

Fundamentals of computer science and artificial intelligence methods

COURSE SYLLABUS

Code and name of specialty	122 Computer Science	Institute / faculty	Faculty of Computer Science and Software Engineering
Program name	“Computer Science and Intelligent Systems”	Department	Software Engineering and Management Information Technologies
Type of program	Educational and Professional	Language of instruction	Ukrainian/English

LECTURER

Moskalenko Valentyna Volodymyrivna

Valentyna.Moskalenko@khpi.edu.ua



Doctor of Technical Sciences, Associate Professor, Professor of SEMIT Department. Number of scientific and educational publications is more than 90. (<https://publons.com/researcher/1588564/valentyna-moskalenko/>; Web of Science Researcher ID R-9960-2018; <https://scholar.google.com.ua/citations?user=eUidJHIAAAAJ&hl=ru>; <https://www.scopus.com/authid/detail.uri?authorId=36021571200>; <https://orcid.org/0000-0002-9994-5404>).

Courses taught: "Probability Theory and Mathematical Statistics", "Fundamentals of Computer Science and Artificial Intelligence Methods", "Fundamentals of Information Systems and Technologies", "Software Requirements Engineering", "Fundamentals of Business Analysis", "Computational Intelligence Methods", "Methods of computational intelligence and intellectual analysis", "Machine learning", "Business systems analytics"

GENERAL DESCRIPTION OF THE COURSE

Summary	<p>The course “Fundamentals of computer science and artificial intelligence methods” is a discipline in the cycle of special mandatory training in the specialty 122 "Computer Sciences". It is taught in the first semester in the amount of 130 hours (4 ECTS credits), in particular: lectures - 32 hours, workshops - 32 hours, independent work – 56 hours. The course provides two content modules and two module tests. The discipline ends with a the test.</p> <p>The study of the academic discipline provides a systematized detailed teaching of the foundations of the theory, methods and technologies of computational intelligence and their application in various fields.</p>
Course objectives	The purpose of studying the discipline is to form theoretical knowledge and practical skills in the basics of computational intelligence among computer scientists for the development of intelligent control systems.
Types of classes and control	Lectures, laboratory classes. Continuous assessment – laboratory works, intermediate modular assessment. Final assessment – the test.
Term	1

Student workload (credits) / Type of course	4 / Mandatory	Lectures (hours)	32	Workshops (hours)	32	Self-study (hours)	56
--	---------------	-------------------------	----	--------------------------	----	---------------------------	----

Program competences	<p>GC1. Ability to abstract thinking, analysis and synthesis.</p> <p>GC2. Ability to apply knowledge in practical situations.</p> <p>GC3. Knowledge and understanding of the subject area and understanding of professional activity.</p> <p>GC6. Ability to learn and master modern knowledge.</p> <p>GC7. Ability to search, process and analyze information from various sources</p>
----------------------------	---

PC 2. Ability to detect statistical patterns of non-deterministic phenomena, the use of computational intelligence methods, including statistical, neural network and fuzzy data processing, machine learning and genetic programming methods, etc.

PC 3. Ability to think logically, build logical conclusions, use formal languages and models of algorithmic calculations, design, develop and analyze algorithms, evaluate their efficiency and complexity, solvability and insolvability of algorithmic problems for adequate modelling of subject areas and creation of software and information systems.

PC 11. Ability to conduct intelligent data analysis based on methods of computational intelligence, including large and poorly structured data, their operational processing and visualization of analysis results in the process of solving applied problems.

Learning outcomes	Teaching and learning methods	Forms of assessment (continuous assessment CAS, final assessment FAS)
<p>PLO 1. Apply knowledge of the fundamental forms and laws of abstract-logical thinking, the basics of the methodology of scientific knowledge, forms and methods of extraction, analysis, processing, and synthesis of information in the subject area of computer science.</p> <p>PLO 3. Use knowledge of the laws of random phenomena, their properties and operations with them, models of random processes, and modern software environments to solve problems of statistical data processing and construction of predictive models.</p> <p>PLO 4. Use methods of computational intelligence, machine learning, neural network, and fuzzy data processing, genetic and evolutionary programming to solve problems of recognition, prediction, classification, identification of management objects, etc.</p> <p>PLO 12. Apply methods and algorithms of computational intelligence and intelligent data analysis in the tasks of classification, prediction, cluster analysis, search for associative rules using software tools to support multidimensional data analysis based on technologies DataMining, TextMining, WebMining.</p>	<p>Interactive lectures with presentations, discussions, laboratory classes, teamwork, case method, student feedback method, problem-based learning</p>	<p>Written individual assignments for laboratory works (CAS), assessment of knowledge in laboratory classes (CAS), express surveys (CAS), online tests (CAS), final/semester control in the form of a semester test, according to the schedule of the educational process (FAS)</p>

ASSESSMENT AND GRADING

Ranges of points corresponding to grades	Total score (points) for all types of learning activities	ECTS grading scale	The national grading scale	Allocation of grade points	100% Final assessment as a result of Final test (10%) and Continuous assessment (90%). 10% Final test 90% Continuous assessment: Test №1 (15%) Test №2 (15%) Laboratory works (60%) Laboratory work №1 (12%) Laboratory work №2 (12%) Laboratory work №3 (12%) Laboratory work №4 (12%) Laboratory work №5 (12%)
	90-100	A	excellent		
	82-89	B	good		
	74-81	C			
	64-73	D	satisfactory		
	60-63	E			
	35-59	FX	Unsatisfactory (with the exam retake option)		
	0-34	F	Unsatisfactory (with mandatory repetition of the course)		

Course policy Students must attend all classes according to the study schedule and adhere to the norms of academic ethics. To study the course, students need to have their personal computer and (or) use computers of the computer center at the department. Students must work with compulsory and recommended reading, including Internet resources. Students must complete and submit all laboratory works during the semester in which the course is taught, before the examination session. The final assessment is not carried out without the personal presence of students.

COURSE STRUCTURE AND CONTENT

Lecture 1	Basic components of computer science	Laboratory work 1	Searching for information on GOOGLE and forming text documents in MS Word	Self-study	Information coding. Number systems
Lecture 2	Fundamentals of information culture and information technology	Laboratory work 2	Presentation development in Microsoft Power Point		Development of computer technology and computer science
Lecture 3	PC structure PC architecture				
Lecture 4	Basic concepts about algorithms. Algorithm complexity measures	Laboratory work 3	Algorithms, ways of their presentation		Programming languages: development, purpose, popular modern languages
Lecture 5	Classes of problems P and NP. Typical NP Problems				
Lecture 6	Basic operating tools and functional components of the operating system				OS development stages
Lecture 7	Types of OS architecture				Operating systems for smartphones: development, summary of modern operating systems
Lecture 8	Computer network, topology, OSI model TCP / IP Model				Network operating systems
Lecture 9	Cloud computing and cloud computing				Development of cloud technologies
Lecture 10	Cybersecurity basics				Network botnet
Lecture 11	Types of attacks on software systems and protection of software systems from attacks				The main cyber threats in modern life
Lecture 12	The main directions of development and the main tasks of artificial intelligence	Laboratory work 4	Basic information processing skills in the MS EXCEL environment		The concept of the development of artificial intelligence in Ukraine
Lecture 13	Knowledge representation models in artificial intelligence systems	Laboratory work 5	Knowledge representation models in artificial intelligence systems		Modern trends in the development of data analytics
Lecture 14	Methods for solving artificial intelligence problems				Expert systems (definition, directions, development)
Lecture 15	Data processing and storage technologies. Database. DBMS. Data warehouses				
Lecture 16					

RECOMMENDED READING

Compulsory

- 1 Chris Bourke (2018) Computer Science I // <https://cse.unl.edu/~cbourke/ComputerScienceOne.pdf>
- 2 Peter Norton Introduction to Computer. 7th Ed. // <https://cag.gov.in/uploads/media/introduction-to-computers-by-peter-norton-6th-ed-20210326115622.pdf>.
- 3 Makarova M.V., Karnaukhova G.V., Zapara S.V.(2008) Informatics and computer technology: textbook. way. Sumy: University Book.
- 4 Voytyushenko N.M., Ostapets A.I. (2009) Informatics and computer technology: textbook. way. for students. higher textbook lock Київ: Центр учбової літератури.
- 5 Forouzan B.(2017) Foundations of Computer Science. New York: Cengage Learning EMEA
- 6 Glenn Brookshear, Dennis Brylow 2019) Marquette University Computer Science: An Overview (13th Ed.) Pearson.
- 7 Sergienko I. V. (2004) Informatics and computer technology. Київ:
- 8 David Evans (2011) Introduction to Computing. Explorations in Language, Logic, and Machines Retrieved from: // <http://computingbook.org/FullText.pdf>
- 9 Thomas H. (2009) Cormen Introduction to Algorithms, 3rd Ed. The MIT Pres.
- 10 Sedgewick, Robert; Wayne, Kevin (2011) Algorithms (4th Ed.). Addison-Wesley Professional
- 11 Polishchuk V. V.(2018) Software technologies of information protection: lecture notes for students in the direction of training 6.050103 "Software Engineering" of the Faculty of Information Technologies of Uzhhorod National University / Developer: Ph.D. – Uzhhorod.
- 12 Vavilenkova A.I. Analysis of models of knowledge representation in expert management systems Retrieved from // <https://jrnل.nau.edu.ua/index.php/PIU/article/view/9140>
- 13 SubbotinS. O.(2008) Representation and processing of knowledge in artificial intelligence systems and decision support: A textbook. Zaporozhye: ZNTU.

Додаткова

- 14 Information Technology Innovation. Resurgence, Confluence, and Continuing Impact (2020) Retrieved from: // <https://doi.org/10.17226/25961>
 - 15 William M Springer, Nicholas R Allgood (2019) A Programmer's Guide to Computer Science: A virtual degree for the self-taught developer. Jaxson Media
 - 16 D.E Knuth (2010) Fundamental Algorithms. Vol.1 Editorial Reverte
 - 17 Jon Kleinberg, Eva Tardos (2013) Algorithm Design by Algorithm Design. Pearson Group.
 - 18 Novotarsky. M.A.(2019) Algorithms and methods of calculations: textbook. way. for students. specialties 121 "Software Engineering" Kyiv: KPI named after Igor Sikorsky.
 - 19 Thomas D Feigenbaum (2015) Building Intelligent Information Systems Software: Introducing the Unit Modeler Development Technology: Elsevier Science.
 - 20 Peter Jackson (1999). Introduction To Expert Systems, 3rd Ed. Addison-Wesley.
- Information resources on the Internet**
- 21 Harvard CS50. [Electronic resource] - Access mode: https://javarush.ru/quests/lectures?quest=QUEST_HARVARD_CS50&level=0
 - 22 https://javarush.ru/quests/lectures?quest=QUEST_HARVARD_CS50&le
 - 23 // <https://networkguru.ru/osnovnye-kiberugrozy-2019-2020/>
 - 24 // https://www.handybackup.ru/backup_articles/computer-securing.shtml
 - 25 // <https://www.kaspersky.ru/resource-center/threats/botnet-attacks>.
 - 26 // <https://intellect.icu/modeli-i-metody-resheniya-zadach-v-sitemakh-iskusstvennogo-intellekta-6779>.
 - 27 https://ru.wikibooks.org/wiki/Састемы_хранения_данных

ACADEMIC INTEGRITY

Students are expected to adhere to the Code of Ethics of Academic Relations and Integrity of NTU “KhPI”.

The content of this syllabus is consistent with the course program.