

MINISTRY of EDUCATION of the REPUBLIC of BELARUS

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FUNDAMENTALS OF INFORMATION TECHNOLOGIES

The Minimum Program of the candidate credit (differential credit) on general educational discipline “Fundamentals of Information Technologies”

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INTRODUCTION

This Minimum Program is intended for students who master the content of the educational program of higher education of the II stage through forming the knowledge and skills of scientific, pedagogical and research work and providing the possibility of obtaining a Master's degree; for applicants who master the content of the educational program of postgraduate studies (adjunct), providing the possibility of obtaining the scientific qualification "Researcher"; for individuals enrolled for training at stage I of postgraduate education in the application form for passing Candidate credits (differential credits) and exams in general educational subjects (hereinafter - students).

The general educational discipline "Fundamentals of Information Technologies", which is a set of knowledge about the ways and means of achieving goals with the help of computer facilities, is now put forward in one line with such fundamental disciplines as mathematics, physics, philosophy.

Information technologies is currently one of the most fast-growing spheres. The element base and computer architecture are being improved, programming languages and technologies are being developed, new application packages are being created on the basis of modern mathematical methods of modeling and optimization. On this basis, both the systematization of basic concepts and familiarity with modern achievements in the field of information technologies are the necessary elements of training specialists.

The purpose of the general educational discipline "Fundamentals of Information Technologies" is preparation of students for using modern information technologies as a tool for solving scientific and practical tasks in their subject area at a high level.

Students must:

- have a clear understanding of information technologies in their subject area;

- have an idea about modern operating systems and toolkits;

- have skills to work with major software products of information technologies: text, graphic and tabular processors, databases, means of presentation preparation and tools to support mathematical calculations;

- familiarize with the basics of network technologies and Internet services, be able to find the necessary information on the Internet;

- have an idea about the problems of information security in computers and computer networks;

- get acquainted with the basic methods of mathematical modeling and optimization in solving applied problems in various subject areas.

On the basis of the Minimum Program the Institution of higher education, other educational institution or organization implementing the educational programs of postgraduate education (hereinafter-the

educational institution) may develop its own curriculum, in which, depending on the profile of education, which provides training for specialists on the II stage of higher education, specialties and branches of science, which implement the educational program of postgraduate studies (adjunct), the distribution of academic hours and topics of lectures and laboratory (practical) works are specified. At the same time, it is possible to introduce new topics reflecting the dynamics of information technologies development. The educational program should specify which Minimum Program topics are to be studied on an independent basis.

The study of general educational subject “Fundamentals of Information Technology” is designed for 108 hours, including 72 classroom hours, 36 hours of independent work.

The Minimum Program includes lectures, laboratory (practical) classes and individual graduation work in the form of abstract. Specific topics of abstracts are prepared by the teaching staff, delivering the general educational discipline “Fundamentals of Information Technologies”. Training ends with defending the abstract and passing the Candidate credit (differential credit) on the general educational discipline “Fundamentals of Information Technologies”.

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**Indicative thematic outline of the general educational discipline
 “Fundamentals of Information Technologies”**

№	Theme	Number of classroom hours		
		lectures	laboratory (practical) classes	in total
1	Modern information technologies	4	4	8
2	Basic information software technologies	6	12	18
3	Network and Internet technologies	6	4	10
4	Database management systems	4	4	8
5	Information protection	4	4	8
6	Mathematical modeling and numerical methods	6	4	10
7	Optimization methods and decision-making support systems	6	4	10
Subtotal		36	36	72

THE CONTENT OF THE EDUCATIONAL DISCIPLINE
"FUNDAMENTALS OF INFORMATION TECHNOLOGIES»

Topic 1. Modern information technologies

Keywords: operating systems, programming languages and technologies

History, current state and prospects of computer technologies development. Element base, architecture, networking, performance.

The concept of information. Classification and types of information technologies.

Operating systems. Purpose, classification, current state, familiarity with the capabilities and work in a modern operating system.

Programming languages and technologies. History of development of programming languages. Comparative characteristics, purpose and capacities of modern languages (Basic, Delphi, C++, Java, C#...). Programming technologies. Procedural, object-oriented and logical programming.

Topic 2. Basic information software technologies

Keywords: text and graphic editors, spreadsheets, databases, systems of mathematical calculations

Software. Text editors-Word, PageMaker, etc. Their purpose and capabilities.

Graphic editors. Methods of graphic information storage and processing. Editors: PhotoShop, CorelDraw, etc. Their capacities.

Excel spreadsheets. Their purpose, capabilities.

Service tools: file managers, archivers, e-dictionaries and translators, text recognition programs.

Systems of mathematical calculations: MathCad, MathLab. Purpose, capabilities, application examples.

Presentation preparation system. Purpose, capacities. Work in MS PowerPoint.

Topic 3. Network and Internet technologies

Keywords: computer networks, Internet, Internet services, websites

The seven-level model of the structure of communication protocols.

Computer networks.

The organizational structure Internet. Internet protocols (TCP and UDP). Basic Internet services (DNS, FTP, HTTP, SNMP, POP3, SMTP).

Scripting programming languages (Java, Perl, HTML, XML).

Tools for creating web servers and websites (PHP, ASP NET, Delphi). The basics of web design.

Topic 4. Database management systems

Keywords: database, tables, transactions, queries, SQL

Database management systems. Data structure, data models, database and table forming. Databases: Access, Oracle, MySQL, Foxpro, dBase, SQL Server, etc. SQL basics and SQL query forming.

Topic 5. Information protection

Keywords: coding, anti-virus protection, electronic signature

Methods and means of information protection. Information coding and decoding. Protection against unauthorized access to data. Security classes of computer systems. Electronic signature. Organizational and legal aspects of information protection and copyright.

Topic 6. Mathematical modeling and numerical methods

Keywords: mathematical models, numerical methods

Mathematical models and numerical methods for solving problems in various subject areas.

Models leading to the necessity for numerical differentiation and integration of functions. The main methods and characteristics of the error.

Models described by ordinary differential equations. Classification, methods of solution. Runge-Kutta and prediction and correction methods.

Models described by partial differential equations. Grid solution methods. Projection methods. Projection-grid methods (finite element method). Standard packages.

Methods of mathematical statistics.

Topic 7. Optimization methods and decision-making support systems

Key words: optimization, methods of unidimensional search, unconstrained optimization methods, constrained optimization methods

Optimization as the final stage of the computational experiment. Models and formulation of optimization tasks in various subject areas. Methods for minimizing functions of one variable.

Classification of methods of minimization of functions of many variables. Conditional optimization methods.

Methods for solving variational tasks. Reduction of the variational task to the task of minimizing the function of many variables. Decision-making support systems. The concept of expert systems. Overview and characteristics of existing standard software packages.

LITERATURE

Basic literature

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