SQL Database service. DTU, vCore purchase models.

5.4. Classification, types and characteristics of virtual machines.

**Topic 6. General characteristics of Amazon Web Services (AWS). Basic concepts, definitions, composition of components and features of functioning.**

6.1. Composition and purpose of platform components and services: Amazon EC2, Amazon EBS, Amazon EC2 Container Service (ECS), Amazon Simple Storage Service (Amazon S3), AWS Storage Gateway, Amazon Elastic MapReduce (Amazon EMR).

6.2. AWS Deep Learning AMI - deep learning in Amazon Elastic Compute Cloud (EC2).

6.3. Classification, types and characteristics of virtual machines.

**Topic 7. General characteristics of IBM CLOUD. Basic concepts, definitions, composition of components and features of functioning.**

7.1. The general concept of IBM CLOUD. IBM Cloud Reference Architecture.

7.2. IBM Cloud Services service delivery models. IBM Cloud Computing Reference Architecture (CCRA).

7.3. Common Cloud Management Platform.

7.4 Data analysis and visualization software using Cognos Analytics.

**Topic 8. General characteristics of Google Compute Engine - Google Cloud Computing platform (GCP).**

8.1. The composition and purpose of the main functional components of the Google Compute Engine platform.

8.2. Google App Engine (GAE) components. App Engine architecture.

8.3. GAE server analytics collection. GAE Customer Analytics Collection.

8.4. Sandbox services.

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

Table 2

### The list of laboratory studies

Name of the topic and/or task	Content
Topic 1-3. Laboratory work No. 1	Creation of a relational database using Azure SQL Database service
Topic 1-3, 5, 6. Laboratory work No. 2	Development and creation of queries to relational databases in the Azure SQL Database service
Topic 1-8. Laboratory work No. 3	Development and deployment of the application using the Azure Web App service

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

Table 3

### List of self-studies

Name of the topic and/or task	Content
Topic 1 – 8	Studying lecture material
Topic 1 – 8	Preparation for laboratory classes
Topic 1 – 8	Preparation for the exam

The number of hours of lectures, laboratory classes and hours of self-study are given in the technological card for the course.

## TEACHING METHODS

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

Verbal (lecture-discussion (Topic 1-8), problematic lecture (Topic 7, 8), lecture-visualization (Topic 5).

Visual (demonstration (Topic 1 – 8)).

Laboratory work (Topic 1–8).

## 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 disciplines 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:

defense of **laboratory work** (60 points);

Semester control: Grading including **Exam** (40 points)

An example of an exam card and assessment criteria.

### **An example of an examination paper**

Simon Kuznets Kharkiv National University of Economics  
First (bachelor) level of higher education  
Specialty "Software Engineering"  
Educational and professional program "Software engineering"  
Semester 6  
The course "Cloud Platform and Services Software"

#### **EXAM CARD**

**Task 1** (diagnostic, 10 points).

Specify the composition of the cloud platform service model stack. Describe the SaaS model.

**Task 2** (heuristic, 15 points).

List the composition of IBM service solutions for the cloud platform IBM Cloud.

**Task 3** (heuristic, 15 points).

List the composition of the main services of the Microsoft Azure platform. Describe the Azure SQL Database service.

Protocol No.   1   dated "  22  "   08     2023   was approved at the meeting of the Department of Information Systems

Examiner

Professor Minukhin S.

Chief Department

PhD, Associate Professor Bondarenko D.

#### **Assessment criteria**

The final marks for the exam consist of the sum of the marks for the completion of all tasks, rounded to a whole number according to the rules of mathematics.

The algorithm for solving each task includes separate stages that differ in complexity, time-consumingness, and importance for solving the task. Therefore, individual tasks and stages of their solution are evaluated separately from each other as follows.

##### **Task 1.**

This task is evaluated on a 10-point scale.

A score of 10 points is given if the acquirer provides a complete description of the service models and provides a comprehensive description of the SaaS model.

A score of 9 points is given if the acquirer provides a complete description of the services and provides a comprehensive description of the SaaS model. However, the answer has some inaccuracies in defining the differences between service model levels.

A score of 8 points is given if the acquirer provides a full range of services and provides a general description of the SaaS model. However, there are certain inaccuracies in the answer in defining the differences in service model levels.

A score of 7 points is given if the acquirer provides a sufficient amount of the composition of services and only the general characteristics of the SaaS model are provided. However, the answer contains certain errors in defining the differences between service model levels.

A score of 6 points is given if the acquirer provides an incomplete list of services and provides the main characteristics of the SaaS model. However, the answer contains certain errors in defining the differences between service model levels.

A score of 5 points is given if the acquirer provides an incomplete list of services and does not provide all the main characteristics of the SaaS model. The answer contains certain errors in defining the characteristics and differences in service model levels.

A score of 4 points is given if the acquirer provides an insufficient amount of the composition of services and not all the main characteristics of the SaaS model are provided. The answer contains certain errors and inaccuracies in defining the characteristics and differences of service model levels.

A score of 3 points is given if the acquirer does not provide enough information about the composition of services and does not provide the main characteristics of the SaaS model. The answer contains certain errors and inaccuracies in defining the characteristics of service model levels.

A score of 2 points is given if the acquirer does not specify the composition of services and the main characteristics of the SaaS model are not provided. The answer contains certain errors and inaccuracies in defining the characteristics of service model levels.

A score of 1 point is given if the acquirer does not specify the composition of services and the characteristics of the SaaS model are not provided. The answer contains significant errors in defining the characteristics of the stack levels of service models.

A score of 0 points is given for failure to complete the task in general.

### **Task 2.**

This task is evaluated on a 15-point scale.

A score of 15 points is given if the acquirer provides the full composition of the IBM service solutions model for the IBM Cloud cloud platform.

A score of 14 points is given if the acquirer provides a complete list of services and provides a comprehensive description of the IBM Cloud cloud platform. However, the answer contains some inaccuracies in defining the characteristics of the services.

A score of 13-11 points is given if the acquirer provides an incomplete list of services and only general characteristics of the IBM Cloud cloud platform are provided. However, the answer contains some inaccuracies in defining the characteristics of the services.

A score of 10-8 points is given if the acquirer has insufficiently provided the composition of services and the general characteristics of the cloud platform IBM Cloud. However, the answer contains certain inaccuracies in defining the characteristics of the services.

A score of 7-5 points is given if the acquirer has insufficiently provided the composition of services and the general characteristics of the IBM Cloud cloud platform. The answer contains certain errors in defining the characteristics of the services.

A score of 4-2 points is given if the acquirer provides an insufficient amount of services and general characteristics of the IBM Cloud cloud platform are not provided. The answer contains significant errors in defining the characteristics of the services.

A score of 1 point is given if the acquirer does not specify the composition of services and the characteristics of the cloud platform IBM Cloud. The answer contains significant errors in defining the characteristics of the services.

A score of 0 points is given for failure to complete the task in general.

### **Task 3.**

This task is evaluated on a 15-point scale.



A score of 15 points is given if the acquirer provides a complete description of the main services of the Microsoft Azure platform and a detailed description of the Azure SQL Database service.

A score of 14 points is given if the acquirer provides a complete description of the main services of the Microsoft Azure platform and the general characteristics of the Azure SQL Database service.

A score of 13-11 points is given if the applicant does not provide the composition of the main services of the Microsoft Azure platform and the general characteristics of the Azure SQL Database service in full.

A score of 10-8 is given if the acquirer does not provide enough information about the composition of the main services of the Microsoft Azure platform and the characteristics of the Azure SQL Database service. However, there are some inaccuracies in the definition of the Azure SQL service

A score of 7-5 points is given if the acquirer does not fully provide the composition of the main services of the Microsoft Azure platform and the characteristics of the Azure SQL Database service. However, there are some errors in the Azure SQL service definition

A score of 4-2 points is given if the applicant does not provide sufficient information on the composition of the main services of the Microsoft Azure platform and inaccuracies in the characteristics of the Azure SQL Database service. There are some errors in the Azure SQL service definition.

A score of 1 point is given if the acquirer does not specify the composition of the main services of the Microsoft Azure platform and the characteristics of the Azure SQL Database service.

A score of 0 points is given for failure to complete the task in general.

## RECOMMENDED LITERATURE

### Main

1. Гордієнко Ю.Г., Таран В.І. Хмарні обчислення : Конспект лекцій // Ю.Г. Гордієнко, В.І. Таран. – Електронне мережне навчальне видання : Режим доступу : <https://comsys.kpi.ua/katalog/files/konspekt-lekciy-1.pdf>.

2. Зінченко О.В., Прокопов С.В., Серих С.О., Василенко В.В., Березівський М.Ю. Хмарні технології : Навчальний посібник. – Режим доступу : [https://duikt.edu.ua/uploads/1\\_2048\\_32915773.pdf](https://duikt.edu.ua/uploads/1_2048_32915773.pdf).

3. Юрчишин, В. Я. Хмарні та Грід-технології. Конспект лекцій [Електронний ресурс] : навч. посіб. для студ. спеціальності 121 «Інженерія програмного забезпечення» (освітня програма «Інженерія програмного забезпечення мультимедійних та інформаційно-пошукових систем») / В. Я. Юрчишин ; КПІ ім. Ігоря Сікорського. – Електронні текстові дані (1 файл: 6,37 Мбайт). – Київ : КПІ ім. Ігоря Сікорського, 2022. – 245 с. – Назва з екрана.- Режим доступу : <https://ela.kpi.ua/server/api/core/bitstreams/6db9b134-8c26-4687-9f98-7d3c8e85096e/content>.

4. Microsoft Azure portal. Режим доступу : <https://azure.microsoft.com/en-us/get-started/azure-portal>.

5. What is Azure? <https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-azure>.

6. Azure OpenAI Service. Режим доступу : <https://azure.microsoft.com/en-us/products/ai-services/openai-service>.

7. Overview of Amazon Web Services. Режим доступу : <https://docs.aws.amazon.com/whitepapers/latest/aws-overview/introduction.html>.

8. Amazon EMR. Режим доступу: <https://www.amazonaws.cn/en/elasticmapreduce/>.

9. IBM Analytics Engine <https://www.ibm.com/products/analytics-engine>.

10. Cloud Compute Engine <https://cloud.google.com/compute>.

11. Олещенко Л. М. Технології оброблення великих даних: конспект лекцій з дисципліни «Технології оброблення великих даних» [Електронний ресурс] : навч. посіб. для студ. спеціальності 121 «Інженерія програмного забезпечення» (освітня програма «Інженерія програмного забезпечення мультимедійних та інформаційно-пошукових систем») / Технології оброблення великих даних : Конспект лекцій / Олещенко Л. М. - Київ: КПІ ім. Ігоря Сікорського, 2021. – 227 с. Електронний ресурс - Режим доступу:

<https://ela.kpi.ua/server/api/core/bitstreams/d05e72c9-26d1-41ad-bc6f-97f88d8e0938/content>.

12. Інформатика в сфері комунікацій [Електронний ресурс] : навч.-практ. посіб. : у 3-х ч. Ч. 3 : Використання web-технологій у сфері комунікацій / С. Г. Удовенко, В. А. Затхей, О. В. Гороховатський [та ін.] ; за заг. ред. С. Г. Удовенка; Харківський національний економічний університет ім. С. Кузнеця. - Електрон. текстові дан. (10.5 МБ). - Харків : ХНЕУ ім. С. Кузнеця, 2020. - 154 с. : іл. - Загол. з титул. екрану. - Бібліогр.: с. 153. <http://www.repository.hneu.edu.ua/handle/123456789/24506>

### **Additional**

13. Сучасні інформаційні технології та системи [Електронний ресурс] : монографія / Н. Г. Аксак, Л. Е. Гризун, С. В. Мінухін [та ін.] ; за заг. ред. Пономаренка В. С. – Харків : ХНЕУ ім. С. Кузнеця, 2022. – 270 с. <http://www.repository.hneu.edu.ua/handle/123456789/29233>.

14. Голубничий, Д. Ю. Операційні системи [Електронний ресурс] : навч. посіб. / Д. Ю. Голубничий, А. В. Холодкова ; Харківський національний економічний університет ім. С. Кузнеця. - Електрон. текстові дан. (12,5 МБ). - Харків : ХНЕУ ім. С. Кузнеця, 2018. - 316 с. : іл. - Загол. з титул. екрану. - Бібліогр.: с. 313-315. <http://www.repository.hneu.edu.ua/handle/123456789/23844>

### **Information resources**

15. The website of the personal educational system for the course " Cloud Platform and Services Software" <https://pns.hneu.edu.ua/enrol/index.php?id=10254>.