Ministry of Science and Higher Education of the Russian Federation

Federal State Autonomous Educational Institution of Higher Education
Perm National Research Polytechnic University

ACADEMIC COURSE WORKING PROGRAM

Academic course: Data bases ("Robotics in automated manufacturing" module)
<div align="center">(Name)</div>

Form of education: _____ Full-time
<div align="center">(full-time / part-time / correspondence)</div>

Level of higher education: _____ Bachelor's program
<div align="center">(Bachelor's program / Specialist program / Master's program)</div>

Total labour intensiveness: _____ 144 (4)
<div align="center">(Hours (CU))</div>

Training program (degree): 15.03.06 Mechatronics and robotics
<div align="center">(Code and denomination of degree)</div>

Direction: _____ Mechatronics and robotics (general profile, SMOS)
<div align="center">(Title of curriculum)</div>

Perm 2021

1 General Provisions

1.1 Goals and Objectives of the Course

The goal of the course is to develop systematic understanding of databases organization principles, possibilities of their application and design as a component elements of functional subsystems of automated information systems.

The objectives of the course are:

To study:
- basic data models, advantages and problems of data integration;
- theory of relational databases and methods of relational systems design by using normalization method;
- databases and database management systems for information systems of different purposes;
- programming methods of databases searching and updating;
- language means of describing and manipulating data.

To obtain ability:
- to design a relational database for the selected subject area using
- normalization method;
- to develop program database objects: stored procedures, custom functions, custom data types, triggers,
- to develop all kinds of SQL requests;
- to perform the database administrator functions.

To develop skills:
- to develop database structures;
- to apply scripts for managed code in databases, make requests for selection and updating of database administrator.

1.2 Prescribed Objects of the Course

The subject of the discipline are the following objects:
- databases and their structure;
- databases models;
- languages of description and data manipulation;
- history and actual state of databases.

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 be able to, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
GPC-14	AI-1 GPC-14	To know: - modern databases and rules of operating them.	Knows basic programming languages programming languages and database operation, operating systems and shells, modern software environments development of information systems and technologies.	Grading test
GPC-14	AI-2 GPC-14	To be able: - to operate databases using modern database management systems.	Is able to apply programming and database operation languages, modern information systems and process automation technology development environments, application solutions of different classes, maintaining information storage databases	Report on laboratory work
GPC-14	AI-2 GPC-14	To master: - the skills in applying modern database management systems to solve professional problems.	Has mastered the skills of programming, debugging and testing of software and hardware task complexes prototypes	Report on laboratory work
GPC-2	IA-1 GPC-2	To know: - main date models, advantages and problems of data integration.: - relational databases theory and relational systems design with normalization methods; - databases and database management systems for information systems of various purposes; - search processes programming methods and methods of databases updating; - language tools for data descriptions and manipulations.	Knows principles of local and wide area networks construction, fundamentals of IT, common procedures of problem-oriented software application.	Grading test
GPC-2	IA-2 GPC-2	To be able:	Is able to use modern	Report on

		- to design relational database for the selected subject area using normalization method; - to develop infological and datalogical schemes of databases; - to develop program objects of database: kept procedures, user functions, user data types, triggers, to develop all kinds of SQL requests; - to perform functions of data bank administrator.	information and computer technology, means of communication promoting efficiency improvement of scientific and educational activity.	laboratory work
GPC-2	IA-3 GPC-2	To master: - methods and techniques to design database structure; - skills in applying scripts for managed code in databases, making requests for data retrieving and updating; - skills of data administrator.	Has the skill of mastering modern and advanced directions of engineering, progressive native and foreign experience in conducting research, design work, organization of technological processes and maintenance of mechatronic and robotic systems and/or their components.	Report on laboratory work

3 Full time and forms of academic work

Form of academic work	Hours in all	Distribution in hours according to semesters
		Number of semester
		7
1. Holding classes (including results monitoring) in the form: 1.1.Contact classwork, including:	54	54
- lectures (L)	24	24
- laboratory work (LW)	16	16
- practice, seminars and/or other seminar-type work (PW)	10	10
- control of self-work (CSW)	4	4
- test		
1.2. Students' self-work (SSW)	90	90
2. Intermediate attestation		
Exam		
Grading test	9	9
Test (Credit)		
Course Project (CP)		
Course Work (CW)		
Workload in hours	**144**	**144**

4 Course contents

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
7th semester				
Introduction to databases.	4	0	0	4
The role of development, design and modeling of databases. Applications in the development of information systems. Information systems of general purpose: information retrieval Systems (SIS), data banks (DB), knowledge bases (KB). The subject area of information systems, their role and place in ACS. The history of development of information systems. The disadvantages of flat files. Advantages and problems of data integration. The purpose and main components of of a database system; an overview of modern database management systems (DBMS).				
Design of databases.	6	4	4	28
Independence of data from physical devices and programmes. Structure of the data bank. Functions of the databank administrator (DBA). Levels of . data representation; concepts of schema and subschema. Client-server architectures. Publication of databanks on the Internet. Hierarchical, networking, relational data model and the data model based on inverted files. Object-oriented and object-relational models object-oriented and object-relational model of data. Two approaches to database design: "based on subject area analysis" and "based on user's requests users". "Entity-connection" model. Objects, attributes, connections, types. Object and connection keys. Modeling the local views, their combining, aggregation and generalization of models' elements. Elimination of identified contradictions. Design with the use of the "entity - connection" method.				
Application of databases.	8	10	4	44
Storage structures and access methods. Indexing and factorization. Types of indexes. B-tree. Hashing. Physical organization of a database; Hashed, indexed files. Domains and associations. Tuples and keys. Integrity constraints. Relational algebra. Properties of relational operations. Relational calculus based on tuple variables and domains. Association scheme. Data manipulation language for				

relational model. SQL language. Functional dependencies. Universal relation. Anomalies of including, deleting and correcting. Normalization of the database. Relationship decomposition, transitive dependencies.				
Modern DBMSs and their applications.	6	2	2	14
Requests using a single table: unconditional requests and requests with a condition. Writing the conditions. Sampling with ordering. Aggregate functions. Multiple table requests. Cartesian product of tables. Connecting tables. External connecting tables. Connecting a table to its copy. Subrequests. Grouping and association. Data modification operators in the SQL language. Restoration. Parallelism. Security. Integrity. Management of transactions. ASID properties of transactions. Data sharing. Integrity and safety of databases. Database protection. Study of one of the modern DBMSs of choice. Databases creation and modifying; searching, sorting, database indexing, creating forms and reports.				
Total with regard to 7th semester	**24**	**16**	**10**	**90**
Total with regard to the course	**24**	**16**	**10**	**90**

Topics of exemplary practical work

№	Topic of practical (seminar) work
1	Client-server architecture.
2	Relational data model.
3	Hierarchical, unique, interval indexes.
4	Description of the data in the chosen DBMS.
5	Loading and manipulating data in the selected DBMS.
6	Transactions management.

Topics of exemplary course projects/works

№	Topic of course projects/works
1	Dense and non-dense indexes. Hierarchical, unique and interval indexes. Advantages and disadvantages of indexing. B-tree. Hashing and ways of resolving collisions.
2	Description of the data in the chosen DBMS. Constructing relational database layouts. Requests in the language of relational algebra.
3	Loading and manipulating data in the selected DBMS. Designing the layout of a relational data model using the normalization method.
4	Requests recording in SQL language for the selected DBMS.

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 formulated by the teacher in advance.

Practical lessons 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; students' skill-building of teamwork, interpersonal communication and development of leadership skills; consolidation of the basic theoretical knowledge.

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, it is advisable for students to implement the following recommendations:

1. Learning of the discipline 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 the basic terms, definitions, notions of the unit from memory.

3. Special attention should be paid to the reports on practical studies and individual complex tasks for self-work.

4. The topics list for individual study is given by the teacher at the lectures. The teacher also provides students with literary sources (first of all, new ones in the periodical scientific literature) for a more detailed under-standing of the issues presented at the lectures.

6 List of Teaching Materials and Information Supply for Students' Self work in the Discipline

6.1 Paper-based courseware

№	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	Graber M. Introduction to SQL : translated from English. M.: Laurie, 2008	13
2	Grigoriev Y. A., Revunkov G. I. Data banks : textbook for higher educational institutions. Moscow: Publishing house of Bauman Moscow State Technical University, 2002.	34
3	Khomonenko A. D., Tsygankov B. M., Maltsev M. G. D. Databases: textbook for high schools. Saint-Petersburg: KORONA print, 2002.	23
2 Additional literature		
2.1 Educational and scientific literature		
1	Deith, K.D. Introduction to database systems: transl. from English. M.: Williams, 2006.	20
2	Digo S. M. Databases: design and use : textbook for high schools. Moscow: Finance and Statistics, 2005.	11
3	Ullman D. D., Witham D. Introduction to database systems: transl. from English. Moscow: Laurie, 2000.	33

		2.2 Standardized and Technical literature		
		3 Students' manual in mastering discipline		
		4 Teaching and learning materials for students' self-work		

6.2 Electronic Courseware

Kind of literature	Name of training tool	Reference to information resource	Accessibility of EBN (Internet / local net; authorized / free access)
Educational and methodological support for student's self-study student activities	SQL Tasks and Solutions	http://www.sql-tutorial.ru/ru	Internet network; authorized access
Educational and methodological support for student's self-study student activities	Interactive SQL tutorial	https://sqlacademy.org/ru/guide	Internet network; free access

6.3 License and Free Distributed Software used in the Course Educational Process

Type of Software	Software branding
Operating systems	Windows 10 (subp. Azure Dev Tools for Teaching)
Office applications	Microsoft Office Professional 2007. lic. 42661567
General Purpose Application Software	Dr.Web Enterprise Security Suite, 3000 lic. PSTU 2017

6.4 Modern Professional Databases and Inquiry Systems Used in the Course Educational Process

Branding	Reference to information resource
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://elibrary.ru/
Scientific Library of Perm National Research Polytechnic University	http://lib.pstu.ru/
Lan' Electronic library system	https://e.lanbook.com/
IPR books Electronic library system	http ://www.iprbookshop.ru/
Information resources of the Network ConsultantPlus	http://www.consultant.ru/

7 Logistics of the Course Educational Process

Type of classes	Name of the necessary basic equipment	Number of units
Laboratory work	PC	30
Lecture	Multimedia projector, monitor	1
Practical class	PC	30

8 Fund of the Course Evaluating Tools

Described in a separate document