#### МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ Харківський національний економічний університет імені семена кузнеця

#### ЗАТВЕРДЖЕНО

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ПОГОДЖЕНОТИ
Проректор з навчально-методичної роботи
Каріна НЕМАШКАЛО

# СУЧАСНІ МЕТОДОЛОГІЇ ТА СЕРЕДОВИЩА РОЗРОБЛЕННЯ КОМП'ЮТЕРНИХ ІНФОРМАЦІЙНИХ СИСТЕМ

робоча програма навчальної дисципліни (РПНД)

Галузь знань Спеціальність Освітній рівень Освітня програма 12 "Інформаційні технології" 122 "Комп'ютерні науки" другий (магістерський) "Комп'ютерні науки"

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Розробник: к.е.н., доцент

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Гарант програми

підписано КЕП

Сергій МІНУХІН

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#### MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

#### SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

APPROVED

at the meeting of the Information Systems Department Protocol № 1 of 27.08.2024



### MODERN METHODOLOGIES AND DEVELOPMENT ENVIRONMENTS OF COMPUTER INFORMATION SYSTEMS

**Program of the course** 

Field of knowledge Specialty Study cycle Study programme 12 "Information technologies" 122 "Computer Sciences" second (master's) "Computer Sciences"

Course status Language

mandatory English

Developer: Doctor of Economics, associate professor

Head of the department Information Systems

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Kharkiv 2024

## **INTRODUCTION**

An effective way to improve management and increase the competitiveness of enterprises is the development and implementation of modern information systems (IS), which makes it possible to increase the speed, quality and reliability of the processes of information collection, storage and processing; provide management with relevant information in a timely manner; timely and qualitative analysis and forecasting of the financial and economic activity of companies.

In view of this, the educational discipline provides an opportunity to acquire and systematize knowledge related to modern methodologies and environments for the development, implementation and development of IS, namely: principles, methodologies, instrumental environments, templates and standards for the development and implementation of IS. The educational discipline is mandatory and is studied according to the training plan for specialists in specialty 122 "Computer Science" of the second (master's) degree.

The goal of the course "Modern methodologies and development environments of computer information systems" is the provision of basic profiling training by profession, the formation of theoretical knowledge and practical skills necessary for the development and implementation of IS using modern methodologies and environments.

- The tasks of the course are:

- study of the life cycle of information systems, advantages and limitations of Agile methodology, principles, roles, artifacts and phases of Scrum as a life cycle model;

- definition of the basics of quality assurance, quality models during development and use, directly product and data quality models, testing levels and methodologies, advantages and limitations of their application;

- mastering the content of IT projects, their properties and classification, stages of development of IT project management methods;

- research on the diversity of project management standards, value delivery systems and PMBOK project delivery principles, defining the main purpose of Devops methodology, responsibilities, life cycle stages and principles and benefits of Devops implementation;

 definition of the principles and review of IS implementation methodologies, in particular, the goals and content of the Microsoft - Business Solutions Partner Methodology & OnTarget, JD Edwards - OneMethodology (PeopleSoft) and Oracle stages;

- learning the benefits of migration, typical design and approaches to IS migration, maintenance basics, key issues, software maintenance process and techniques in the SWEBOK.

The object of the course is a process of development and implementation of

information systems.

The subject of the course are principles and methodologies for the development and implementation of information systems.

The learning outcomes and competence formed by the course are defined in the table. 1.

Table 1

Learning outcomes	Competences
LO1	GC02, GC07, SC02, SC11
LO2	GC03, SC01, SC02, SC10, SC11
LO3	GC01, SC01
LO4	GC02, GC05, SC01, SC02, SC04, SC05,
	SC07, SC08, SC10, SC11
LO5	GC01, GC02, GC05, GC06, SC01,
	SC02, SC05, SC10
LO6	SC01, SC02, SC05, SC07, SC08 SC11
LO10	GC01, GC02, GC05, GC07, SC04, SC05,
	SC07, SC08, SC11
LO11	GC01, GC02, GC03, GC05, GC07, SC02,
	SC06, SC07, SC08, SC10
LO13	GC03, SC10, SC11
LO14	SC11, SC12
LO15	GC01, GC02, GC07,SC02, SC05
LO16	SC04, SC07, SC08
LO17	GC01, GC07, SC08
LO18	GC02, GC03, GC07, SC02, SC04, SC05,
	SC06, SC08, SC11
LO19	SC05, SC11
LO 20	GC01, SC05, SC08, SC10

Learning outcomes and competencies formed by the course

where, LO1. Have specialized conceptual knowledge that includes modern scientific achievements in the field of computer science and is the basis for original thinking and conducting research, critical understanding of problems in the field of computer science and at the border of fields of knowledge.

LO2. Have specialized computer science problem-solving SCills necessary for conducting research and/or carrying out innovative activities in order to develop new knowledge and procedures.

LO3. It is clear and unambiguous to convey one's own knowledge, conclusions and arguments in the field of computer science to specialists and non-specialists, in particular to people who are studying.

LO4. Manage work processes in the field of information technologies, which are complex, unpredictable and require new strategic approaches.

LO5. Evaluate the results of teams and collectives in the field of information technologies and ensure the effectiveness of their activities.

LO6. Develop a conceptual model of an information or computer system.

LO10. To design architectural solutions of information and computer systems for various purposes.

LO11. Create new algorithms for solving problems in the field of computer science, evaluate their effectiveness and limitations on their application.

LO13. Assess and ensure the quality of information and computer systems for various purposes.

LO14. Test the software.

LO15. Identify the needs of potential customers regarding the automation of information processing.

LO16. Conduct research in the field of computer science.

LO17. Identify and eliminate problematic situations during software operation, formulate tasks for its modification or reengineering.

LO18. Collect, formalize, systematize and analyze the needs and requirements for the information or computer system being developed, operated or supported.

LO19. To analyze the current state and global trends in the development of computer sciences and information technologies.

LO 20. Develop algorithms and software components of computer information systems for high-performance big data processing systems (including distributed and parallel computing) and cloud platform services.

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Ability to apply knowledge in practical situations.

GC03. Ability to communicate in the national language both orally and in writing.

GC05. Ability to learn and master modern knowledge.

GC06. The ability to be critical and self-critical.

GC07. Ability to generate new ideas (creativity).

SC01. Awareness of the theoretical foundations of computer science.

SC02. The ability to formalize the subject area of a certain project in the form of an appropriate information model.

SC04. The ability to collect and analyze data (including large data) to ensure the quality of project decision-making.

SC05. Ability to develop, describe, analyze and optimize architectural solutions of information and computer systems for various purposes.

SC06. Ability to apply existing and develop new algorithms for solving problems in the field of computer science.

SC07. Ability to develop software according to formulated requirements, taking into account available resources and constraints.

SC08. The ability to develop and implement software development projects, including in unpredictable conditions, with unclear requirements and the need to apply new strategic approaches, use software tools to organize teamwork on the project.

SC10. The ability to evaluate and ensure the quality of IT projects, information and computer systems of various purposes, to apply international standards for assessing the quality of software of information and computer systems, models for assessing the maturity of information and computer systems development processes.

SC11. Ability to initiate, plan and implement the development processes of information and computer systems and software, including its development, analysis, testing, system integration, implementation and support.

# **COURSE CONTENT**

# **Content module 1 Theoretical foundations and practical aspects of developing computer information systems (CIS)**

## Topic 1. The main concepts and stages of development of CIS

- 1.1. The concept and purpose of developing the CIS.
- 1.2. Stages of development of CIS.
- 1.3. Connection of development of CIS with other disciplines.
- 1.3. Life cycle models of CIS.

# Topic 2. Linear and evolutionary approaches to CIS design

- 2.1. Life cycle models of CIS.
- 2.2. The cascading model of CIS development, its main features.
- 2.3. V-shaped model as a kind of cascade model.
- 2.4. An incremental model of the CIS life cycle.
- 2.5. Models of the evolutionary approach to the design of CIS.

# Topic 3. Modern methodologies of design and development of CIS

3.1. Agile methodology.

- 3.2.Extreme programming method.
- 3.3. Crystal as a software life cycle model supported by Agile methodology.

3.4. SCRUM methodology for organizing teamwork in IT projects.

# Topic 4. Quality assurance of the CIS

4.1. Basics of quality assurance of CIS.

4.2. Testing of CIS development processes.

#### **Content module 2. Management of development and implementation of CIS Topic 5. Management of projects and development of CIS.**

5.1. IT projects, their properties and classification.

5.2. Project management processes and PMBOK as a standard for IT project management.

5.3. Concepts of DevOps in the process of development of CIS.

# **Topic 6. Deployment (implementation) of CIS**

6.1. Principles and methodology of implementation of CIS.

6.2. Microsoft – Business Solutions Partner Methodology & OnTarget: content of work stages.

6.3. JD Edwards - OneMethodology (PeopleSoft) and the Oracle methodology as a methodology for the implementation of CIS.

## **Topic 7. Support and support of CIS**

7.1. Migration of CIS and peculiarities of implementation of migration projects.

7.2. Support of CIS.

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

#### List of laboratory classes

Name of the topic and / or task	Content
Topic 1. Laboratory work 1.	Project management using cloud services
Topic 2. Laboratory work 2.	Creating a product vision (Vision)
Topic 3. Laboratory work 3.	Modeling users using the character method
Topic 4. Laboratory work 4.	Creating a user story (User Story)
Topic 5, Topic 6	Creating an application prototype
Laboratory work 5.	
Topic 7. Laboratory work 6.	Creation of acceptance criteria and acceptance tests

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 - 7	Studying lecture material
Topic 1 - 7	Preparation for laboratory classes
Topic 1 - 7	Preparation for the test

The number of hours of lecture and laboratory studies and hours of self-study is given in the technological card of the course.

### **TEACHING METHODS**

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

Verbal (lecture (Topic 1-2, 4, 6-7), problem lecture (Topic 3, 5).

In person (demonstration (Topic 1-7)).

Laboratory work (Topic 1 - 7), case method (Topic 1-7)).

Laboratory works are built according to the design principle. Winners are divided into small teams (up to 3 winners in a team). Each laboratory team performs a separate end-to-end project. Laboratory tasks consist of a common part that the team performs together, and individual tasks for each student.

# 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 grading: maximum amount is 100 points; minimum amount required is 60 points.

The final control includes current control and assessment of the student.

Semester control is carried out in the form of a grading. The final grade in the course is determined:

- for disciplines with a form of grading, the final grade is the amount of all points received during the current control.

During the teaching of the academic discipline, the following control measures are used:

Current control: protection of laboratory works (90 points), current control works (10 points).

Semester control: Grading.

The number of hours of lecture and laboratory classes and hours of independent work is given in the work plan (technological map) for the academic discipline.

#### RECOMMENDED LITERATURE Main

1. Лабораторний практикум з системного аналізу та проєктування інформаційних систем [Електронний ресурс] : навчальний посібник / І.О. Ушакова, І.Б. Медведєва; Харківський національний економічний університет ім. С. Кузнеця. – Харків : ХНЕУ ім. С. Кузнеця, 2022. – 250 с. – Режим доступу : <u>http://repository.hneu.edu.ua/handle/123456789/27815</u>

2. Ушенко Ю.О. Методологія інформаційних систем та баз даних: теоретичний і практичний підходи : навч. посібник / Ю.О. Ушенко, М.Л. Ковальчук, М.С. Гавриляк, А.Л. Негрич. – Чернівці : Чернівецький нац. ун-т ім. Ю. Федьковича, 2021. 240 с.

3. Мартін Р. Чистий Agile / Р. Мартін. – Харків : Фабула, 2021. – 224 с.

4. A guide to the Project Management Body of Knowledge (PMBOK guide) and the Standard for project managemen. – Newton Square, PA, United States : Project Management Institute, 2021. – 250 p.

#### Additional

5. Ушакова I. О. Лабораторний практикум з системного аналізу та

проєктування інформаційних систем [Електронний ресурс] : навчальний посібник / І. О. Ушакова, І. Б. Медведєва. – Харків : ХНЕУ ім. С. Кузнеця, 2022. – 251 с. Режим доступу : http://www.repository.hneu.edu.ua/handle/123456789/27815.

6. Сучасні методології та середовища розроблення комп'ютерних інформаційних систем. Методичні рекомендації до виконання лабораторних робіт для студентів спеціальності 122 "Комп'ютерні науки" другого (магістерського) рівня [Електронний ресурс] / уклад. І. О. Ушакова, І. Б. Медведєва; Харківський національний економічний університет ім. С. Кузнеця. - Харків : ХНЕУ ім. С. Кузнеця, 2022. - 76 с. - Режим доступу : http://repository.hneu.edu.ua/handle/123456789/26830

7. Teixeira, P., Eusébio, C. & Teixeira, L. Understanding the integration of accessibility requirements in the development process of information systems: a systematic literature review. Requirements Eng 29, 143–176 (2024). https://doi.org/10.1007/s00766-023-00409-8

8. Qu, F., Dang, N., Furht, B. et al. Comprehensive study of driver behavior monitoring systems using computer vision and machine learning techniques. J Big Data 11, 32 (2024). <u>https://doi.org/10.1186/s40537-024-00890-0</u>

9. Jalali Khalil Abadi, Z., Mansouri, N. A comprehensive survey on scheduling algorithms using fuzzy systems in distributed environments. Artif Intell Rev 57, 4 (2024). <u>https://doi.org/10.1007/s10462-023-10632-y</u>

10. Hernández, R., Moros, B. & Nicolás, J. Requirements management in DevOps environments: a multivocal mapping study. Requirements Eng 28, 317–346 (2023). <u>https://doi.org/10.1007/s00766-023-00396-w</u>

#### Information resources

11.IEEE Recommended Practice for Software Requirements Specification[Electronicresource].–Accessmode :https://www.cse.msu.edu/~cse870/IEEEXplore-SRS-template.pdf.

12. IEEE Std 830-1998. IEEE Recommended Practice for Software Requirements Specifications [Electronic resource]. – Access mode: http://www.math.uaa.alaska.edu/~afkjm/cs401/IEEE830.pdf

13. ISO/IEC/IEEE 42010-2011. Systems and software engineering. Architecture description [Electronic resource]. – Access mode: <u>https://nanopdf.com/download/iso-iec-ieee-420102011e-systems-and-software-engineering\_pdf</u>.