Syllabus
Course Program

Pre-diploma practice

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), Elective

Semester
6

Language of instruction
English, Ukrainian

Lecturers and course developers

Iryna Liutenko

iryna.liutenko@khpi.edu.ua
Candidate of Technical Sciences (PhD), Associate Professor, Associate Professor of the Department of Software Engineering and Management Intelligent Technologies of NTU "KhPI"

Prepared and published more than 60 publications, 1 collective monograph, 1 textbook with the university stamp, 3 articles in publications indexed in Scopus (Google Scholar: https://scholar.google.com/citations?user=9EhcsRcAAAAJ; ORCID: https://orcid.org/0000-0003-4357-1826).
More about the lecturer on the department's website

General information

Summary

The undergraduate internship is part of the educational process and is conducted in the 4th year of study in the 6th semester for full-time students. The duration of the internship is 180 hours (6 credits). The undergraduate internship is aimed at developing professional skills of students majoring in 122 "Computer Science" and collecting factual material for their thesis.
Pre-diploma practice takes place at enterprises (organizations, institutions) on the basis of concluded agreements with the regulation of the main issues of organizing the work of interns.

Course objectives and goals

Deepening and consolidation of theoretical knowledge acquired by higher education students in the process of studying a certain cycle of theoretical disciplines, practical skills, familiarization directly at the enterprise with the production process of the IT sphere, improvement of skills and abilities in the specialty 122 "Computer Science", as well as collection of material for the thesis.

Format of classes

Independent work. The 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.
GC4. Ability to communicate in the state language both orally and in writing.
GC5. Ability to communicate in a foreign language.
GC6. Ability to learn and master modern knowledge.
GC7. Ability to search, process and analyze information from various sources.
GC8. Ability to generate new ideas (creativity).
GC9. Ability to work in a team.
GC10. Ability to be critical and self-critical.
GC11. Ability to make informed decisions.
GC12. Ability to evaluate and ensure the quality of work performed.
GC13. Ability to act on the basis of ethical considerations.
GC14. Ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine.
GC15. Ability to preserve and enhance moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types and forms of physical activity for active recreation and healthy lifestyle.
PC1. Ability to mathematically formulate and study continuous and discrete mathematical models, justify the choice of methods and approaches for solving theoretical and applied problems in the field of computer science, analysis and interpretation.
PC2. Ability to identify statistical regularities of non-deterministic phenomena, apply methods of computational intelligence, in particular statistical, neural network and fuzzy data processing, machine learning and genetic programming methods, etc.
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.
PC4. Ability to use modern methods of mathematical modeling of objects, processes and phenomena, to develop models and algorithms for numerical solution of mathematical modeling problems, to take into account the errors of approximate numerical solution of professional problems.
PC5. Ability to carry out a formalized description of the tasks of researching operations in organizational, technical and socio-economic systems for various purposes, to determine their optimal solutions, to build models of optimal management taking into account changes in the economic situation, to optimize management processes in systems of various purposes and hierarchy levels.
PC6. Ability to think systematically, apply the methodology of system analysis to study complex problems of different nature, methods of formalizing and solving systemic problems with conflicting goals, uncertainties and risks.
PC7. Ability to apply the theoretical and practical foundations of modeling methodology and technology to study the characteristics and behavior of complex objects and systems, to conduct computational experiments with processing and analysis of results.
PC8. Ability to design and develop software using various programming paradigms: generalized, object-oriented, functional, logical, with appropriate models, methods and algorithms of computation, data structures and control mechanisms.
PC9. Ability to implement a multi-level computing model based on client-server architecture, including databases, knowledge and data warehouses, to perform distributed processing of large data sets on clusters of standard servers to meet the computing needs of users, including cloud services.
PC10. Ability to apply methodologies, technologies and tools to manage the life cycle processes of information and software systems, information technology products and services in accordance with customer requirements.
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.

PC12. Ability to ensure the organization of computing processes in information systems for various purposes, taking into account the architecture, configuration, performance indicators of operating systems and system software.
PC13. Ability to develop network software that operates on the basis of various topologies of structured cabling systems, uses computer systems and data networks and analyzes the quality of computer networks.
PC14. Ability to apply methods and tools to ensure information security, develop and operate special software to protect information resources of critical information infrastructure.
PC15. Ability to analyze and functional modeling of business processes, construction and practical application of functional models of organizational, economic, production and technical systems, methods of risk assessment of their design.
PC16. Ability to implement high-performance computing based on cloud services and technologies, parallel and distributed computing in the development and operation of distributed parallel information processing systems.
PC17. Ability to apply the theoretical and practical foundations of modern management theory of complex organizational, technical and socio-economic systems to build intelligent management systems, to use modern information processing technologies and methods of computational intelligence in the design of intelligent systems.
PC18. Ability to apply modern methods of decision-making theory, including: methods of ranking, formation and coordination of collective expert opinions, multi-criteria optimization and others, to build intelligent control systems.
PC19. Ability to comprehensively use methods of mathematical modeling and analysis of complex systems, methods of modeling and analysis of business processes, information technology for managing business systems to create intelligent control systems.
PC20. Ability to develop the architecture of software systems and their individual components in the construction of intelligent control systems in various fields, to manage the life cycle processes of software of intelligent control systems.

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.
PLO2. To use the modern mathematical apparatus of continuous and discrete analysis, linear algebra, analytical geometry in professional activities to solve theoretical and applied problems in the design and implementation of information objects.
PLO3. To use knowledge of the laws of random phenomena, their properties and operations on them, models of random processes and modern software environments to solve problems of statistical data processing and build predictive models.
PLO4. To use methods of computational intelligence, machine learning, neural network and fuzzy data processing, genetic and evolutionary programming to solve problems of recognition, forecasting, classification, identification of control objects, etc.
PLO5. Design, develop and analyze algorithms for solving computational and logical problems, evaluate the effectiveness and complexity of algorithms based on the use of formal models of algorithms and computable functions.
PLO6. To use methods of numerical differentiation and integration of functions, solution of ordinary differential and integral equations, features of numerical methods and possibilities of their adaptation to engineering problems, to have skills in software implementation of numerical methods.
PLO7. Understand the principles of modeling organizational and technical systems and operations; use methods of researching operations, solving single and multi-criteria optimization problems of linear, integer, nonlinear, stochastic programming.
PLO8. To use the methodology of system analysis of objects, processes and systems for the tasks of analysis, forecasting, management and design of dynamic processes in macroeconomic, technical, technological and financial objects.
PLO9. Develop software models of subject environments, choose a programming paradigm from the standpoint of convenience and quality of application for the implementation of methods and algorithms for solving problems in the field of computer science.

PLO10. To use tools for developing client-server applications, design conceptual, logical and physical models of databases, develop and optimize queries to them, create distributed databases, data warehouses and showcases, knowledge bases, including cloud services, using web programming languages.
PLO11. Have the skills to manage the life cycle of software, products and services of information technology in accordance with the requirements and restrictions of the customer, be able to develop project documentation (feasibility study, terms of reference, business plan, agreement, contract).
PLO12. Apply methods and algorithms of computational intelligence and data mining in the tasks of classification, forecasting, cluster analysis, search for associative rules using software tools to support multivariate data analysis based on DataMining, TextMining, WebMining technologies.
PLO13. To know system programming languages and methods of developing programs that interact with components of computer systems, to know network technologies, computer network architectures, to have practical skills in the technology of computer network administration and their software.
PLO14. To apply knowledge of methodology and CASE tools for designing complex systems, methods of structural analysis of systems, object-oriented design methodology in the development and study of functional models of organizational, economic, production and technical systems.
PLO15. Understand the concept of information security, the principles of secure software design, ensure the security of computer networks in conditions of incomplete and uncertainty of the source data.
PLO16. Perform parallel and distributed computing, apply numerical methods and algorithms for parallel structures, parallel programming languages in the development and operation of parallel and distributed software.
PLO17. Apply theoretical and practical foundations of modern management theory to build intelligent control systems, design intelligent systems using modern information processing technologies and methods of computational intelligence.
PLO18. To apply modern methods of decision-making theory to build intelligent control systems, including methods of ranking, formation and coordination of collective expert opinions, multi-criteria optimization, and others.
PLO19. To create intelligent management systems using methods of mathematical modeling and analysis of complex systems, methods of modeling and analysis of business processes, information technology management of business systems.
PLO20. Develop the architecture of software systems and their individual components in the construction of intelligent control systems in various industries, as well as manage the life cycle processes of software of intelligent control systems.
PLO21. Apply the principles of moral, cultural, scientific values and multiply the achievements of society, use various types and forms of physical activity for a healthy lifestyle and professional activities in the field of information technology.

Student workload

The total volume of the course is 180 hours (6 ECTS credits): self-study - 180 hours.

Course prerequisites

Students must complete the required general and professional training courses in 1-8 semesters of study in full.

Features of the course, teaching and learning methods, and technologies

The practice involves individual work of higher education students.
During the internship, higher education students should consider:
- the structure of the IT enterprise, the functions of its individual subsystems, organizational and information relationships between these subsystems, the corresponding scheme of information flows;
- technological processes in the IT sphere, in particular, information processing;
- main characteristics of modern equipment and tools for developing, testing and maintaining software systems used in the practice;
- means of organizing and planning work on the basis of practice, determine the role of existing software systems, in particular intelligent systems, in improving labor efficiency;
- means of labor protection and safety.

During the internship, students must familiarize themselves with the promising areas of development of information processing systems based on the internship; responsibilities of employees of a particular unit (at the place of internship); standards, norms and other regulatory and reference documentation used in a particular unit; prospects for the development of the enterprise and the industry.
In the course of undergraduate practice, students must participate in the performance of production tasks; in seminars, excursions, problematic lectures, trainings and other classes held at the practice site.
An individual task is drawn up with the participation of the university internship supervisor, the company internship supervisor and is agreed with the supervisor of the student's thesis after the interns are assigned to workplaces.
At the end of the internship, the student must prepare all the necessary reporting documentation, including a practice diary, a practice report and a presentation.
The working time of the internship is 30 hours per week.

Program of the course

Topics of the lectures

Lectures are not provided as part of the practice.

Topics of the workshops

Workshops are not provided as part of the practice.

Topics of the laboratory classes

Laboratory classes are not provided as part of the practice.

Self-study

During the internship, students must:
- fully fulfill the tasks provided by the internship program;
- study and comply with the rules of labor protection, safety and industrial sanitation;
- participate in the social life of the enterprise - the base of practice;
- be responsible for the work performed on an equal footing with all employees.

Course materials and recommended reading

Training materials and assignments are provided by the supervisors of the internship.

Assessment and grading

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

The main control measures are:
- obtaining feedback from the supervisor of the internship from the company;
- Presentation of the results of the internship (using a prepared presentation) to the commission, which is formed from the staff of the department authorized to evaluate the internship;
- review of the undergraduate internship report and the internship diary by the university internship supervisor and the committee.

The undergraduate internship report must contain:
- a qualitative statement of the problem;
- a description of the main technologies used to solve the problem;
- description of the main stages of software design;
- description of the architecture, functionality, features of the developed software;
- description of the results of the developed software;
- description of the results of software testing;
- description of work with data (data processing) for control examples.

The main stages of work on the tasks of the internship must be properly presented in the internship diary.
The defense of the practice takes place at the department.

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