

Ministry of Science and Higher Education of the Russian Federation
Federal State Autonomous Educational Institution of Higher Education
Perm National Research Polytechnic University



APPROVED BY

Pro-rector for Academic Affairs

N.V. Lobov

2021

ACADEMIC COURSE WORKING PROGRAM

Academic course: Computer science as an application to the industry
(Name)

Form of education: Full-time studies
(full-time / part-time / correspondence)

Level of higher education: Bachelor's program
(Bachelor's program / Specialist program / Master's program)

Workload in hours (in credits): 108 (3)
(Hours (CU))

Training program (degree): 15.03.06 Mechatronics and robotics technology
(Code and denomination of degree)

Direction: Mechatronics and robotics technology
(Title of curriculum)

Perm 2021

1. GENERAL PROVISIONS

1.1. GOALS AND OBJECTIVES OF THE COURSE

Gaining the necessary and sufficient level of research competences to solve problems in professional activities using advanced information technologies and applied hardware and software.

Discipline objectives:

1. Gain knowledge necessary for research work with data from metrology, qualimetry, standardization, certification of oil and gas production, as well as data containing the composition and properties of oil and gas.
2. Develop computer skills for solving simple engineering calculations.
3. Develop the skills to search, extract, systematize, analyze and select information necessary for solving problems, organize it, transform it, and save it.
4. Learn about methods of storing, transmitting, processing and presenting information in the computer.

1.2. STUDIED OBJECTS OF THE COURSE

Technical documentation in the field of oil and gas production; Hardware of computer equipment; Software computer technology; The means of interaction between hardware and software; Means of human interaction with hardware and software.

1.3. STARTING CONDITIONS

Unstipulated

2. PLANNED RESULTS OF THE COURSE TRAINING

Competence	Indicator's Index	Planned Results of the Course Training (to know, to know how, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
1	2	3	4	5
GPC-5	IA-1 _{gpc-5}	To know structure and methods of digital reporting of oil and gas properties and composition; basic rules for registration and preparation of business documentation based on the basic provisions on measurements, methods, means of ensuring their unity and ways to achieve the required accuracy, comprehensive and	Knows content and properties of oil and gas, general provisions of metrology, qualimetry, standardization and certification of oil production.	Test

1	2	3	4	5
		<p>quantitative assessment of the quality of oil and gas production facilities</p> <p>- basic rules for the registration and preparation of business documentation based on the main provisions for establishing norms, rules and characteristics and confirming the compliance of objects with the requirements of technical regulations, standards, codes of rules or terms of contracts for oil and gas production</p>		
GPC-5	IA-2 _{gpc-5}	<p>Be able to use sources of information to implement the main technologies of search, exploration and organization of oil and gas production in Russia and abroad; independently search, extract, systematize, analyze and select information necessary to solve problems, organize, transform, save and transmit it; apply information in researches by presenting it using various methods of text processing</p>	<p>Is able to use computer to make simple engineering calculations; appropriately use software packages; use general technologies of exploration and prospects for oil as well as organization of oil production in Russia and abroad, standards and specification, sources of information, mass media and multimedia technologies; acquire knowledge by the application of advanced educational and information technologies; operate in data flows selecting principal and necessary information; consciously assimilate information, independently find, derive, systematize, analyze and select necessary information aimed at problems solution, organize, transform, store and pass it; critically reconsider cumulative information, form personal opinion, convert information into knowledge, apply information in problems solution using different ways of text processing.</p>	Internship report
GPC-5	IA-2 _{gpc-5}	<p>To master methods for protecting the storage and</p>	<p>Has mastered methods of risk assessment and</p>	Internship report

1	2	3	4	5
		submission of information using advanced information technologies and hardware and software; methods of collecting and processing the received information for risk assessment and quality management of technological operations	management of quality performance of manufacturing operations; methods of collection and processing of obtained information using modern information technologies and applied hardware and software, methods of information security, storage and submission.	

3. FULL TIME AND FORMS OF ACADEMIC WORK

Form of academic work	Total hours	Distribution in hours according to semesters		
		Number of semester		
		7		
1. Holding classes (including results monitoring) in the form:				
1.1. Contact classwork, including:	45	45		
– lectures (L)	16	16		
– laboratory work (LW)				
– practice, seminars and/or other seminar-type work (PW)	27	27		
– control of self-work (CSW)	2	2		
– test				
1.2. Students' self-work (SSW)	63	63		
2. Intermediate attestation				
Exam				
Grading test				
Test (Credit)	9	9		
Course Project (CP)				
Course Work (CW)				
Workload in hours	108	108		

4. COURSE OUTLINE

Name of the units with the course outline	Full time of classroom activity in hours according to the forms			Full time of extracurricular work in hours according to the forms
	L	LW	PW	SSW
	1	2	3	4
7 semester				
Module 1. Information processes and their software	8		13	31
Topic 1. Software tools for implementing information processes. Software and its levels. Software classification. Files and file storage system. Organization of work with the objects				

1	2	3	4	5
<p>in the file structure. File manager. Archiving documents. Purpose, features, window structure, operating modes, and control menu of the archiver. The procedure for creating and maintaining archives. Determine the hardware configuration of the computer using software. Determining the characteristics of computer components. Computer viruses and information security methods. Antivirus programs and how to use them.</p>				
<p>Topic 2. Software for processing text information. Text editors and word processors. Purpose, features and areas of their application. Basic principles of work. Purpose, capabilities and structure of the screen. Document display modes. Creation and editing of documents. Formatting of text documents. Controlling the size, style and method of aligning the font. Create bulleted and numbered lists. Parameter control. Clipboard, search and replace, spell check. Insert page dividers, headers, footers, and footnotes. Reviewing text documents, and protection methods. Techniques and tools for automating document processing and object management. Working with styles and templates. Creation of graphic objects. Creation of elements and connections of hierarchical structures. Insert pictures, formulas and tables.</p>				
<p>Topic 3. Spreadsheet processors. Types of table processors. Basic principles of work in tabular processors. Purpose, possibilities and structure of the table processor screen. Creation of spreadsheets. Data types, input, editing and formatting. Operations with elements of a spreadsheet. Formatting cells, rows and columns in a spreadsheet. Clearing, inserting and deleting cells, rows and columns. Copying and moving elements of a spreadsheet. Simple calculations and use of standard functions. Function wizard and table processor functions. Creation of calculation tables using the function wizard. Use of logical functions in calculations. Creating and editing diagrams. Data protection in a table processor. Filtering and sorting lists. Perform calculations and manage data in the processor.</p>				
<p>Topic 4. Databases. Databases (DB) and knowledge bases. The purpose of the database. Basic concepts of relational databases: fields and records, field properties, data types. Database management systems. Database design and processing.</p>				
<p>Topic 5. Creation of presentations. Creation of presentations. Using templates. Create slides: insert text, pictures, formulas, tables, audio and video information.</p>				
<p>Module 2. Algorithms and software for the implementation of algorithms</p>	8		14	32
<p>Topic 6. The concept of an algorithm. Stages of solving problems on a computer. Algorithm, its properties and presentation forms. Algorithm visualization. Graphical representation of algorithms. Basic set of structures. Linear, branched and cyclic algorithms. Building an algorithm from basic structures.</p>				

1	2	3	4	5
Topic 7. Software for the implementation of algorithms. Programming languages. Algorithmization and programming. Syntax and semantics. The structure of the program. The instrumental system of the programming language. Broadcast and interpretation of programs. Program input and debugging. Testing programs. Algorithm programming. Programming linear structure algorithms. Branching algorithms programming. Cyclic algorithms programming. Array programming. Data processing of one-dimensional arrays. Data processing of two-dimensional arrays.				
Total with regard to semester	16		27	63
Total with regard to the course	16		27	63

Topics of exemplary practical work

Sl.№	Topic of practical (seminar) work
1	Presentation and processing of oil and gas properties data using Microsoft Word and Google Docs
2	Create formulas using built-in support and the formula object
3	Techniques and means for automating document processing and object management. Creation of graphic objects. Creation of elements and links of hierarchical structures and block diagrams
4	Formatting and Calculations in Word Processor Tables
5	Presentation and processing of oil and gas properties data using Microsoft Excel and Google Sheets
6	Analyze data in Microsoft Excel and Google Sheets using Boolean functions
7	Capturing events using the function wizard. Ways to present data for analysis in Microsoft Excel and Google Sheets
8	Calculation of pressure losses in the oil pipeline using Microsoft Excel and Google Sheets
9	Graphical presentation of the results of calculating the characteristics of the main oil product pipeline using Microsoft Excel and Google Sheets
10	Data processing of experimental indicators of oil and gas production facilities using Microsoft Excel and Google Sheets
11	Data processing of oil and gas production facilities by means of programming languages
12	Data representation and processing of oil and gas production facilities by means of databases

Topics of exemplary laboratory practice

Sl.№	Topic of laboratory work
	Unstipulated

5. ORGANIZATIONAL AND PEDAGOGICAL CONDITIONS

5.1. EDUCATIONAL TECHNOLOGIES USED FOR COMPETENCES FORMATION

Holding lectures in the discipline is based on the active method of training in the process of which students are not passive but active participants of the lesson answering questions of the teacher. Teacher's questions are aimed at activating the process of learning material as well as at the development of logical thinking. The questions stimulating associative thinking and connecting new material with the previous one are identified by the teacher in advance.

Practical classes are held by realization of the method based on active training: problem areas are determined, groups are formed. The following aims are pursued in the process of practical education: use of definite disciplines knowledge and creative methods in solving problems and decision-making; student skill-building of teamwork, interpersonal communication and development of leadership skills; consolidation of the basic theoretical knowledge. The teacher's place in interactive classes is reduced to orienting students' activities to achievement of the goals of studies. Interactive lectures, group discussions, role-playing games, training sessions, and analysis of situations and simulation models are used in academic studies

5.2. STUDENTS' MANUAL FOR THE COURSE STUDY

Learning the course students are recommended to fulfill the following positions:

1. The learning should be done systematically.
2. After learning one of the course units with the help of the text-book or lecture notes, it is recommended to reproduce in memory the basic terms, definitions, notions of the unit.
3. Special attention should be paid to the reports on practical studies, laboratory works and individual complex tasks for self-work.
4. The topic of questions studied individually is given by the teacher at the lectures. Also the teacher refers to the literary resources (first of all, to the newly published in periodicals) in order the students understand the problems discussed at the lectures in detail.

6. LIST OF TEACHING MATERIALS AND INFORMATION SUPPLY FOR STUDENTS' SELF WORK IN THE DISCIPLINE

6.1. PAPER-BASED COURSEWARE

Sl.No	Bibliographic entry (author, title, mode of publication, place, publishing house, year of publication, number of pages)	Number of copies in the library
1. Basic literature		
1	English for Computer Science Students : textbook / T. V. Smirnova;. – Moscow: Flinta, Science, 2004.	19
2	Computers and Informatics in Developing Countries / World Acad. of Sciences TriesteThird,Italy. – London: Butterworths, 1989.	1
2. Additional literature		
2.1. Educational and scientific literature		
1	Rajaraman A. Computer Graphics for Engineers / A. Rajaraman. – Oxford: Alpha Science Intern. Ltd, 2009.	1
2	Patil P.B. Numerical Computational Methods / P.B. Patil, U. P. Verma. – Oxford: Alpha Science Intern. Ltd, 2006.	1
3	An Attribute Grammar for the Semantic Analysis of Ada / J. Uhl [et al.]. – Berlin [et al.]: Springer-Verlag, 1982.	1
2.2. Standardized and Technical literature		
	Unstipulated	
3. Students' manual in mastering discipline		
	Unstipulated	
4. Teaching and learning materials for students' self work		
	Unstipulated	

6.2. ELECTRONIC COURSEWARE

Kind of literature	Name of training tool	Reference to information resource	Accessibility of EBN (Internet/ local net; authorized/ free access)
1	2	3	4
Basic literature	Informatics. Laboratory workshop on English language. Teaching manual / V. I. Lebedev, I. V. Lebedeva. – Stavropol: Publisher of NCFU, 2018. – 153 p.	URL: http://www.iprbookshop.ru/83195.html (date of request: 30.11.2020)	authorized access
Basic literature	Lebedev V. I. Informatics: course of lectures in English. – Stavropol: Publisher NCSU, 2015. – 102 p	URL: http://www.iprbookshop.ru/63090.html (date of request: 30.11.2020)	authorized access
Additional literature	Gvozdeva E. A. Computer science : educational and methodical manual / E. A. Gvozdeva. – Moscow : NRNU MEPhI, 2011. – 52 c. – ISBN 978-5-7262-1601-0.	URL: https://e.lanbook.com/book/75995 (date of request: 29.11.2020)	authorized access

1	2	3	4
Additional literature	Pushkina E.N. English for radio physicists and computer science learners / E.N. Pushkina. – Nizhnij Novgorod : Lobachevsky UNN, 2020. – 131 c.	URL: https://e.lanbook.com/book/144628 (date of request: 30.11.2020)	authorized access

6.3. LICENSE AND FREE DISTRIBUTED SOFTWARE USED IN THE COURSE EDUCATIONAL PROCESS

Type of Software	Software branding
Operating system	Windows 10, lic. 66232645
Operating system	Windows 7, lic. MS Imagine
Office software	Adobe Acrobat 9.0 Pro Edu, lic. 21134490
Office software	Microsoft Office Professional 2007. lic. 42661567
General purpose application software	ΠO Dr.Web Desktop Security Suite , 2000 lic, PNIPU 2017
General purpose application software	Mathcad 14 University Classroom, lic. SE14RYMMEV0002-FLEX
General purpose application software	WinRAR, lic. # 879261.1493674
Image processing software	CorelDRAW Graphics Suite X4, lic. LCCDGSX4MULAB
General purpose application software	Total Commander 7.xx, lic. 110000
Management systems for projects, research, development, design, modeling and implementation	Autodesk AutoCAD 2019 Education Multi-seat Stand-alone

6.4. MODERN PROFESSIONAL DATABASES AND INQUIRY SYSTEMS USED IN THE COURSE EDUCATIONAL PROCESS

Branding	Reference to information resource
Elsevier "Freedom Collection" database	https://www.elsevier.com/
Scopus database	https://www.scopus.com/
Springer Nature e-books database	http://link.springer.com/ http://jwww.springerprotocols.com/ http://materials.springer.com/ http://zbmath.org/ http://npg.com/
Web of Science database	http://www.webofscience.com/
Scientific electronic library database (eLIBRARY.RU)	https://elibrary.ru/
Scientific library of Perm national research Polytechnic University	http://lib.pstu.ru/
LAN electronic library system	https://e.lanbook.com/
Iprbooks electronic library system	http://www.iprbookshop.ru/
Virtual reading room of the Russian state library	https://dvs.rsl.ru/
Electronic library of dissertations of the Russian state library	http://www.diss.rsl.ru/

7. LOGISTICS OF THE COURSE EDUCATIONAL PROCESS

Type of classes	Name of the necessary basic equipment	Number of units
Laboratory work	Computers included (system unit, monitor, keyboard, mouse)	15
Lecture	Interactive whiteboard	1
Lecture	Multimedia complex consisting of: multimedia projector, interactive whiteboard, acoustic system	1

8. FUND OF THE COURSE EVALUATING TOOLS

Described in a separate document