



SYLLABUS

EDUCATIONAL DISCIPLINE



"Cloud computing"

Code and name of the specialty:	122 Computer Science and Information Technology	Faculty / Institute	Educational and scientific Institute of Information Technology
Name of educational and scientific program	Computer science and information technology	Department	Computer science and intellectual property

TEACHER



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Candidate of Technical Sciences, Senior Lecturer of the Department of Computer science and intellectual property NTU "KhPI". Work experience - more than 15 years. Author of more than 30 scientific and educational works. Leading lecturer in the following disciplines: "Modern Web technologies", "Service-oriented architecture and cloud technologies"

GENERAL INFORMATION ABOUT THE DISCIPLINE

Summary	The course is aimed at mastering the student's theoretical knowledge and practical skills of using cloud computing in creating software systems
Purpose and goals	Study of technologies, tools and open standards of cloud computing for integration of applications, processes, data, integrated workstations, resources, management of integrated systems and technologies and tools for modeling, analysis, design of integrated information systems
Format	Lectures, laboratory work, independent work, consultations. Final control – final test.
Learning outcomes	Know and be able to apply cloud computing mechanisms to develop and deploy applications
Amount	The total volume of the discipline is 120 hours: lectures - 32 hours, laboratory work - 32 hours, independent work - 56 hours.
Prerequisites	"Fundamentals of Programming", "Computer Networks", knowledge of English at the Intermediate + level
Requirements teacher	The student is obliged to attend all classes according to the schedule, not to be late. Adhere to ethics of behavior. To pass the discipline you need to have: a personal computer at your disposal for independent work. Work with educational and additional literature, with literature on electronic media and on the Internet. When skipping lectures, an oral interview is held on the topic. Practice laboratory classes with the permission of the teacher. In order to master the necessary quality of education in the discipline requires attendance and regular preparation for classes. Without the personal presence of the student the final control is not carried out.

STRUCTURE OF THE DISCIPLINE

Lecture 1	Principles of construction and advantages of using cloud platforms	Laboratory work №1	Deploy a website in Azure using the Application Service	Independent work	Deploy a website on Google Cloud and AWS
Lecture 2	SOA concept	Laboratory work №2	Create and work with a Windows virtual machine in Azure		Create and work with a virtual machine in Google Cloud and AWS
Lecture 3	Distributed cloud application architecture. General concepts	Laboratory work №3	Linux virtual machine in Azure		Linux virtual machine in Google Cloud and AWS
Lecture 4	Network communication	Laboratory work №4	Deploy a website with cognitive services in Azure via GitHub		Deploy a website with cognitive services on Google Cloud and AWS via GitHub
Lecture 5	Messaging and service version management	Laboratory work №5	Preparing SQL Azure database for data storage		Preparing an SQL database in Google Cloud and AWS for data storage
Lecture 6	Data storage	Laboratory work №6	Launch container applications in Azure Kubernetes (AKS)		Launch container applications on Google Cloud and AWS
Lecture 7	DevOps methodology	Laboratory work №7	Creation and administration of microservice		Creating and administering a microservice on Google Cloud and AWS
Lecture 8	Infrastructure as a code	Laboratory work №8	Deployment of microservice in Azure		Deploy microservice to Google Cloud and AWS
Lecture 9	Microservices and containers	Laboratory work №9	Create and deploy cloud-native ASP.NET Core microservice		
Lecture 10	Container management system - Kubernetes				
Lecture 11	Overview of service-oriented architecture and cloud computing on the example of the Windows Azure cloud platform				
Lecture 12	Basic Azure Cloud Services . Calculation options				
Lecture 13	Data storage. Windows Azure network connection options				
Lecture 14	Basic concepts of infrastructure and data protection when working in Azure . Control and organization of Azure resources				
Lecture 15	An overview of cloud computing from Google				
Lecture 16	An overview of cloud computing from Amazon				

LITERATURE AND EDUCATIONAL MATERIALS

1. Microsoft Documentation [Electronic resource] - Resource access mode: <https://docs.microsoft.com/ru-ru/learn/modules/principles-cloud-computing/>
2. Derevyanko AS, Soloshchuk MN Technologies and tools consolidation information . Kharkiv : NTU "KhPI", 2008
3. Bieberstein N., Bose S., Jones K., et al . Compass in the world of service-oriented Architecture (SOA): Business Value , Planning and Development Plan enterprises . - М .: "KUDITS-PRESS", 2007. - 256p.
4. Newcomber E. Web services . For professionals . - СПб .: Питер , 2003. - 256с.
5. Learning platform Wintellectnow , Architecting Distributed Cloud Applications [Electronic resource] - Resource access mode: <https://www.wintellectnow.com/Home/SeriesDetail?seriesId=architecting-distributed-cloud-applications>
6. Pluralsight.com training platform, DevOps : The Big Picture [Electronic resource] - Resource access mode: <https://app.pluralsight.com/library/courses/devops-big-picture/table-of-contents>
7. Pluralsight.com training platform, Implementing DevOps in the Real World [Electronic resource] - Resource access mode: <https://app.pluralsight.com/library/courses/implementing-devops-real-world/table-of-contents>
8. Microsoft Azure documentation DevOps [Electronic resource] - Resource access mode: <https://docs.microsoft.com/en-us/azure/devops/get-started/?view=azure-devops>
9. Portal Microsoft Azure , Education [Electronic resource] - Mode of access to the resource: https://portal.azure.com/?Microsoft_Azure_Education_correlationId=a06e03a7-a48d-40aa-a0f8-f97c4c78dcc0&l=ru.ru-ru#bladeAz/EducationMenuBlade/learning
10. Pluralsight.com training platform, Getting Started with Docker on Windows [Electronic resource] - Resource access mode: <https://app.pluralsight.com/library/courses/docker-windows-getting-started/table-of-contents>
11. Learning platform Wintellectnow , Mastering Docker [Electronic resource] - Resource access mode: <https://www.wintellectnow.com/Home/SeriesDetail?seriesId=mastering-docker>
12. Microsoft Learning Platform, Introduction to Kubernetes [Electronic resource] - Resource access mode: <https://docs.microsoft.com/en-us/learn/modules/intro-to-kubernetes/>
13. Microsoft Learning Platform, Azure Kubernetes Service (AKS) [Electronic resource] - Resource access mode: <https://azure.microsoft.com/en-us/services/kubernetes-service/>
14. Microsoft Learning Platform, Azure fundamentals [Electronic resource] - Resource access mode: <https://docs.microsoft.com/en-us/learn/paths/azure-fundamentals/>
15. Google Learning Platform , Google Cloud Computing Foundations [Electronic resource] - Resource access mode: https://go.qwiklabs.com/skills?utm_source=CGC&utm_medium=lp&utm_campaign=grow
16. AWS learning platform, AWS Cloud Practitioner Essentials [Electronic resource] - Resource access mode: <https://www.aws.training/Details/Curriculum?id=27076>
17. Microsoft Learning Platform, .NET Tutorial [Electronic resource] - Resource access mode: <https://dotnet.microsoft.com/learn/aspnet/microservice-tutorial/intro>
19. Microsoft Learning Platform, Create and deploy a cloud-native ASP.NET Core microservice [Electronic resource] - Resource access mode: <https://docs.microsoft.com/uk-ua/learn/modules/microservices-aspnet-core/>

1. Radchenko, GI Distributed computing systems / G.I. Radchenko. - Chelyabinsk :: Photo artist, 2012. - 184 p.
2. Kononyuk AE K213 Fundamental theory cloudy technologies . - In 18 books. Book 1. —К .: Education of Ukraine. 2018. — 620 p.
3. Microsoft Documentation, Introduction to .NET and Docker [Electronic resource] - Resource access mode: <https://docs.microsoft.com/en-us/dotnet/core/docker/introduction>
4. Docker Documentation [Electronic resource] - Resource access mode: [https://www.tutorialspoint.com/docker/index.htm](https://docs.docker.com/Tutorialspoint learning platform , Docker Interactive Course Tutorial [Electronic resource] - Resource access mode: <a href=)
6. Tutorialspoint learning platform , Kubernetes Interactive Course Tutorial [Electronic resource] - Resource access mode: <https://www.tutorialspoint.com/kubernetes/index.htm>

LIST OF QUESTIONS FOR PREPARATION FOR TEST

Definitions, proposed computing services, computing resources, types of virtualization. Virtual machines, containers, serverless computing, storage, flexibility and cost-effectiveness, cloud computing benefits (cost-effectiveness, scalability, flexibility, relevance, reliability and security), capital costs (OpEx) operating costs (OpEx), cloud deployment models (Public cloud, Public cloud Private cloud,

Hybrid cloud), types of cloud services (IaaS , PaaS , SaaS), costs and cost of ownership, Distribution of management responsibilities. Problems of integration in modern data processing systems and historical ways to solve them. Architectural concepts of SOA. OASIS SOA reference model. Components of the problem of information integration, which are solved by means of SOA. Examples of partial implementations of SOA. The role of open standards in the implementation of SOA. Review of Web -services standards and their interaction as a full implementation of SOA. General architecture of the web application. Why cloud applications. Concept - Acceptance of failure. Orchestration. Regions, availability zones, and error domains. The main features of cloud applications are scalability and high availability. Service-based architectures. Monoliths against microservices . Service Level Agreements (SLAs) and dependent services. Automatic scaling. 12-factor applications. Containers. Insulation against density. Containers and operating systems. Orchestrators and containers. Continuous integration and implementation (CI CD) , devops pipeline pipeline). Eight miscalculations of distributed computing. Service endpoints. Direct and reverse proxy. Orchestration and load balancing. Connecting microservices . Transformation of a monolith into a microservice . circuit breakers. API version. Network API contracts. Leaks RPC-like abstractions. Restore the network. Idempotence . Execution of operations is impotent . Benefits of messaging. Message with queues. Fault-Tolerant message processing. Additional queue functions. TTL (Lifetime Message). Options for updating services. Comparison of service update options. Two-phase updates. Disable service instance. Service configuration. Cryptographic message syntax. What is a leader's election? Leader elections by lease. Election of the leader by means of turn. Temperature data. Caching . Save files and objects. Content delivery network delivery network CDN). Database repositories. Data splitting. Data consistency (strong, weak consistency, ACID transactions, BASE transactions, CAP theorem). Apology-based calculations. CQRS template. Event-Sourcing Template. Final consistency. Saga template. Data concurrency and version control. Pessimistic and optimistic parallelism. Versions of data schemes. Backup and restore. Recovery goals and timelines. Disaster recovery (Active-Passive architecture, Active-Active architecture). DevOps and Agile . Components of DevOps . DevOps integration into the software development process. DevOps and Digitization . Continuous Feedback mechanism. Ensuring high availability of services - High Availability Azure DevOps . Infrastructure paradigm as Code , components, importance. Definition of microservices , their advantages over monolithic architecture. The difference between containerization and conventional virtualization. Principles of container construction (Docker). The process of creating a container, basic images. Container optimization. Container management system - Kubernetes (Main components and architecture). Hosting the site in Azure . Debugging the application service. Access the application service using Azure Cloud Shell . Physical structure, redundancy and service guarantees. Manage services through the Azure portal . Monitoring panel. Access to public and private features. Virtual machines. Containers in Azure . Application Services. Serverless computing. Meet your business storage needs with Azure Storage . Comparison of Azure storage and local storage. Deploy a site in Azure . Zoom with Azure Load Balancer . Reduce latency with Azure Traffic Manager . Advanced protection against Azure threats . General information about security aspects for application lifecycle management solutions. Using Azure Resource Manager for organizing resources, applying standards, and protecting critical resources from deletion.

LIST OF EQUIPMENT

The laboratory workshop is equipped with the following equipment: IBM PC / AT personal computers. Internet access.

EVALUATION SYSTEM

Distribution of points for assessing the success of graduate students	The sum of points for all types of educational activities	ECTS assessment	Score on a national scale	Scoring	Grades accrued according to the following ratio: <ul style="list-style-type: none"> laboratory work: 50% of the semester grade; tests: 25% of the semester grade; final test: 25% of the semester grade
	90-100	A	perfectly		
	82-89	B	okay		
	74-81	C			
	64-73	D	satisfactorily		
	60-63	E			
	35-59	FX	unsatisfactory with the possibility of the re-study of the discipline		
	0-34	F	unsatisfactory with mandatory re-study of the discipline		

STANDARDS OF ACADEMIC ETHICS

The student must adhere to the "Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to show discipline, politeness, friendliness, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and in case of unresolved conflict to the dean's office.

The syllabus in content is fully consistent with the work program of the discipline