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

ЗАТВЕРДЖЕНО
на засіданні кафедри
інформаційних систем
Протокол № 1 від 27.08.2024 р.

ПОГОДЖЕНО
Проректор з навчально-методичної роботи

Каріна НЕМАШКАЛО

ІНТЕЛЕКТУАЛЬНІ ІНФОРМАЦІЙНІ СИСТЕМИ В УПРАВЛІННІ

робоча програма навчальної дисципліни (РПНД)

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

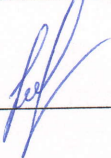Статус дисципліни   **вибіркова**
Мова викладання, навчання та оцінювання   **англійська**

Розробник:
кандидат фізико-
математичних наук, доцент   підписано КЕП   Віктор ЗАДАЧИН

Завідувач кафедри
інформаційних систем   _____   Дмитро БОНДАРЕНКО

Гарант програми
доктор технічних наук,   підписано КЕП   Сергій МІНУХІН
професор

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 No. 1 of 27.08.2024

AGREED
Vice-rector for educational and methodical work

_____ Karina NEMASHKALO

INTELLIGENT INFORMATION SYSTEMS IN MANAGEMENT

Program of the course

Field of knowledge	**12 "Information technologies"**
Specialty	**122 "Computer sciences"**
Study cycle	**Second (master's)**
Study programme	**"Computer sciences"**

Course status	**Elective**
Language	**English**

Developer:
Ph.D. (Mathimatical sciences),
associate professor

digital signature

Viktor ZADACHYN

Head of Information systems
department:
Ph.D. (Technical sciences),
associate professor

Dmytro BONDARENKO

Head of Study Programme:
doctor of technical
sciences, professor

digital signature

Serhii MINUKHIN

Kharkiv
2024

INTRODUCTION

The course "Intelligent information systems in management" provides for the formation and acquisition of in-depth theoretical knowledge, practical skills and competencies, focused on the creation and application of modern information technologies for solving the problems of effective management of socio-economic and technical systems. The purposes of intelligent information technologies in management, which are based on intelligent methods and means of information processing, are, firstly, to expand the range of tasks solved with the help of computers, especially in weakly structured subject areas, and, secondly, to increase the level of intellectual information support of a modern specialist.

In the process of learning, students acquire the necessary knowledge during classroom classes: lectures and laboratories. Independent work of students is also of great importance in the process of studying and consolidating knowledge.

The goal of the course "Intellectual information systems in management" is the formation of a system of theoretical knowledge and the acquisition of practical abilities and skills in the field of theory and methods of computational intelligence, aimed at solving the problems of effective management of socio-economic and technical systems.

This course aims to provide students with an understanding of the fundamental concepts and principles of building intelligent information systems, equip them with the methods and tools for developing intelligent systems for management, and develop their skills in designing and implementing such systems. Specifically, the course aims to:

- introduce students to the basic concepts of artificial intelligence, machine learning, and their applications in management information systems;
- provide knowledge about modern technologies and tools used in the creation of intelligent systems, particularly in decision-making, forecasting, optimization, and the automation of management processes;
- familiarize students with the practical aspects of developing intelligent information systems, including their analysis, design, implementation, and integration into existing management processes;
- familiarization with innovative approaches and the latest technologies.

The object of the course is the process of managing socio-economic and technical systems with which human activity is connected.

The subject of the course is modern technologies for the development of intelligent information systems.

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

Table 1

Learning outcomes and competencies formed by the course

Learning outcomes	Competencies
LO6.	GC01, GC 02, SC03.
LO8.	SC03.
LO9.	GC02, SC03
LO10.	GC01, GC02, SC05.
LO19.	GC05

where,

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

LO8. Develop mathematical models and data analysis methods (including large ones).

LO9. Develop algorithmic and software for data analysis (including large data).

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

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

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Ability to apply knowledge in practical situations.

GC05. Ability to learn and master modern knowledge.

SC03. Ability to use mathematical methods to analyze formalized models of the subject area.

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

COURSE CONTENT

Content module 1: Basics of intelligent information systems (IIS).

Topic 1. The main types of IIS and their characteristics.
Basic concepts of IIS. Structure of IIS. The main types of IIS and their characteristics.

Topic 2. Classification of problems solved by IIS.
Data interpretation. Diagnostics. Monitoring. Designing. Prognostication. Planning. Teaching. Management. Decision support. Methods of their solution.

Topic 3. Basic concepts of artificial intelligence.
Definition and history of artificial intelligence. Machine learning. Artificial neural networks.

Topic 4. Management of complex systems.
Algorithmic and declarative approaches to management. Quasi-algorithms. Stages of functioning of intelligent systems.

Topic 5. Representation of knowledge in intelligent systems.
Approaches to presenting knowledge. The problem of exceptions. Properties and models of knowledge.

Content module 2: Methods and means of implementation of IIS.

Topic 6. IIS knowledge base.
Knowledge base models. Knowledge bases that ensure decision-making.

Topic 7. Expert systems development technologies.
The essence of the method of expert evaluations. Processing of expert evaluations. Formation of a group system of preferences based on individual comparison matrices. Methods of mathematical processing of expert evaluations.

Topic 8. Intelligent multi-agent systems (MAS).
The main properties of intelligent agents. Principles of creation of MAS. Modern structural organization of the MAS.

Topic 9. IIS based on artificial neural networks (ANNs).
The concept of an artificial intelligence system. Features of building an artificial intelligence system. Basic approaches to the development of an artificial intelligence system. ANN learning methods. Examples of implementation and prospects for the development of ANNs. Overview of popular IIS.

Topic 10. Evolutionary analogues in IIS.
Evolutionary programming. Evolutionary strategies. Genetic algorithms. Genetic programming.

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 1,4-8. Task 1	Create a presentation on at least one modern intellectual information system with a description of its purpose and functionality.
Topic 2,9. Task 2	Solving problems of classification of multidimensional objects.
Topic 3,9. Task 3	Solving problems of clustering multidimensional objects.
Topic 3,9. Task 4	Solving time series forecasting problems.
Topic 9,10. Task 5	Solving pattern recognition problems using neural networks.

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 1,4-9. Task 1	Review Internet sources regarding modern intelligent information systems. Create a presentation.
Topic 2. Task 2	Review Internet sources for problems solved by IIS.
Topic 3,9. Task 3	Review Internet sources on problems and methods of solving them

	using machine learning and artificial neural networks.
Topic 7. Task 4	To review the methods of mathematical processing of expert evaluations.
Topic 8-10. Task 5	Based on the materials of the Internet, research trends in the development of intelligent information systems.

The number of hours of lectures, laboratory studies and hours of self-study is given in the technological card of 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 (Topics 1, 3, 4, 6, 7, 8), problematic lecture (Topics 5, 10), mini-lecture (Topics 2, 9)).
Visual (demonstration (Topici 1-10)).
Practical (practical work (Topics 2, 3, 9, 10), presentations (Topic 9), case studies (Topic 2), business and role-playing games (Topic 2)).

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 and 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; the 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:
Current control: defense of laboratory works (50 points), written control works (10 points).
Semester control: Exam (40 points)..
More detailed information on the assessment system is provided in technological card of the course.
An example of an exam card and assessment criteria

An example of an examination paper

Semyon Kuznets Kharkiv National University of Economics
Second (master's) level of higher education
Specialty 122 "Computer sciences"
Educational and professional program "Computer sciences"
Academic discipline "Intelligent information systems in management"

EXAM CARD

Task (heuristic, 40 points).

Perform clustering of multidimensional objects for the "Adult" data from the "UCI Machine Learning repository" (http://archive.ics.uci.edu/ml/index.php), where the data sample corresponds to a folder with the appropriate name, in which there are a file with a description of the subject area and a data file directly.

When recording the results of the task, it is necessary to comply with the following requirements: formulate the general statement of the task to which the task refers; explain the meaning of the main attributes; conduct data preparation; build a model; evaluate the quality of the model based on test data; apply the model to solve the problem; provide an interpretation of the obtained results; to build graphs, which are necessary for the interpretation of both the data and the obtained results.

"___"_____20___yr.

Examiner   PhD, Associate Professor Zadachynn V.
Chief Department   PhD, Associate Professor Bondarenko D.

Assessment criteria

The examination ticket consists of one heuristic task. The final grade for the exam is a maximum of 40 points.

As a result of the task, there should be two files: the first is in DOC format (explanations and screenshots of the results of the program), the second is a program script (Python or R) that implements the task. These files should be attached as an answer to the task on the PNS course.

When recording the results of the task (in the first file), it is necessary to comply with the following requirements: formulate the general statement of the task to which the task refers; explain the meaning of the main attributes; conduct data preparation; build a model; evaluate the quality of the model based on test data; apply the model to solve the problem; provide an interpretation of the obtained results; to build graphs, which are necessary for the interpretation of both the data and the obtained results.

The task is evaluated according to the following scale.

40 points	The task is completed in full. The script of the program is presented, the results obtained, the analysis of the obtained results with reference to the essence of the problem is carried out, the answers to the questions posed in the condition of the problem are provided. Conclusions made. All requirements for recording the results of the task have been met.
35 points	The task is completed in full. The script of the program is presented, the results obtained, the analysis of the obtained results with reference to the essence of the problem is carried out, the answers to the questions posed in the condition of the problem are provided. Conclusions made. Not all requirements for recording performance results have been met.

30 points	The task is completed in full. The script of the program is presented, the results obtained, the analysis of the obtained results with reference to the essence of the problem is carried out, the answers to not all the questions posed in the condition of the problem are provided. Conclusions made. Not all requirements for recording performance results have been met.
25 points	Task accomplished. There is a program script, the program works, but there are minor inconsistencies with the condition of the task. The results were obtained, but the analysis of the obtained results was not carried out, there are no answers to the questions posed in the condition of the problem. Not all requirements for recording performance results have been met.
20 points	There is a program script, but it does not work. Not all requirements for recording the results of the task are met, but the modeling logic is given.
10 points	Task not completed. There is a fragment of the program script and the simulation logic is given. The requirements for recording the results of the task have not been met.
0 points	Task not completed

RECOMMENDED LITERATURE

Main

1. Нікольський Ю. В. Системи штучного інтелекту: Навчальний посібник / Ю. В. Нікольський, В.В. Пасічник, Ю. М. Щербина. – Київ: Магнолія, 2021. – 280 с.
2. Троцько В.В. Методи штучного інтелекту: навчально-методичний і практичний посібник / В.В. Троцько. – Київ: Університет "КРОК", 2020. – 86 с.
3. Інтелектуальні системи управління: Експертні системи – основи проектування та застосування в системах автоматизації: навч. посіб. для студ. спеціальності 151 «Автоматизація та комп'ютерно-інтегровані технології» / уклад.: Л. Д. Ярощук. – Київ: КПІ ім. Ігоря Сікорського, 2019. – 136 с.

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4. Ямпольський Л. С. Системи штучного інтелекту в плануванні, моделюванні та управлінні: підруч. для студ. вищ. навч. закл. / Л. С. Ямпольський, Б. П. Ткач, О. І. Лісовиченко. – Київ: ДП «Вид. дім «Персонал», 2017. – 544 с.
5. Коцовський В. М. Інтелектуальні інформаційні системи: Конспект лекцій / В. М. Коцовський. – Ужгород: ДВНЗ "Ужгородський національний університет", 2019. – 73 с.
6. Методи та системи штучного інтелекту: Навчальний посібник для студентів напряму підготовки 6.050101 «Комп'ютерні науки» / Уклад. : А.С. Савченко, О. О. Синельніков. – Київ: НАУ, 2017. – 190 с.
7. Stephan S. Jones, Frank M. Groom Artificial Intelligence and Machine Learning for Business for Non-Engineers. – CRC Press, 2019. – 148 p.

8.   Шаров С.В. Інтелектуальні інформаційні системи: навч. посіб. / С.В. Шаров, Д.В. Лубко, В.В. Осадчий. – Мелітополь: Вид-во МДПУ ім. Б. Хмельницького, 2015. – 144 с.

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

10.   Перепелюкова О. В. Сучасні проблеми інформаційної системи регіону / О. В. Перепелюкова // Вісник Хмельницького національного університету. – 2020. – С. 310-314. – http://repository.hneu.edu.ua/handle/123456789/26019

Інформаційні ресурси в Інтернеті

11.   9 сервісів зі штучним інтелектом для айтівців – https://highload.today/uk/9-servisiv-zi-shtuchnim-intelektom-dlya-ajtivtsiv/

12.   Philosopher AI: вийшов сайт, де штучний інтелект відповідає на філософські запитання – https://nachasi.com/tech/2020/08/31/philosopher-ai/

13.   The site of personal educational systems of Khnei National University named after S. Kuznetsia – https://pns.hneu.edu.ua/