Syllabus

Course Program

Fundamentals of computer science and artificial intelligence methods

Specialty
122 – Computer Science

Institute
Institute of Computer Science and Information Technology

Educational program
Computer Science and Intelligent Systems

Department
Software Engineering and Management Intelligent Technologies (321)

Level of education
Bachelor's level

Course type
Special (professional), Mandatory

Semester
1

Language of instruction
English, Ukrainian

Lecturers and course developers

Valentyna Moskalenko

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Doctor of Technical Sciences, Professor, Professor of SEMIT Department.
Number of scientific and educational publications is more than 100, 13 articles in publications indexed in Scopus.
(https://publons.com/researcher/1588564/valentyna-moskalenko/;
Web of Science ResearcherID R-9960-2018;
https://scholar.google.com.ua/citations?user=eUidJHIAAAAJ&hl;
https://www.scopus.com/authid/detail.uri?authorId=36021571200;
https://orcid.org/0000-0002-9994-5404)
Leading lecturer in disciplines: "Fundamentals of computer science and artificial intelligence methods", "Probability theory and mathematical statistics", "Business analysis methods for requirements management", "Methods of computational intelligence", "Software requirements engineering", "Fundamentals of Machine Learning", "Introduction to neural networks".
Scientific directions: development of information systems for strategic company management; application of computer intelligence methods and models for solving problems of managing complex organizational systems; business analytics.
More about the lecturer on the department's website

General information

Summary

The subject of study of the educational discipline is the main areas of computer science, the use of information technologies, the Internet, application programs for creating and processing text and graphic information, the computer architecture, operating systems, network technologies and computer security, methods artificial intelligence, which are used in the development of intelligent control systems.

Course objectives and goals

The goal is to acquaint students with the current state of development of computer science and information technologies, the role and capabilities of modern information technologies, the acquisition by

students of knowledge, skills and communications for the effective use of modern information technologies and application programs for solving complex scientific and technical problems in in various industries.

Format of classes

Lectures, laboratory classes, consultations. Final control is a test.

Competencies

GC1. Ability to think abstractly, analyze and synthesize.
GC2. Ability to apply knowledge in practical situations.
GC3. Knowledge and understanding of the subject area and understanding of professional activities.
GC6. Ability to learn and master modern knowledge.
GC7. Ability to search, process and analyze information from various sources.
PC3. Ability to think logically, build logical conclusions, use formal languages and models of algorithmic computing, design, develop and analyze algorithms, evaluate their effectiveness and complexity, solvability and intractability of algorithmic problems for adequate modeling of subject areas and creation of software and information systems.
PC11. Ability to intelligently analyze data based on computational intelligence methods, including large and poorly structured data, their operational processing and visualization of analysis results in the process of solving applied problems.

Learning outcomes

PLO1. To apply knowledge of the basic forms and laws of abstract and logical thinking, the basics of the methodology of scientific knowledge, forms and methods of extracting, analyzing, processing and synthesizing information in the subject area of computer science

Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures - 32 hours, laboratory classes - 32 hours, self-study - 56 hours.

Course prerequisites

The basis of studying the discipline is general knowledge of the basics of informatics.

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 test, according to the schedule of the educational process (FAS).

Program of the course

Topics of the lectures

Topic 1. The main components of computer science
Description of components of computer science. Basics of information culture and information technologies.
Topic 2. PC construction
PC structure PC architecture.
Theme 3. Algorithmizing fundamentals
Basic algorithms concepts. Algorithm complexity measures
Classes of problems P and NP. Typical NP problems
Topic 4. Operating systems fundamentals

Basic work tools and functional components of the operating system. Types of OS architecture.
Topic 5. Computer networks fundamentals.
Concept of computer network, topology, OSI model. TCP/IP model. Cloud technologies and cloud computing
Topic 6. Cyber security fundamentals.
Basic information about cyber security. Types of attacks on software systems and protection of software systems from attacks
Topic 7.The main areas of artificial intelligence.
Main directions of development and main tasks of artificial intelligence
Models of knowledge representation in artificial intelligence systems
Topic 8. Methods of solving artificial intelligence problems
Solving problems by the method of searching in the space of states, by the method of reduction. Solving problems of deductive choice.
Topic 9. Data processing and storage technologies.
Databases. Data warehouses. Data storage systems.

Topics of the workshops

Workshops are not provided within the discipline.

Topics of the laboratory classes

Topic 1. Searching for information in GOOGLE and creating text documents in MS Word
Topic 2. Development of a presentation in Microsoft Power Point
Topic 3. Algorithms, methods of their presentation
Topic 4. Basic skills of information processing in MS Excel
Theme 5. Knowledge representation models in artificial intelligence systems.

Self-study

Topic 1. The main components of computer science.
Coding of information. Numerical systems. Development of computer technology and computer science
Topic 2. PC construction.
Interrupt mechanism.
Theme 3. Algorithmizing fundamentals.
Programming languages: development, purpose, popular modern languages.
Topic 4. Operating systems fundamentals.
OS development stages. Operating systems for smartphones: development, summary of modern OSesTopic .
5. Computer networks fundamentals.
Network operating systems. The development of cloud technology.
Topic 6. Cyber security fundamentals.
Botnet network. The main cyber threats in modern life.
Topic 7. The main areas of artificial intelligence.
Current trends in data analytics development.
Topic 8. Methods of solving artificial intelligence problems.
Expert systems (definition, directions, development).

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. Bourke C. (2018) Computer Science I // https://cse.unl.edu/~cbourke/ComputerScienceOne.pdf
2. Norton P. Introduction to Computer. 7th Ed. // https://cag.gov.in/uploads/media/introduction-to-computers- by-peter-norton-6th-ed-20210326115622.pdf.

3. Informatics. Computer Engineering. Computer technologies / V.A. Bazhenov, P.S. Wengerskyi, V.S. Garvona. etc. / Sciences. ed. HA. Shinkarenko, O.V. Shishov Textbook. – K.: Caravela, 2019. – 592 p.
4. Zlobin H.G. PC architecture and hardware / H.G. Zlobin, R.E. Rykalyuk Education manual –K.: Karavela, 2018. – 224 p.
5. Forouzan, B. (2017). Foundations of Computer Science. New York: Cengage Learning EMEA.
6. Brookshear G., Brylow D. (2019). Computer Science: An Overview. (13th Ed.). Pearson.
7. Pavlysh V. A. Fundamentals of information technologies and systems: a textbook / V. A. Pavlysh, L. K. Glinenko, N. B. Shakhovska. – Lviv: Publishing House of Lviv Polytechnic, 2018. – 620 p.
8. Evans D. Introduction to Computing. Explorations in Language, Logic, and Machines (2017) // http://computingbook.org/FullText.pdf? // https://www.computer-pdf.com/other/554-tutorial-introduction-to-computing.html
9. Cormen T. H. (2022). Introduction to Algorithms. (4th Ed.) Publisher MIT Press Ltd. 1332 pp.
10. Sedgewick R., Wayne K. (2016). Algorithms. (4th Ed.). Addison-Wesley Professional, 952 p.
11. Polishchuk V. V. (2018). Software technologies of information protection: a synopsis of lectures for students in the field of training 6.050103 "Software engineering" of the Faculty of Information Technologies of UzhNU. Uzhhorod
12. Subbotin S. O. Neural networks: theory and practice: teaching. manual / S. O. Subbotin. - Zhytomyr: Ed. O. O. Evenok, 2020. - 184 p.

Additional literature

1 Information Technology Innovation. Resurgence, Confluence, and Continuing Impact. (2020). Retrieved from https://doi.org/10.17226/25961
2. Springer W. M., Allgood N. R. (2019). A Programmer's Guide to Computer Science: A virtual degree for the self-taught developer. Jackson Media.
3. Knuth D. E. (2021). Fundamental algorithms. /Donald E. Knuth. Ed. Revert. - 692 p.
4 Novotarsky M. A. (2019). Algorithms and calculation methods: teaching. manual for special students 121 "Software engineering". Kyiv: KPI named after Igor Sikorsky.
5. Hulten G. Building Intelligent Systems. A Guide to Machine Learning Engineering (2018) // https://doi.org/10.1007/978-1-4842-3432-7

Information resources on the Internet

1. CS50: Introduction to Computer Science //https: pll.harvard.edu/course/cs50-introduction-computer-science?delta=0
2. Learn Computer Science //https://www.learncomputerscienceonline.com/
3. CS101: Introduction to Computer Science //https://learn.saylor.org/course/CS101
4. Introduction to Computer Science // https://en.wikiversity.org/wiki/Introduction_to_Computer_Science
5. Expert Systems // https://www.javatpoint.com/expert-systems-in-artificial-intelligence.

Assessment and grading

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

100% final assessment in the form of
a test (20%) and a current assessment (80%).
20% credit: semester credit, according to the schedule of the educational process;
80% current assessment:
Laboratory work №1 (16%)
Laboratory work №2 (16%)
Laboratory work №3 (16%)
Laboratory work №4 (16%)
Laboratory work №5 (16%)

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 Andrii KOPP