Syllabus

Course Program

CI/CD

Specialty
121 – Software Engineering

Institute
Institute of Computer Science and Information Technology

Educational program
Software Engineering

Department
Software Engineering and Management Intelligent Technologies (321)

Level of education
Bachelor's level

Course type
Special (professional), Mandatory

Semester
5

Language of instruction
English, Ukrainian

Lecturers and course developers

Volodymyr Petrovych Burdaev

volodymyr.burdaev@khpi.edu.ua
Ph.D., S.Sc., Associate Professor of the Department of Software Engineering and Intelligent Management Technologies

Google Scholar:https://scholar.google.com/citations?user=&user=RX9JedIAAAAJ
ORCID: https://orcid.org/0000-0001-9848 -9059
Scopus: https://www.scopus.com/authid/detail.uri?authorId=6507982230, https://www.scopus.com/authid/detail.uri?authorId=57224197566.
More about the lecturer on the department's website

General information

Summary

The task of the discipline is for students to acquire the necessary level of knowledge regarding the use of virtualization of server systems and services for distributed computing; acquiring knowledge and skills to use methods and tools for remote data management, as well as remote service functions based on the organization and application of cloud computing technologies.

Course objectives and goals

Formation of students' system of theoretical knowledge and acquisition of practical abilities and skills on the use of cloud computing technologies, cloud deployment models, basic cloud computing service provision models, development of web applications for conducting scientific research in a cloud environment

Format of classes

Lectures, laboratory classes, self-study, consultations. Final control in the form of credit.

Competencies

K05. Ability to learn and master modern knowledge.
K06. Ability to search, process and analyze information from various sources.

К24. Ability to carry out the system integration process, apply change management standards and procedures to maintain the integrity, overall functionality and reliability of the software.
К25. Ability to reasonably choose and master the tools for software development and maintenance.

Learning outcomes

PLO01. Analyze, purposefully search and select information and reference resources and knowledge necessary for solving professional problems, taking into account modern achievements of science and technology.
PLO07. To know and apply in practice the fundamental concepts, paradigms and basic principles of functioning of language, tools and computing tools of software engineering.
PLO15. Motivated to choose programming languages and development technologies to solve the problems of creating and maintaining software.
PLO18. To know and be able to apply information technologies for data processing, storage and transmission.
PLO21. To know, analyze, select, and competently apply means of ensuring information security (including cybersecurity) and data integrity in accordance with the applied tasks and software systems being created.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures – 16 hours, laboratory classes – 32 hours, self-study – 42 hours.

Course prerequisites

Object-oriented programming
Basics of web development

Features of the course, teaching and learning methods, and technologies

Teaching and learning methods:
interactive lectures with presentations, discussions, laboratory classes, teamwork, case method, student feedback, problem-based learning.
Forms of assessment:
written individual assignments for laboratory work (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).

Program of the course

Topics of the lectures

Topic 1: Introduction to Continuous Integration/Deployment and DevOps
What is CI/CD? DevOps concepts that are used most often in practice. Competencies are essential for every DevOps engineer. Overview of the most popular CI systems (TeamCity, Jenkins). CI architecture, configuration (server, collection agents). Definitions: pipeline, stage, job, build, runner, environment, artifact, CI Lint, cache
Topic 2. Git - operations with the version control system
The concept of GitFlow and strategies for working with versions, familiarity with GitHub-like systems (gitlab, bitbucket, gitea, Azure Repos), CI/CD based on GitLab. Git principles
Topic 3. Virtualization technologies
Concept of virtualization of computer systems and networks. Overview of network virtualization systems, computer resources, applications and data storage. Definition of application and operating system level virtualization. Server virtualization. Concept of virtualization of operating systems. Familiarization with the concepts and technologies of converting a server solution to a virtual machine, migration of virtual machines and "live migration" data
Topic 4. Cloud platform stacks

Principles of operation and architecture of IaaS, PaaS, SaaS cloud systems. Classification of cloud computing systems. Definition of systems: IaaS, PaaS, SaaS. IaaS is infrastructure as a service. PaaS is a platform as a service. SaaS - software as a service. The concept of a business model for providing software for rent. An overview of the main cloud computing providers

Topic 5. Microsoft Azure cloud platform. Machine learning

Features of the platform. Historical information about the implementation of the platform. The main components of the platform. Technologies supported by the Microsoft Azure cloud. Application examples. The main areas of application of the Microsoft Azure platform for commercial applications and performing research and design of technical systems. Principles of pricing when consuming cloud computing resources. Linear methods of machine learning. Special types of regression in machine learning.

Topic 6. Features of the construction of the Amazon cloud platform

Historical information about the implementation of the platform. The main components of the platform. Technologies supported by the AWS cloud. Application examples. The main areas of application of the AWS platform for commercial applications and performing research and design of technical systems. Principles of pricing when consuming cloud computing resources. Machine learning algorithms. Linear classification methods. Decision trees. Clustering

Тема 7. IBM cloud infrastructure. Watson Studio

Classic IBM technologies for cloud solutions. Composition of the Cloud Service Provider service. IBM Cloud Reference Architecture. Features of the platform. Architecture and core services. Watson Studio

Тема 8. Features of the Google cloud platform

Computing stack. Cloud services. Infrastructure as a Service (IaaS). Platform as a Service (PaaS). Software as a Service (SaaS). Google Compute Engine (GCE) - IaaS. Google Kubernetes Engine (GKE) — (Caas / Kaas). Google Application Engine (GAE) — (PaaS). Google Cloud Functions - (FaaS)

Topics of the workshops

Workshops are not provided within the discipline.

Topics of the laboratory classes

Topic 1: Deploy ASP.NET web applications to Azure App Service using Visual Studio
Topic 2. Version control systems (Git)
Topic 3. Database deployment in Microsoft Azure. Creation of informational model and queries
Topic 4. SQL Server DB migration to Microsoft Azure using the Data Migration Assistant
Topic 5. Creating and deploying web applications using Azure DevOps (VSTS) tools of the Microsoft Azure platform
Topic 6. Building predictive models in Microsoft Azure ML Studio (regression model)
Topic 7. Building predictive models in Microsoft Azure ML Studio (classification model)
Topic 8. Building predictive models in Microsoft Azure ML Studio (clustering model)

Self-study

Individual assignments are not provided in the curriculum.
Students are recommended with additional materials (videos, articles) for self-study and processing.

Course materials and recommended reading

Key literature

1. M. Labouardy, Pipeline as Code: Continuous Delivery with Jenkins, Kubernetes, and Terraform , O'Reilly Media, 2021, 632 p.
2. C. Cowell, N. Lotz, C. Timberlake, Automating DevOps with GitLab CI/CD Pipelines: Build efficient CI/CD pipelines to verify, secure, and deploy your code using real-life examples, Packt Publishing, 2023, 348p.
3. J. Lord, Building CI/CD Systems Using Tekton: Develop flexible and powerful CI/CD pipelines using Tekton Pipelines and Triggers, Packt Publishing, 2021, 278 p.
4. D. Farley, Continuous Delivery Pipelines: How To Build Better Software Faster, Nachiket Prakashan, 2021, 162 p.

5. R. Leszko, Continuous Delivery with Docker and Jenkins. Create secure applications by building complete CI/CD pipelines, Packt Publishing, 2022, 374 p.

Additional literature

1. M. Anastasov, J. Petazzoni, T. Fernandez, CI/CD with Docker and Kubernetes: How to Deliver Cloud Native Applications at High, Semaphore, 2022, 91 p.
2. Q. Liang, Continuous Delivery 2.0: Business-leading DevOps Essentials, CRC Press, 2021, 332 p.
3. P. M. Duvall, Enterprise DevOps on Amazon Web Services Releasing Software to Production at Any Time with AWS, Addison-Wesley Professional, 2021, 368 p.
4. B. Aiello, Hands-On DevOps for Architects. Implementing continuous delivery through automation, Packt Publishing Limited, 2021, 358 p.
5. P. Abdoulaye, Transforming Your Business with AWS. Getting the Most Out of Using AWS Cloud to Modernize and Innovate Your Digital Services, Wiley, 2021, 336 p.

Assessment and grading

Criteria for assessment of student performance, and the final score structure

The final grade is 100% composed of the assessment results in the form of credit (40%) and the current grade (60%):
- 8 laboratory works (5% each);
- 2 tests (10% each).

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by	08.06.2023	Head of the department Ihor HAMAIUN
	08.06.2023	Guarantor of the educational program Uliya LITVINOVA