MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

**National Aerospace University
Kharkiv Aviation Institute**

APPROVED
scientific council
National Aerospace University
Kharkiv Aviation Institute
19.04.2017, Minutes № 13
order № 178 dated 19.04.2017

EDUCATIONAL PROFESSIONAL PROGRAM

Information technology design

Level of higher education - first (bachelor's)
field of knowledge 12 Information technologies
specialty 122 Computer Science
Qualification: Bachelor of Computer Science in the educational program "Information Technology Design"

(as amended in accordance with the decision:
of the Academic Council of KHAI protocol № 9 dated April 25, 2018
scientific-methodical commission of KHAI protocol № ___ dated 31.08.2019,
scientific-methodical commission of KHAI protocol № 1 from 31.08.2020)

The educational program is put into operation
"01" September 2020

Rector of the National Aerospace University
Kharkiv Aviation Institute

_____ MV Nechiporuk
order № 383 dated 01.09.2020

Kharkiv 2020

PREFACE

Educational and professional program "Information Technology Design" for the preparation of applicants for the first (bachelor's) level of higher education in the specialty 122 "Computer Science" at the National Aerospace University"Kharkiv Aviation Institute" (hereinafter - KHAI) was updated in connection

− with the redistribution of ECTS credits between the components of the educational-professional program and updating the content of the description of the educational program (approved by the decision of the Academic Council of KHAI protocol № 9 from 25.04.2018);

− with changes in accordance with the Standard of the Ministry of Education and Science (order of the Ministry of Education and Science № 962 of 10.07.2019) (approved by the decision of the scientific-methodical commission 2 (NMC 2) KHAI protocol № 1 of 30.08.2019);

− with a change in the National Qualifications Framework (Resolution of the Cabinet of Ministers of Ukraine of June 25, 2020, № 519) (approved by the decision of the scientific-methodical commission 2 (NMC 2) KHAI protocol № 1 from 31.08.2020).

Update of the educational-professional program "Information Technologies of Design" was carried out by the group of development and support of EPP KHAI consisting of:

1	Guarantor of the educational program	Ovsyannik V.	- Cand. tech. Sciences, Associate Professor, Professor of Information Technology Design
2	Group members:	Druzhinin E.	- Dr. tech. Sciences, Professor, Professor of the Department of Information Technology Design
3		Shevel V.	- Cand. tech. Sciences, Associate Professor, Professor of Information Technology Design

Workgroup:

Karatanov O.	- Cand. tech. Sciences, Associate Professor of Information Technology Design
Kritsky D.	- Cand. tech. Sciences, Associate Professor, Head Department of Information Technology Design
Pogudina O.	- Cand. tech. Sciences, Associate Professor, Associate Professor of Information Technology Design

INTRODUCTION

According to Art. 1 "Basic terms and their definitions" of the Law of Ukraine "On Higher Education" from 01.07.2014 № 1556-VII (as amended) educational program - a system of educational components at the appropriate level of higher education within the specialty that determines the requirements for the level of education persons who can start studying under this program, the list of disciplines and the logical sequence of their study, the number of ECTS credits required to implement this program, as well as the expected learning outcomes (competencies) that must be mastered by the applicant.

The educational program is used during:
– accreditation of the educational program, inspection of educational activity by specialty and specialization;
– curriculum development, curricula and practices;
– development of diagnostic tools for the quality of higher education;
– determining the content of training in the system of retraining and advanced training;
– professional orientation of applicants for the specialty.

The educational and professional program takes into account the requirements of the Law of Ukraine "On Higher Education" dated 01.07.2014 № 1556-VII (as amended), the Resolution of the Cabinet of Ministers of Ukraine "On approval of the National Qualifications Framework" dated 23.11.2011 № 1341, the standard of higher education in the specialty 122 "Computer Science", which was approved and put into effect by the order of the Ministry of Education and Science of Ukraine dated 10.07.2019 № 962, and establishes:
– volume and term of study of bachelors;
– general competencies;
– professional competencies;
– program learning outcomes;
– the list and volume of academic disciplines for mastering the competencies of the educational-professional program;
– requirements for the structure of academic disciplines.

Educational and professional program is used for:
– drawing up curricula and working curricula;
– formation of individual plans of students;
– formation of working programs of academic disciplines, practices;
– determination of the information base for the formation of diagnostic tools;
– accreditation of educational and professional program;
– internal and external quality control of training;
– certification of bachelors in the educational-professional program "Information Design Technologies" in the specialty 122 Computer Science.

Users of the educational and professional program:
– applicants for higher education studying at the National Aerospace University"Kharkiv Aviation Institute";
– research and teaching staff who train bachelors in the educational and professional program "Information Technology Design" in the specialty 122 "Computer Science";
– examination commission of specialty 122 "Computer Science";
– Admissions Committee of the National Aerospace University"Kharkiv Aviation Institute".

The educational and professional program extends to the departments of the University involved in the training of bachelor's degree specialists in the educational and professional program "Information Technology Design" in the specialty 122 "Computer Science".

1 REGULATORY REFERENCES

The educational and professional program is developed on the basis of the following regulations and recommendations:

1.1 Law of Ukraine "On Higher Education". № 1556-UII dated 01.07.2014 (as amended).

1.2 Resolution of the Cabinet of Ministers of Ukraine "On approval of the National Qualifications Framework" dated 23.11.2011 № 1341 (as amended).

1.3 Standard of higher education in the specialty 122 "Computer Science" in the field of knowledge 12 "Information Technology" for the first (bachelor's) level of higher education (order of the Ministry of Education and Science of Ukraine № 962 of July 10, 2019) - https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/2019/07/12/122-kompyuterni-nauki-bakalavr.pdf.

1.4 Resolution of the Cabinet of Ministers of Ukraine "On approval of the list of branches of knowledge and specialties in which the training of applicants for higher education" from 29.04.2015 № 266.

1.5 Resolution of the Cabinet of Ministers of Ukraine "On approval of the Regulations on the procedure for exercising the right to academic mobility" dated 12.08.2015 № 579.

1.6 Methodical recommendations for the development of standards of higher education (order of the Ministry of Education and Science of Ukraine № 600 of 01.06.2017) approved by the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine (as amended).

1.7 Regulations "On the organization of the educational process" of the National Aerospace University"Kharkiv Aviation Institute".

1.8 ATuningGuidetoFormulatingDegreeProgrammeProfilesIncludingProgrammeCompetencesandProgrammeLearningOutcomes. -Bilbao, GroningenandTheHague, 2010.

1.9 A TUNING-AHELO conceptualframeworkofexpected / desiredlearningoutcomesinengineering. OECD Education Working Papers, No. 60, OECD Publishing 2011. http://dx.doi.org/10.1787/5kghtchn8mbn-en

1.10 Development of educational programs. Methodical recommendations / Author: V. Zakharchenko, V.Lugovyi, Yu.M. Rashkevich, G. Talanova / Ed. V.G. Flint. - Kyiv: State Enterprise "Priorities", 2014. - 120 p.

1.11 Order of the Ministry of Education and Science of Ukraine "On the peculiarities of the introduction of the list of branches of knowledge and specialties for which higher education students are trained, approved by the Cabinet of Ministers of Ukraine dated April 29, 2015 № 266" dated 06.11.2015 № 1151.

1.12 Classification of economic activities: DK 009: 2010. - Valid from 01.01.2012. - (National Classifier of Ukraine).

1.13 Classifier of professions: DK 003: 2010. - Valid from 01.11.2010. - (National Classifier of Ukraine).

1.14 National educational glossary: higher education / 2nd ed., Revised. and ext. / Author: V. Zakharchenko, C. Kalashnikov, V.Lugoviy, A. Stavytsky, Yu.M. Rashkevich, G. Talanova / Ed. V.G. Flint. - Kyiv: Pleiades Publishing House LLC, 2014. - 100 p.

2 PROFILE OF THE EDUCATIONAL PROFESSIONAL PROGRAM "INFORMATION DESIGN TECHNOLOGIES" IN THE SPECIALTY 122 "COMPUTER SCIENCES"

1 - General information	
Full name of the higher educational institution and structural subdivision	National Aerospace University"Kharkiv Aviation Institute" Department of Information Technology Design
Degree of higher education	Degree of higher education - bachelor
Name of qualification in the original language	Qualification: Bachelor of Computer Science in the educational program "Information Technology Design"
The official name of the educational and professional program	Information Technology Design
Type of diploma and scope of educational and professional program	Bachelor's degree, single, term of study 3years 10 months (or 2 years 10 months for part-time students) - on the basis of complete general secondary education - 240 ECTS credits. - on the basis of the degree of junior bachelor (educational qualification level "Junior Specialist") - 240 ECTS credits. KHAI recognizes and recalculates no more than 120 ECTS credits received within the previous educational program of junior bachelor (junior specialist) in specialties within the industry, and no more than 60 ECTS credits received within the previous educational program of junior bachelor (junior specialist) for other specialties.
Availability of accreditation	Certificate of accreditation: Series UD № 21008322 issued on January 25, 2019, protocol № 110 (order of the Ministry of Education and Science of Ukraine dated 15.07.2014 № 2642l) Validity 01.07.2024
Cycle / level	NRC of Ukraine - level 6, FQ-EHEA - first cycle, EQF-LLL - level 6
Prerequisites	A person has the right to obtain a bachelor's degree subject to full general secondary education and / or primary level (short cycle) of higher education (junior bachelor, professional junior bachelor, educational qualification level "Junior Specialist"), based on the results of external independent assessment (introductory) tests)
Language(s) of instruction	The language of instruction is the state language. In order to create conditions for international academic mobility, it may be decided to teach one or more subjects in English and / or other foreign languages.
Validity of the educational and professional program	The educational program is reviewed at least once every 5 years or at the request of stakeholders.
Internet address of the permanent placement of the description of the educational-professional program	https://khai.edu/ua/education/osvitni-programi-i-komponenti/osvitni-programi-bakalavriv/ https://drive.google.com/file/d/16U_Q0AjWXJZtFEDuDTH3eeyH1U-3IBnR/view

2 - The purpose of the educational program
1 To provide theoretical knowledge and practical skills sufficient for successful performance of professional duties under the educational-professional program "Information Technologies of Design", specialty 122 Computer Science. 2 Formation of the personality of the expert capable to use professional-profile knowledge and practical skills for the decision of difficult specialized problems and practical problems in the field of information technologies, as well as in the fields of aviation, mechanical engineering and related industries.

3 - Characteristics of the educational and professional program	
Subject area	**Object (s) of study and / or activity:** – mathematical, informational, simulation models of real phenomena, objects, systems and processes, subject areas, presentation of data and knowledge – methods and technologies for obtaining, storing, processing, transmitting and using information, data mining and decision making – theory, analysis, development, performance evaluation, implementation of algorithms, high-performance computing, including parallel computing and big data. **Learning objectives:** training of specialists capable of conducting theoretical and experimental research in the field of computer science; apply mathematical methods and algorithmic principles in modeling, design, development and maintenance of information technologies; to develop, implement and maintain intelligent systems for analysis and data processing of organizational, technical, natural and socio-economic systems. **Theoretical content of the subject area:** modern models, methods, algorithms, technologies, processes and methods of obtaining, presenting, processing, analyzing, transmitting, storing data in information systems. **Methods, techniques and technologies:** mathematical models, methods and algorithms for solving theoretical and applied problems that arise in the development of IT; modern technologies and programming platforms; methods of collecting, analyzing and consolidating distributed information; technologies and methods of design, development and quality assurance of IT components; computer graphics methods and data visualization technologies; knowledge engineering technologies, CASE-technologies of IT modeling and design; **Tools and equipment:** distributed computing systems; computer networks; mobile and cloud technologies, database management systems, operating systems.
Orientation of the educational program	The educational and professional bachelor's degree program is designed for students who aspire to become specialists in the field of computer science.
The main focus of the educational-professional program (specialization)	The educational-professional program establishes qualification requirements for social and production activities of graduates of higher education institutions in the specialty 122. "Computer Science" educational degree "Bachelor" and state requirements for the properties and qualities of a person who has obtained a certain educational level of education. -professional program "Information Technology Design".
Features of the program	The educational program is aimed at studying systems and programming languages that will facilitate the implementation of a cross-cutting approach to computer-aided design systems, which begins with the construction of the model and ends with its manufacture on machines with numerical program control. The practice is carried out at enterprises of various industries.

4 - Suitability of graduates for employment and further study	
Suitability for employment	Professional activity as a specialist in software development, information systems, in the field of information technology. Graduates can work in professions according to the National Classification of Occupations DK 003: 2010: 3121 - software technician; 3121 - specialist in information technology; 3121 - software development and testing specialist; 3121 - specialist in computer program development; 3121 - specialist in computer graphics (design). Places of employment: educational institutions; research, design, manufacturing, public and private enterprises (specialists of IT departments or IT enterprises).
Academic and professional rights of graduates	They have the right to continue their studies at the second (master's) level of higher education. Acquisition of additional qualifications in the system of postgraduate education.
5 –Teaching and assessment	
Teaching and learning	Student-centered learning, self-study, problem-oriented learning aimed at the development of critical and creative thinking, learning through laboratory practice, dual, distance education and more. Lectures, multimedia lectures, laboratory work, seminars, practical classes in small groups, independent work based on textbooks and abstracts, consultations with teachers, preparation of a bachelor's thesis project.
Evaluation	Written exams, practice reports, essays, presentations, current (modular) control, bachelor's thesis projectand its protection.
6 - Program competencies	
Integral competence	Ability to solve complex specialized problems and practical problems in the field of computer science or in the learning process, which involves the application of theories and methods of information technology and is characterized by complexity and uncertainty of conditions.
General Competences (GC)	GC1. Ability to abstract thinking, analysis and synthesis. GC2. Ability to apply knowledge in practical situations. GC3. Knowledge and understanding of the subject area and understanding of professional activity. 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. The 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 ethical considerations. GC14. The 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 multiply moral, cultural, scientific values and achievements of society based on understanding 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, techniques and technologies. Active recreation and a healthy lifestyle.

Professional competencies of the specialty (SC)	SC1. 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.
	SC2. Ability to detect statistical patterns of nondeterministic phenomena, the use of methods of computational intelligence, including statistical, neural network and fuzzy data processing, methods of machine learning and genetic programming, etc.
	SC3. Ability to think logically, build logical conclusions, use formal languages and models of algorithmic calculations, design, development and analysis of algorithms, evaluate their efficiency and complexity, solvability and unsolvability of algorithmic problems for adequate modeling of subject areas and creation of software and information systems.
	SC4. 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.
	SC5. Ability to provide a formalized description of operations research tasks in organizational, technical and socio-economic systems for different 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 different systems and hierarchies.
	SC6. Ability to systems thinking, application of systems analysis methodology to study complex problems of different nature, methods of formalization and solution of system problems with conflicting goals, uncertainties and risks.
	SC7. Ability to apply the theoretical and practical foundations of methodology and modeling technology to study the characteristics and behavior of complex objects and systems, to conduct computational experiments with processing and analysis of results.
	SC8. Ability to design and develop software using different programming paradigms: generalized, object-oriented, functional, logical, with appropriate models, methods and algorithms of calculations, data structures and control mechanisms.
	SC9. Ability to implement a multi-tier computing model based on client-server architecture, including databases, knowledge and data warehouses, perform distributed processing of large data sets on clusters of standard servers to meet the computing needs of users, including cloud services.
	SC10. 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.
	SC11. Ability to data mining 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.
	SC12. Ability to ensure the organization of computational processes in information systems for various purposes, taking into account the architecture, configuration, performance indicators of operating systems and system software.
	SC13. Ability to develop network software that operates on the basis of different topologies of structured cabling systems, uses computer systems and data networks and analyzes the quality of computer networks.
	SC14. Ability to apply methods and means of information security, to develop and operate special software for protection of information resources of critical information infrastructure.
	SC15. Ability to analyze and functional modeling of business processes, construction and practical application of functional models of organizational, economic and

| | production-technical systems, methods of risk assessment of their design. |
| | SC16. 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. |

7 –Program learning outcomes

	PR1. Apply knowledge of the basic 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.
	PR2. To use the modern mathematical apparatus of continuous and discrete analysis, linear algebra, analytical geometry, in professional activity for the decision of problems of theoretical and applied character in the course of designing and realization of objects of informatization.
	PR3. 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 construction of predictive models.
	PR4 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 control objects, etc.
	PR5. Design, develop and analyze algorithms for solving computational and logical problems, evaluate the efficiency and complexity of algorithms based on the use of formal models of algorithms and computational functions.
	PR6. 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, have skills of software implementation of numerical methods.
	PR7. Understand the principles of modeling organizational and technical systems and operations; use methods of operations research, solving single- and multicriteria optimization problems of linear, integer, nonlinear, stochastic programming.
	PR8. 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.
	PR9. 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.
	PR10. Use tools for developing client-server applications, design conceptual, logical and physical models of databases, develop and optimize queries to them, create distributed databases, repositories and showcases of databases, knowledge bases, including on cloud services, using web languages -programming.
	PR11 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, contract).
	PR12. Apply methods and algorithms of computational intelligence and data mining in the problems of classification, forecasting, cluster analysis, search for associative rules using software tools to support multidimensional data analysis based on technologies DataMining, TextMining, WebMining.
	PR13. To know the languages of system programming and methods of program development that interact with the 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.

	PR14. To know the languages of system programming and methods of program development that interact with the 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.
	PR15. 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 and production-technical systems.
	PR16. Understand the concept of information security, the principles of secure software design, ensure the security of computer networks in conditions of incomplete and uncertain source data.
	PR17. Perform parallel and distributed calculations, apply numerical methods and algorithms for parallel structures, parallel programming languages in the development and operation of parallel and distributed software.

8 - Resource support for program implementation

Staffing	Research and teaching staff involved in the teaching of professionally oriented disciplines have academic degrees and / or academic titles and meet licensing requirements.
Materially-technical software	The total area on which the premises of the Department of Information Technology Design is located is 483.6 m2. The educational area on which the educational process is carried out is 418.55 m2. Territorially, the premises of the department are located in one educational building. In all premises comfortable conditions for training of applicants and work of teachers are provided. The Department of Information Technology Design has its own computer classrooms with an area of 236.15 m2, equipped with 52 computers, 3 multimedia projectors for higher education. Training is carried out in training laboratories, computer classes: 221, 228, 228a, 324, 326, 327, 328, 329, 333, 340, 341, 342 classroom of the aircraft building.
Information and educational methodically software	The use of virtual learning environment of the National Aerospace University "Kharkiv Aviation Institute" and author's developments of scientific and pedagogical staff.

9 - Academic mobility

National credit mobility	Based on bilateral agreements between the National Aerospace University "Kharkiv Aviation Institute" and technical institutions of Ukraine. SE "State Kyiv Design Bureau" Ray "(Agreement № 4/4 dated 14.04.2016, valid for 3 years); Pivdenne State Design Bureau (Agreement № 4/1 dated April 14, 2016, valid for 3 years); State Enterprise "Plant. VO Malyshev "(Agreement № 6 / 2-1731 dp dated 31.08.2015, valid for 3 years); SE Kharkiv Machine-Building Plant "FED" (Agreement № 2/7 dated 19.02.2016, valid for 3 years); Antonov State Enterprise (Agreement № 1/11 dated March 25, 2016, valid for 3 years); LLC "Himmash Compressor Service" (Agreement № 4/1 dated 30.09.2016, valid for 3 years).
International credit mobility	Based on bilateral agreements between the National Aerospace University"Kharkiv Aviation Institute" and educational institutions of partner countries. ERASMUS +, namely academic mobility from the University of the Basque Country and EcoleCentraledeNantes.
Training of foreign applicants for higher education	Education of foreign citizens is carried out in the state or English languages. If the education is conducted in the state language, then in certain cases it may be decided to teach one or more subjects in English and / or other foreign languages.

3 LIST OF COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM (COP) AND THEIR LOGICAL SEQUENCE

3.1 List of OP components

COP code	Components of the educational program (academic disciplines, course projects (works), practices, qualification work)	Number loans	Form final control
1	2	3	4
Mandatory components of the OP			
MC1	Introduction to information technology design	3	test
MC2	Higher mathematics	5	exam
MC3	Discrete mathematics and theory of algorithms	4.5	exam
MC4	Basics of programming	7	exam
MC5	Software development technology	4.5	exam
MC6	Higher mathematics	5	exam
MC7	Educational practice	3	test
MC8	System software	4	exam
MC9	Physics	5	test
MC10	Digital circuitry	4	exam
MC11	Higher mathematics	5	exam
MC12	Object-oriented programming	5	exam
MC13	Organization of databases	6.5	exam
MC14	Modern WEB-technologies	4.5	exam
MC15	Probability theory	4.5	test
MC16	Visual programming tools	6.5	exam
MC17	Computer geometry	4.5	exam
MC18	Introductory practice	3	test
MC19	Fundamentals of mechanics of engineering objects	4	exam
MC20	Artificial intelligence systems	5.5	exam
MC21	Visual programming (CP) tools	2	diff. test
MC22	Intercomputer communications	4.5	exam
MC23	Mobile software	6	exam
MC24	Fundamentals of engineering analysis	4.5	exam
MC25	Special information technology software	6.5	exam
MC26	Internship	3	test
MC27	Robotic systems software	4.5	exam
MC28	System modeling	4.5	exam
MC29	Special software of information technologies (KP)	2	diff. test
MC30	Project and program management	3	test
MC31	Cloud technologies	4.5	exam
MC32	Life safety, labor protection and civil protection	3	test
MC33	Computer technology in production	4.5	exam
MC34	Robotic Systems (CP) Software	2	diff. test
MC35	Information protection technology	4.5	exam
MC36	Technology of distributed systems and parallel computing	4.5	exam
MC37	Review course (KP)	2	diff. test
MC38	Completely designed	5.5	exam
MC39	Computer aided design technology	5	exam
MC40	Bachelor's thesis project	9	defense of a bachelor's thesis project
The total amount of mandatory components:		**179.00**	

1	2	3	4
**Selective components of OP**			
*Selective unit 1*			
SC1	Legal competence	3	test
SC2	Ukrainian studies	3	test
SC3	Language competences (foreign language)	3	test
SC4	Language competences (foreign language)	3	test
SC5	Special sections of mathematics	5	test
SC6	Humanities or economics of your choice	3	test
SC7	Competences aimed at forming a systematic scientific worldview	3	test
SC8	Competences of the general cultural outlook and development of communications	3	test
**Block of disciplines of professional orientation MINOR ****			
SC9	MINOR1	5	exam
SC10	MINOR2	5	exam
SC11	MINOR3	5	exam
SC12	MINOR4	5	exam
**Selected elective courses *****			
SC13	Discipline of free choice 1	5	exam
SC14	Discipline of free choice 2	5	exam
SC15	Discipline of free choice 3	5	exam
**The total amount of sample components:**		61.0	
**TOTAL VOLUME OF THE EDUCATIONAL PROGRAM**		240	

*The applicant chooses one of the disciplines offered in the lists / blocks of educational components SC1 - SC8, thus providing mastery and deepening of general competencies and learning outcomes aimed at acquiring social skills in accordance with the requirements of the specialty standard. The lists of components of educational components SC1 - SC8 can be increased and updated by the decision of branch NMC.

**The applicant can choose any block of disciplines of the MINOR professional direction. The blocks of MINOR professional disciplines can be increased and updated by the decision of the branch NMC.

*** General university block, in which disciplines for choice are offered by University departments or other subdivisions according to the directions of their activity or scientific directions / schools.

The applicant, who is enrolled on the basis of complete general secondary education, performs an educational-professional program in the amount of 240 ECTS credits.

The applicant, who is enrolled on the basis of a bachelor's degree (educational qualification level "Junior Specialist"), performs an educational and professional program in the amount of 240 ECTS credits. At the same time, KHAI recognizes and re-credits not more than 120 ECTS credits received within the previous educational program of junior bachelor (junior specialist) in specialties within the industry, and not more than 60 ECTS credits received within the previous educational program of junior bachelor (junior specialist) in other specialties.

According to the principles of the competency approach to higher education, the re-enrollment of the results of previously completed disciplines in accordance with the individual curriculum is carried out at the request of the applicant on the basis of the Regulation "On re-enrollment of disciplines and academic difference "Kharkiv Aviation Institute" (https://khai.edu/ua/university/normativna-baza/polozheniya1/polozhennya-yaki-regulyuyut-poryadok-zdijsnennya-osvitnogo-procesu/polozhennya-pro-poryadok-perezarahuvannya/) by comparison: compliance with the content of the discipline of educational and professional program (OPP); planned learning outcomes in the relevant discipline; total in hours and ECTS credits; forms of final control, etc.

3.2 Structural and logical scheme of OP

The structural and logical scheme (Appendix A) of the educational program reflects the sequence of studying its components, both mandatory and optional. The applicant of higher education chooses an individual learning trajectory which is realized through the selection of selective components.

3.3 Formation of competencies (special, professional) and program learning outcomes of the mandatory component

№ s / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies		Program learning outcomes
				common	professional	
			And the semester			
1	MC1	Introduction to information technology design	**Goal** study: preparing students for the development of professionally-oriented disciplines of the curriculum. **Task:** study of the main modern directions of information technology development.	GC1 GC2 GC3 GC6 GC7 GC10	SC6	
2	MC2	Higher mathematics	**Goal:** deep mastering of knowledge about the basic methods of higher mathematics that will provide the logic of mathematical thinking of students. **Task**: study of basic methods of higher mathematics for further use in disciplines related to mathematical models and optimization methods; know the general theory of building mathematical models of work processes and their implementation.	GC1 GC12	SC1 SC4	PR2
3	MC3	Discrete mathematics and theory of algorithms	**Goal:** providing bachelors with a theoretical foundation for the correct formulation, formal presentation and justification of the method of solving theoretical and practical problems in the field of algorithmization, design and construction of information systems. **Task:** formation of students' basic concepts and skills to build and determine the complexity of algorithms and properties of basic objects of discrete mathematics - sets, algebras, combinatorial objects, logical statements, graphs, trees - to solve relevant problems in the development and analysis of information systems for use in professional activities.	GC1 GC2 GC3 GC12	SC1 SC3 SC4 SC8	PR2 PR6
4	MC4	Basics of programming	**Goal:** study of the general syntax of the C ++ programming language. **Task:** study of general command line operators, integrated Microsoft VisualStudio application development environment, basic data processing algorithms, C ++ data types and operations on them, functions, structural data types and their use; gaining skills of testing and debugging programs, solving typical data processing problems.	GC2 GC3 GC9 GC12	CK8	PR5
			II semester			
5	MC5	Software development technology	**Goal:** study of modern software of personal computers (PC), typical algorithms for solving problems of computer-aided design (CAD), existing approaches to writing programs to improve the productivity of programmers. **Task:** teach the performer of the algorithm to choose the right algorithmic design of branching or choice of alternatives, which, in turn, will choose a sequence of actions depending on certain conditions when writing programs, which significantly increases the productivity of programmers, improves program readability.	GC2 GC3 GC12	SC3 SC8	PR5 PR9
6	MC6	Higher mathematics	**Goal:** deep mastering of knowledge about the basic methods of higher mathematics that will provide the logic of mathematical thinking of students.	GC1 GC12	SC1 SC4	PR2 PR6

№ s/n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies		Program learning outcomes
				common	professional	
			Task: have methods of mathematical analysis and synthesis of technical solutions; use mathematical methods of optimization in order to obtain the best performance of systems.			
7	MC7	Educational practice	**Goal:** acquainting students with the specifics of the future profession, their acquisition of primary professional skills and abilities, as well as the relevant working profession. **Task:** - consolidation of knowledge gained by students in the learning process; - acquaintance with the place of practical training; - acquaintance with working conditions; - adaptation to the working conditions of the organization; - acquaintance with the organization of work and management; - development of students' practical skills and their consistent consolidation for real interaction with the work environment, in which he will get after graduation; - establishing relationships, the ability to adapt to the external, not always familiar working environment; - raising the level of practical and general training of specialists.	GC2 GC3 GC4 GC7 GC9	SC8	
8	MC8	System software	**Goal:** providing students with knowledge and skills in the field of fundamental concepts and practical solutions that are the basis of modern operating systems, the use of operating system capabilities; acquaintance with functions, structure, principles of construction, methods of development, bases of functioning and use of operating systems of various level of complexity and their components. **Task:** formation of students' basic system concepts and skills, a holistic vision of the current level of basic characteristics of computer software (SOFTWARE), which are clearly reflected in the programs and must be taken into account in the development and implementation of programs: principles, methods and tools for software development improvement; methods of controlling external devices and methods of memory manipulation; strengthening of interdisciplinary connections, development of system thinking without which effective use of information technologies is impossible.	GC2 GC3	SC12	PR5
9	MC9	Physics	**Goal:** to form students' ideas about the modern physical picture of the world, to provide knowledge about the most important principles and laws that determine the structure and simplest forms of motion of matter, thus preparing them for a quality study of general technical and special disciplines. **Task:** study of basic patterns, methods and models for further use in specialties.	GC1	SC4 SC7	
10	MC10	Digital circuitry	**Goal:** to give knowledge about modern methods of circuitry and creation of architecture of computer systems for design tasks. **Task:** study of circuit design and structural solutions for the creation of modern architectures	GC3	SC12	

№ s / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies		Program learning outcomes
				common	professional	
			of computer systems.			
III semester						
11	MC11	Higher mathematics	**Goal:** deep mastering of knowledge about the basic methods of higher mathematics that will provide the logic of mathematical thinking of students. **Task:** apply modern tools in the form of computer mathematics systems and other applications to solve design problems; choose among the existing methods of mathematical problems those that correspond to the specific problem to be solved.	GC1 GC12	SC1 SC4	PR2 PR6
12	MC12	Object-oriented programming	**Goal:** training of specialists in information systems to perform work on software development using the principles and methods of object-oriented programming. Objectives: to study the tools of software development for work under the guidance of Windows with extensive use of object-oriented programming, the rules of building software in visual programming environments, debugging programs and solving common problems.	GC1 GC2 GC3 GC6	SC3 SC8	PR5 PR9
13	MC13	Organization of databases	**Goal:** providing students with knowledge, skills, abilities and methodological techniques necessary for the design of modern databases (DB), design queries to the database, as well as the acquisition of skills to create modern application software for interaction with the database. **Task:** - study of the basic principles of construction of relational databases; - study of architectural solutions and models of database management systems (DBMS); - study of the relational model of the database; - study of the basics of database design using normal forms; - study of the basics of database creation using MySQL database; - study of SQL; - study of database security issues; - learning the basics of NoSQL.	GC1 GC2 GC3 GC6 GC7 GC9 GC11	SC9	PR9 PR10
14	MC14	Modern WEB-technologies	**Goal:** students gain knowledge about Web-programming, mastering the capabilities of HTML, CSS and JavaScript, PHP for Web-site development. **Task:** learning ways to develop WEB-pages using HTML markup language, CSS technology and Java-script scripting language with cross-browser and usability, creating a server part of the site in PHP.	GC2 GC3 GC6 GC11	SC3 SC8 SC9	PR5 PR9
15	MC15	Probability theory	**Goal:** formation of a system of theoretical knowledge and practical skills on the basics of probabilistic and statistical apparatus, basic methods of quantitative measurement of the randomness of factors, the principles of mathematical statistics and their software implementation in computer design systems. **Task:** study of the basic principles and tools of the probabilistic-statistical apparatus, mathematical methods of systematization, processing and application of statistical data for scientific and	GC1 GC2	SC1	PR2 PR3

№ s / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies		Program learning outcomes
				common	professional	
			practical conclusions.			
			IV semester			
16	MC16	Visual programming tools	**Goal:** training of computer science specialists to perform work on software development using the principles and methods of object-oriented programming. **Task:** study of software development tools for work under the guidance of Windows with extensive use of object-oriented programming, the rules of building software in visual programming environments, debugging programs and solving common problems.	GC2 GC3 GC9	SC8	PR5 PR15
17	MC17	Computer geometry	**Goal:** study of the principles of working with graphics, the basic models of presentation of graphic information, the principles of functioning of graphic packages, the ability to choose the appropriate tools to solve specific problems in the design of aerospace technology. **Task:** - acquaintance with the basic concepts of computer graphics, its purpose, functionality in various areas of its application; - formation of abilities and skills of use of mathematical and algorithmic maintenance of computer graphics for the decision of problems of geometrical character; - study of the principles of building graphic systems; - study of rules and modern ways of creating drawings; - development of practical skills of work with the software of raster, two-dimensional and three-dimensional vector graphics.	GC2 GC3 GC12		
18	MC18	Introductory practice	**Goal:** training of specialists in information systems to perform work on software development using the principles and methods of object-oriented programming in C ++ / CLI in MicrosoftVisualStudio. **Task:** study of software development tools for work under the guidance of Windows with extensive use of object-oriented programming, the rules of building software in visual programming environments and debugging Windows settings.	GC2 GC3 GC4 GC7 GC9		
19	MC19	Fundamentals of mechanics of engineering objects	**Goal:** to give knowledge in the field of creation of mechanical objects of aerospace technology by means of information technologies. **Task:** to study the basics of creating mechanical structures of aerospace objects	GC11		
20	MC20	Artificial intelligence systems	**Goal:** formation of knowledge, skills and abilities necessary for the development of an intelligent system (IS), the study of modern technologies for the creation of artificial intelligence systems (AIS), acquaintance with the representation of knowledge in distributed systems. **Task:** study of theoretical bases and acquisition of practical skills of designing and application of artificial intelligence systems on the basis of Prolog tools and shells of expert systems, to give general idea about applied artificial intelligence systems,	GC2 GC3 GC6	SC2 SC11	PR4 PR5 PR12

№ s/n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies		Program learning outcomes
				common	professional	
			role of artificial intelligence systems in development of computer-aided design systems.			
V semester						
21	MC21	Visual programming (CP) tools	**Goal:** training of computer science specialists to perform work on software development using the principles and methods of object-oriented programming. **Task:** study of software development tools for work under the guidance of Windows with extensive use of object-oriented programming, the rules of building software in visual programming environments, debugging programs and solving common problems	GC2 GC3 GC11	SC8	PR5 PR15
22	MC22	Intercomputer communications	**Goal:** study of capabilities and technologies of modern computer networks (CM), the basics of their construction, maintenance and administration. **Task:** - study of the basic principles of construction of KM; - study of local CM; - study of network architectural solutions; - study of lower level CM protocols; - study of KM design issues; - study of protocols of the middle and upper level of KM; - study of methods of KM administration.	GC2 GC3 GC7	SC13	PR13 PR14
23	MC23	Mobile software	**Goal:** providing students with the basic principles and paradigms of cross-platform programming with appropriate models, methods and algorithms for creating modern software products. **Task:** study of models, methods of cross-platform programming to create software.	GC2 GC3 GC6 GC7	SC8 SC12	PR5
24	MC24	Fundamentals of engineering analysis	**Goal:** to give students knowledge about the peculiarities of deformation of complex structures in general and especially thin-walled. **Task:** study of methods for determining the loads acting on the aircraft in flight, to give an idea of the calculations for the strength of aircraft structures.	GC11	SC4	
25	MC25	Special information technology software	**Goal:** study of the possibilities of modern special software of information technologies (SPO IT) and technologies of its use as a basic component of computer-aided design (CAD) systems. **Task:** - study of the structure of SPO IT; - study of possibilities of typical representatives of SPO IT; - study of the technology of integration of IT SPO components; - study of methods and techniques of adaptation and improvement of SPO IT as a part of CAD.	GC2 GC3 GC9		
VI semester						
26	MC26	Internship	**Goal:** to use knowledge on creation of computer systems by methods of computer sciences in practice of designing of computer systems on manufacture. **Task:** to gain skills and abilities in creating computer systems for information processing and management in real enterprises.	GC2 GC3 GC4 GC7 GC9		
27	MC27	Robotic systems	**Goal:** acquisition by students of knowledge and	GC2	SC8	PR5

№ s/n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies common	Formation of competencies professional	Program learning outcomes
		software	skills in the field of the theory of hierarchical multilevel control systems, construction of local control systems of robots and robotic systems, operative management of robotic production. **Task:** study of the structure, principles of operation of industrial robots and manipulators, technical characteristics of robotic complexes, as well as their control information systems	GC3 GC6 GC7 GC8		
28	MC28	System modeling	**Goal:** to give knowledge in the main directions of mathematical and software modeling of complex systems for control tasks. **Task:** to study methodologies, methods and algorithms of modeling structures and dynamic aspects of functioning of complex systems.	GC2 GC3	SC15	PR7 PR8
29	MC29	Special software of information technologies (KP)	**Goal:** gaining experience in creating a model of an engineering object node and developing a software application in the SolidWorks environment. **Task:** create a full model of a specific node of the engineering object by means of the SolidWorks system; develop a software application to automate 3D modeling in a SolidWorks package.	GC2 GC3 GC9		
30	MC30	Project and program management	**Goal:** providing students with knowledge, skills, abilities, methods and tools, new information technologies for analysis and management of complex IT-projects and programs. **Task:** learn the basics of project management methodology for creating modern computer systems by design teams.	GC2 GC3 GC7 GC9	SC5 SC10 SC15	PR8 PR11
31	MC31	Cloud technologies	**Goal:** to form in students the necessary amount of theoretical and practical knowledge about the technology of cloud computing, skills and abilities of practical implementation of cloud technologies in modern production. To acquaint students with the basic concepts and terminology of cloud computing, with the areas of their application in business. To study the feasibility of transferring existing applications to the cloud environment, to assess the effectiveness of the application and long-term prospects. Consider security, deployment, backup in the context of cloud infrastructure. To form in students the skills of system administration for the development and maintenance of cloud applications. **Task:** providing students with knowledge of the architecture of cloud technologies, methods and features of designing cloud services, as well as gaining skills to develop applications for major platforms.	GC2 GC3 GC6 GC7	SC9 SC16	PR10 PR12
VII semester						
32	MC32	BJD, labor protection and civil protection	**Goal:** to provide knowledge on the basics of BJD, labor protection and civil protection for use in the design and operation of computer systems. **Task:** to study standards and modern approaches for creating conditions for the employee, taking into account the requirements of BJD.	GC15		
33	MC33	Computer technology in production	**Goal:** to form fundamental theoretical knowledge and practical skills in the process of production automation.	GC2 GC3		

№ s / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies common	Formation of competencies professional	Program learning outcomes
			Task:study of basic means of automation of production processes; study of the principles of operation and structure of automated equipment; study of methods of analysis of efficiency of automated productions; knowledge of general principles and trends in modern automated production.			
34	MC34	Robotic Systems (CP) Software	Goal: acquisition by students of knowledge and skills in the field of the theory of hierarchical multilevel control systems, construction of local control systems of robots and robotic systems, operative management of robotic production. Task: study of the structure, principles of operation of industrial robots and manipulators, technical characteristics of robotic complexes, as well as their control information systems	GC2 GC3	SC8	PR5
35	MC35	Information protection technology	Goal: study of modern methods, technologies and means of information protection in automated systems. Task: study of a set of organizational (legal framework, personnel requirements, etc.) and technological (algorithms and protocols used in cryptography) actions performed to ensure information security of automated systems.	GC2 GC3 GC12	SC14	PR16
36	MC36	Technology of distributed systems and parallel computing	Goal: acquisition of theoretical knowledge and practical skills of programming complex, distributed and loaded systems with the help of modern technologies and parallel calculations. Task: gaining skills in developing algorithms for parallel calculations, programming parallel methods for solving equations and converting arithmetic expressions using modern technologies, performing remote procedure calls and applying methods.	GC2 GC3 GC6 GC11	SC16	PR5 PR17
VIII semester						
37	MC37	Review course (KP)	Goal: to practice skills of system thinking, application of approaches of system designing for research of difficult processes, objects and systems. Task: study of the principles of system design for the development of computer systems for information processing and management.	GC1 GC2 GC3 GC7 GC9	SC6	
38	MC38	Completely designed	Goal: providing students with knowledge, skills, abilities, methods and tools necessary for the development and creation of new information technologies for the design of complex systems for various purposes. Task: to study methods and models of system design for tasks of creation of computer systems of information processing and management.	GC1 GC2 GC3 GC7 GC9	SC6	PR7 PR8
39	MC39	Computer aided design technology	Goal: preparation of students to perform work on the creation of automated systems for design and technological purposes. Task: study of the main provisions of the methodology of designing complex objects and capabilities of typical functional components of computer-aided design (CAD).	GC2 GC3	SC3 SC6	PR5
55	MC40	Bachelor's thesis project	Goal: determining the level of student readiness to solve a set of modern scientific and applied tasks in accordance with the generalized object of activity	GC1 GC2 GC3	SC3 SC6 SC7	PR1

| № s / n | Code COP | The name of the OP component | The purpose and objectives of the OP component | Formation of competencies | | Program learning outcomes |
				common	professional	
			based on the application of a system of theoretical knowledge and practical skills acquired during the entire period of study in accordance with higher education standards. **Task:** - systematization, consolidation and expansion of theoretical knowledge, - obtained in the process of training in the educational and professional training program of a certain educational degree, and their practical use in solving specific scientific, applied, engineering, economic, social and industrial issues in a particular field of professional activity; - development of skills of independent work, mastering the methods of research and experimentation, physical or mathematical modeling, - the use of modern information technology in the process of solving problems that are provided by the task of diploma design; - determining the level of training of graduates to the requirements of educational characteristics of the specialist, his readiness and ability to work independently in a market economy, modern production, progress of science, technology and culture.	GC4 GC5 GC6 GC7 GC8 GC10 GC11 GC12 GC13 GC14	SC8	

Selective components, their content, formation of competencies (professional, special) and determination of program learning outcomes are presented in the work programs of disciplines and syllabuses on the site in the section "Short description, structure and educational components of educational programs and components" educational-professional program Specialty 122"Computer Science": https://education.khai.edu/program/122-2-bach

4 FORM OF CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Certification of graduates in the educational-professional program "Information Technology Design" in the specialty 122 "Computer Science" is carried out in the form of defense of the bachelor's thesis project and ends with the issuance of a standard document on awarding him a bachelor's degree with educational qualification: Bachelor of Computer Science according to the educational program "Information Technologies of Design".

Certification is carried out openly and publicly.

5 MATRIX OF CONFORMITY OF SOFTWARE COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM

Program competencies	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6	MC 7	MC 8	MC 9	MC 10	MC 11	MC 12	MC 13	MC 14	MC 15	MC 16	MC 17	MC 18	MC 19	MC 20	MC 21	MC 22	MC 23	MC 24	MC 25	MC 26	MC 27	MC 28	MC 29	MC 30	MC 31	MC 32	MC 33	MC 34	MC 35	MC 36	MC 37	MC 38	MC 39	MC 40
GC1	+	+	+			+			+		+	+	+		+																						+	+		+
GC2	+		+	+	+		+	+				+	+	+	+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
GC3	+		+	+	+		+	+		+		+	+	+		+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
GC4							+											+								+														+
GC5																																								+
GC6	+											+	+	+						+			+				+				+			+		+				+
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SC16																															+					+				

6 MATRIX OF COMPLIANCE OF THE SOFTWARE LEARNING RESULTS (PR) WITH THE RELEVANT COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM

Program learning outcomes	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6	MC 7	MC 8	MC 9	MC 10	MC 11	MC 12	MC 13	MC 14	MC 15	MC 16	MC 17	MC 18	MC 19	MC 20	MC 21	MC 22	MC 23	MC 24	MC 25	MC 26	MC 27	MC 28	MC 29	MC 30	MC 31	MC 32	MC 33	MC 34	MC 35	MC 36	MC 37	MC 38	MC 39	MC 40
PR1																																								+
PR2		+	+			+					+				+																									
PR3															+																									
PR4																				+																				
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