

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
FEDERAL STATE AUTONOMOUS EDUCATIONAL
INSTITUTION OF HIGHER EDUCATION
"NORTH CAUCASUS FEDERAL UNIVERSITY"

SUGGESTIONS FOR TEACHING
for the performance of laboratory work
in the discipline "Object-Oriented Programming"
for students of the field of study
11.03.02 Infocommunication Technologies and Communication Systems
Profile "Intelligent Data Processing in Infocommunication Systems and Networks"

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INTRODUCTION

1. Goals and objectives of mastering the discipline:

The purpose of the discipline "Object-Oriented Programming"

– theoretical and practical training that provides knowledge of the basics of object-oriented programming;

– obtaining practical skills in the development of object-oriented programs;

– acquisition of skills in the use of standard techniques in the compilation and debugging of object-oriented programs on personal computers;

– obtaining skills in using an object-oriented approach to solving

Objectives of the discipline:

– training of a specialist who confidently owns the opportunities provided by the modern computer technologies;

– teaching students object-oriented programming;

– formation of programming skills using object-oriented technologies;

– teaching students to work in a programming environment

2. List of planned learning outcomes in the discipline (module) correlated with the planned results of the development of the educational program

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
OPK-3. Able to apply methods of search, storage, processing, analysis and presentation of information from various sources and databases in the required format, while observing the basic requirements of information security	ID-3 OPK-3 solves data processing problems using computer technology.	solves the problem of data processing using computer technology using the Python language
OPK-4. Able to understand the principles of modern information technologies and use them to solve problems of professional activity	ID-4 OPK-4 uses the capabilities of computer technology and software to solve problems of control and algorithmization of information processing processes.	uses the capabilities of computing and software to create applications, uses the Python language to solve information processing problems
OPK-5. Able to develop algorithms and computer programs suitable for practical application	ID-2 OPK-5 reads the codes of software products written in the mastered programming languages and makes the necessary changes	reads codes, understands and makes required changes to the program code
	ID-3 OPK-5 develops original algorithms and computer programs suitable for practical use	develops original applications suitable for practical use

Laboratory work No1

Topic: General understanding of object-oriented programming. Class and object concepts

Objective: To get a general idea of object-oriented programming

Competencies to be formed:

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
OPK-3. Able to apply methods of search, storage, processing, analysis and presentation of information from various sources and databases in the required format, while observing the basic requirements of information security	ID-3 _{OPK-3} solves data processing problems using computer technology.	solves the problem of data processing using computer technology using the Python language
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Theoretical part

1. Study Baldzhi, A. S. Mathematics in Python [1] pp. 8 –11.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] p. 6 – 12.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS

Word, Adobe Reader MS Excel.

Safety Instructions: To Practical Exercises

Students who have familiarized themselves with the rules of work in the laboratory and have passed safety briefings are allowed.

Contents of the report: the report on the practical lesson must be completed in

Times New Roman font, spacing – one and a half, left margins – 3 cm, right – 1.5 cm, top and bottom – 2 cm. Paragraph indent – 1.25. The text should be justified.

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Control questions:

1. How is a class declared in Python?
2. How are class attributes different from instance attributes?
3. What is the purpose of class methods?
4. What is the `__init__()` class method for?
5. What is the purpose of `self`?
6. How do I add attributes to a class?
7. How do I control access to methods and attributes in Python?
8. What is the purpose of the `isinstance` function

Laboratory Work No2

Topic: Creating Classes and Objects

Objective: To learn how to create classes and objects

Competencies to be formed:

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OPK-3. Able to apply methods of search, storage, processing, analysis and presentation of information from various sources and databases in the required format, while observing the basic requirements of information security	ID-3 _{OPK-3} solves data processing problems using computer technology.	solves the problem of data processing using computer technology using the Python language
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Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] p. 12 – 17.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] p. 13 – 35.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. What tools are there in Python for overloading operations?
2. What are the methods for overloading arithmetic and relation operations in the Python language?
3. In what cases will the following methods be called: `__add__`, `__iadd__` and `__radd__`?
4. What is the purpose of the `__new__` method? How does it differ from the `__init__` method?
5. What is the difference between `__str__` and `__repr__` methods?

Laboratory Work No3

Topic: Class constructor - init method

Objective: To learn the class constructor — the init method

Competencies to be formed:

Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] p. 18 – 25.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] pp. 36 – 54.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. What is inheritance and how is it implemented in Python?
2. What is polymorphism and how is it implemented in Python?
3. What is duck typing in the Python programming language?
4. What is the purpose of the `abc` module of the Python programming language?
5. How do you make a class method abstract?

6. How do you make a property of a class abstract?
7. What is the purpose of the isinstance function?

Laboratory Work No4
Topic: Inheritance in OOP in Python

Objective: To study inheritance in OOP in Python

Competencies to be formed:

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
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OPK-4. Able to understand the principles of modern information technologies and use them to solve problems of professional activity	ID-4 _{OPK-4} uses the capabilities of computer technology and software to solve problems of control and algorithmization of information processing processes.	uses the capabilities of computing and software to create applications, uses the Python language to solve information processing problems
OPK-5. Able to develop algorithms and computer programs suitable for practical application	ID-2 _{OPK-5} reads the codes of software products written in the mastered programming languages and makes the necessary changes	reads codes, understands and makes required changes to the program code
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Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] p. 26 – 30.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] p. 55 – 72.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

Safety Instructions: To Practical Exercises

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Control questions:

1. What are the different types of errors in the Python programming language?
2. How does exception handling work in the Python programming language?
3. What are the finally and else blocks for exception handling?
4. How are exceptions thrown in Python?
5. How are custom exception classes created in Python?
6. What is the purpose of the logging module?
7. What levels of logging are supported by the logging module? Give examples in
8. which messages with this logging level can be used

Laboratory Work No5

Topic: Polymorphism and overriding methods in OOP in Python

Objective: To study polymorphism and override of methods in OOP in Python

Competencies to be formed:

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OPK-3. Able to apply methods of search, storage, processing, analysis and presentation of information from various sources and databases in the required format, while observing the basic requirements of information security	ID-3 _{OPK-3} solves data processing problems using computer technology.	solves the problem of data processing using computer technology using the Python language
OPK-4. Able to understand the principles of modern information technologies and use them to solve problems of professional activity	ID-4 _{OPK-4} uses the capabilities of computer technology and software to solve problems of control and algorithmization of information processing processes.	uses the capabilities of computing and software to create applications, uses the Python language to solve information processing problems
OPK-5. Able to develop algorithms and computer programs suitable for practical application	ID-2 _{OPK-5} reads the codes of software products written in the mastered programming languages and makes the necessary changes	reads codes, understands and makes required changes to the program code

	ID-3 ОПК-5 develops original algorithms and computer programs suitable for practical use	develops original applications suitable for practical use
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Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] pp. 31 – 35.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] pp. 73 – 97.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. What are type annotations for in Python?
2. How is type controlled in Python?
3. What are the suggestions for improving Python for working with annotations?
4. types?
5. How are parameters and function return values annotated?
6. How do I access feature annotations?
7. How is variable annotation done in Python?
8. Why do we need deferred annotation in Python?

Laboratory Work No6 **Topic: Modules and their import**

Objective: To study the modules and their import

Competencies to be formed:

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
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OPK-3. Able to apply methods of search, storage, processing, analysis and presentation of information from various sources and databases in the required format, while observing the basic requirements of information security	ID-3 _{OPK-3} solves data processing problems using computer technology.	solves the problem of data processing using computer technology using the Python language
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Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] p. 36 – 39.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] pp. 98 – 118.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. How do I create a data class in Python?
2. What are the default methods that the data class implements?
3. How do I create an immutable data class?

Laboratory Work No7

Subject: Python source code documentation lines

Purpose of the work: To study the lines of documentation of the source code in Python

Competencies to be formed:

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
OPK-3. Able to apply methods of search, storage, processing, analysis and presentation of information from various sources and databases in the required format, while observing the basic requirements of information security	ID-3 _{OPK-3} solves data processing problems using computer technology.	solves the problem of data processing using computer technology using the Python language
OPK-4. Able to understand the principles of modern information technologies and use them to solve problems of professional activity	ID-4 _{OPK-4} uses the capabilities of computer technology and software to solve problems of control and algorithmization of information processing processes.	uses the capabilities of computing and software to create applications, uses the Python language to solve information processing problems
OPK-5. Able to develop algorithms and computer programs suitable for practical application	ID-2 _{OPK-5} reads the codes of software products written in the mastered programming languages and makes the necessary changes	reads codes, understands and makes required changes to the program code
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Theoretical part

1. Study Baldzhi, A. S. Mathematics in Python [1] p. 40 – 46.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] pp. 119 – 143.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

Safety Instructions: To Practical Exercises

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Control questions:

1. What are the tools in the Python Standard Library for building a graphical user interface?
2. What is Tkinter?
3. What are the steps to build a GUI with Tkinter?
4. What is an event loop?
5. What is the purpose of an instance of the Tk class when building a GUI with Tkinter?
6. What are the Button, Label, Entry, and Text widgets for?
7. What is the purpose of the pack() method when building a graphical user interface?
8. How do you manage widget placement using the pack() method?
9. How do I manage scroll bars in the Text widget?
10. What are tags for when working with the Text widget?
11. How do I insert widgets into a text box?
12. What are the Radiobutton and Checkbutton widgets for?
13. What are Tkinter variables and what are they for?
14. How Tkinter variables are associated with the Radiobutton and Checkbutton widgets.

Laboratory Work No8

Topic: Overloading of operators in OOP

Objective: To study the overload of operators in the HHP

Competencies to be formed:

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
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Theoretical part

1. Study Baldzhi, A. S. Mathematics in Python [1] p. 47 – 54.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] pp. 144 – 163.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. What is the purpose of the ListBox widget?
2. How is an event or action associated with the Tkinter widget?
3. What are the types of events in Tkinter? Give examples.

Laboratory Work No9

Topic: Features of object-oriented programming

Objective: To study the features of object-oriented programming

Competencies to be formed:

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
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Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] p. 55 – 59.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] p. 164 – 184.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. How are events handled in Tkinter?
2. How are mouse events handled in Tkinter?
3. How can I render graphics primitives in Tkinter?

Laboratory Work No10

Topic: Developing your own object-oriented application in Python

Objective: To develop your own object-oriented application in Python

Competencies to be formed:

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Theoretical part

1. Study Balci, A. S. Mathematics in Python [1] p. 60 – 68.

2. Study Borzunov, S. V. Algebra and geometry with examples in Python [2] p. 185 – 201.

Equipment and materials: for this practical lesson

you need a computer with the Windows 7 operating system installed and software products: MS Word, Adobe Reader MS Excel.

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Control questions:

1. List the main methods for displaying graphics primitives in Tkinter.
2. How can I refer to previously created shapes on the canvas?
3. What is the purpose of tags in Tkinter?

References recommended for use:

1. Baldzhi, A. S.; Mathematics in Python : a textbook / A.S. Baldzhi, M.B. Khripunova, I.A. Aleksandrova; Financial University under the Government of the Russian Federation, 1, Elements of linear algebra and analytical geometry. - Moscow : Prometheus, 2018. - 76 p. : tabl. - <http://biblioclub.ru/>. - Bibliogr. in the book. - ISBN 978-5-907003-86-6
2. Borzunov, S.; Algebra and geometry with examples in Python Electronic resource / Borzunov S. V., Kurgalin S. D. : textbook for universities. - St. Petersburg : Lan, 2020. - 444 p. - ISBN 978-5-8114-5489-1
3. Shkaberina, G. Sh.; Programming. Fundamentals of the Python Language Elektronnyi resurs / Shkaberina G. Sh., Rezova N. L. : textbook. - Krasnoyarsk : SibSU named after Academician M. F. Reshetnev, 2018. - 92 p. - APPROVED BY the Editorial and Publishing Council of the University as a textbook for undergraduate students in the areas of training 09.03.01 "Informatics and Computer Engineering", 09.03.02 "Information Systems and Technologies", 09.03.04 "Software Engineering" of all forms of education

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METHODOLOGICAL RECOMMENDATIONS
on the organization of independent work of students
in the discipline "Object-Oriented Programming"
for students of the field of study

11.03.02 Infocommunication Technologies and Communication Systems,
Profile "Intelligent Data Processing in Infocommunication Systems and Networks"

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1. Independent work as the most important form of the educational process

Independent work is the planned educational, research, research work of students, performed in extracurricular (classroom) time on the assignment and under the methodological guidance of the teacher, but without his direct participation (with the partial direct participation of the teacher, leaving the leading role behind the work of students).

Independent work of students at the university is an important type of educational and scientific activity of the student. Independent work of students plays a significant role in the rating technology of education. Education at the university includes two parts that are almost the same in volume and mutual influence - the process of learning and the process of self-study. Therefore, the SRS should become an effective and purposeful work of the student.

The concept of modernization of Russian education defines the main tasks of vocational education - "training a qualified worker of the appropriate level and profile, competitive in the labor market, competent, responsible, fluent in his profession and oriented in related fields of activity, capable of effective work in the specialty at the level of world standards, ready for constant professional growth, social and professional mobility."

The solution of these problems is impossible without increasing the role of students' independent work on educational material, increasing the responsibility of teachers for the development of independent work skills, for stimulating the professional growth of students, fostering creative activity and initiative.

Society imposes a fairly wide list of requirements on a modern specialist, among which it is important that graduates have certain abilities and ability to independently obtain knowledge from various sources, systematize the information received, and assess a specific financial situation. The formation of such a skill occurs during the entire period of study through the participation of students in laboratory classes, the performance of control tasks and tests, the writing of term papers and graduation qualification papers. At the same time, the independent work of students plays a decisive role in the entire educational process.

The forms of independent work of students are diverse. In this discipline "Object-Oriented Programming" the following are provided:

Use of the material of the educational and methodological complex of the discipline

At the first stage, it is necessary to familiarize yourself with the mandatory minimum content of the basic educational program in the discipline studied. Next, it is necessary to study the work program of the discipline, which considers the content of the topics of the lecture course, the relationship between the topics of lectures and laboratory classes, topics and types of independent work.

Work with literature

For the successful development of the discipline, it is necessary to independently study the presented topics in detail according to the recommended sources of information that are presented in the curriculum.

Independent work introduces students to scientific creativity, the search for and solution of urgent modern problems.

2. Goals and main objectives of the SRS

The leading goal of the organization and implementation of SRS should coincide with the goal

of teaching a student - the preparation of a bachelor with higher education. In the organization of SRS, an important and necessary condition is the formation of the ability to work independently to acquire knowledge, skills and the ability to organize educational and scientific activities.

The purpose of students' independent work is to master fundamental knowledge, professional skills and abilities in the profile, experience in creative and research activities. Independent work of students contributes to the development of independence, responsibility and organization, a creative approach to solving problems of the educational and professional level.

The objectives of the SRS are:

- systematization and consolidation of the theoretical knowledge and practical skills of students;
- deepening and expanding theoretical knowledge;
- formation of skills to use regulatory, legal, reference documentation and special literature;
- development of cognitive abilities and activity of students: creative initiative, independence, responsibility and organization;
- formation of independent thinking, abilities for self-development, self-improvement and self-realization;
- development of research skills;
- the use of material collected and obtained in the course of independent studies at seminars, laboratory classes, when writing term papers and final qualification papers, for effective preparation for final tests and exams.

3. Types of independent work

In the educational process of a higher professional educational institution, two types of independent work are distinguished: classroom, under the guidance of a teacher, and extracurricular. A close relationship between these types of work provides for differentiation and effectiveness of the results of its implementation and depends on the organization, content, logic of the educational process (interdisciplinary connections, promising knowledge, etc.):

Classroom independent work on the discipline is carried out in classes under the direct guidance of the teacher and on his assignment.

Extracurricular independent work is performed by the student on the instructions of the teacher, but without his direct participation.

The main types of independent work of students without the participation of a teacher in this discipline are:

- formation and assimilation of the content of lecture notes on the basis of educational literature recommended by the lecturer, including information educational resources (electronic textbooks, electronic libraries, etc.);
- preparation for laboratory work, their design.

The main types of independent work of students with the participation of teachers are:

- ongoing consultations;
- acceptance and defense of laboratory work (during the L/R).

4. Organisation of SSDs

The methodology of organizing students' independent work depends on the structure, nature and features of the discipline "Object-Oriented Programming", the amount of hours for its study, the type of

tasks for students' independent work, the individual qualities of students and the conditions of educational activity.

The process of organizing students' independent work includes the following stages:

- preparatory (definition of goals, drawing up a program, preparation of methodological support, preparation of equipment);
- the main one (implementation of the program, the use of methods of information search, assimilation, processing, application, transfer of knowledge, recording of results, self-organization of the work process);
- final (assessment of the significance and analysis of the results, their systematization, assessment of the effectiveness of the program and methods of work, conclusions about the directions of labor optimization).

Students' Activities for the Formation and Development of Skills of Educational Independent Work

In the process of independent work, the student acquires the skills of self-organization, self-control, self-management, self-reflection and becomes an active independent subject of educational activity.

Performing independent work under the supervision of a teacher

The student must:

- master the minimum content submitted for independent work of students and proposed by the teacher in accordance with the educational standards of higher education;
- plan independent work in accordance with the schedule of independent work proposed by the teacher;
- the student must carry out independent work in the organizational forms provided for by the curriculum and the teacher's work program;
- perform independent work and report on its results in accordance with the schedule for submitting results, types and terms of reporting on students' independent work.

A student can:

in addition to the one proposed by the teacher (with justification and agreement with him) and the minimum mandatory content determined by the program for this discipline:

- independently determine the level (depth) of the study of the content of the material;
- to suggest topics and questions for independent study;
- within the framework of the general schedule for the performance of independent work, offer a reasonable individual schedule for the implementation and reporting on the results of independent work;
- offer their own options for organizational forms of independent work;
- to use for independent work methodological manuals, manuals, developments in addition to the list proposed by the teacher;
- to use not only control, but also self-control of the results of independent work in accordance with the methods of self-control proposed by the teacher or chosen independently.

Independent work of students should have an important impact on the formation of the personality of the future bachelor, it is planned by the student independently. Each student independently determines the mode of his work and the degree of work spent on mastering the educational content in

each discipline. He performs extracurricular work according to a personal individual plan, depending on his preparation, time and other conditions.

5. General recommendations for the organization of independent work

The main form of independent work of the student is the study of lecture notes, their supplementation, recommended literature, active participation in laboratory classes. But for successful educational activity, its intensification, it is necessary to take into account the following subjective factors:

1. Knowledge of school program material, the presence of a solid system of gaps necessary for mastering the main university courses. This is especially important for mathematical disciplines. It is necessary to distinguish gaps in knowledge that make it difficult to assimilate new material from small abilities. By spending effort to overcome these gaps, the student will ensure normal academic performance and believe in his abilities.

2. Availability of skills, skills of mental work:

- a) the ability to take notes at lectures and when working with a book;
- b) mastery of logical operations: comparison, analysis, synthesis, generalization, definition of concepts, rules of systematization and classification.

3. The specifics of cognitive mental processes: attention, memory, speech, observation, intelligence and thinking. Poor development of each of them becomes a serious obstacle in learning.

4. Good working capacity, which is ensured by normal physical condition. After all, serious learning is a large, versatile and diverse work. The result of learning is evaluated not by the amount of information communicated, but by the quality of its assimilation, the ability to use it and the development of one's ability to further independent education.

5. Correspondence of the chosen activity, profession to individual abilities. It is necessary to develop the ability to self-regulate one's emotional state and eliminate circumstances that disturb the business mood, interfere with the planned work.

6. Mastering the optimal style of work that ensures success in activities. Alternating work and pauses in work, rest periods, individually justified sleep duration, preference for evening or morning classes, stress resistance at exams and features of preparation for them,

7. The level of demands on oneself, determined by the established self-esteem.

An adequate assessment of knowledge, advantages, disadvantages is an important component of a person's self-organization, without it it is impossible to successfully manage one's behavior and activity.

One of the main features of education in higher school is that constant external control is replaced by self-control, the active role in learning belongs not so much to the teacher as to the student.

Knowing the basic methods of scientific organization of mental work, it is possible to achieve the best results with the least expenditure of time, money and labor efforts.

The effectiveness of assimilation of incoming information depends on the working capacity of a person at a particular moment of his activity.

Working capacity is the ability of a person to work with a high degree of intensity for a certain time. There are internal and external factors of working capacity.

Internal factors of working capacity include intellectual characteristics, will, and state of health.

External:

- organization of the workplace, work and rest schedule;
- the level of labor organization - the ability to obtain information and use information;

- the amount of mental load.

The outstanding Russian physiologist N. E. Vvedensky identified the following conditions for the productivity of mental activity:

- Any work should be entered gradually;
- dimensionality and rhythm of work. Different people have a more or less different pace of work;
- the usual sequence and systematicity of activity;
- correct alternation of work and rest.

Rest does not imply obligatory complete inaction on the part of a person, it can be achieved by a simple change of business. During the day, the working capacity changes. The most fruitful is the *morning time (from 8 to 14 hours)*, and the maximum working capacity falls on the period from 10 to 13 hours, then *the afternoon (from 16 to 19 hours)* and *the evening (from 20 to 24 hours)*. It is better to study the material that is very difficult to understand at the beginning of each period of time (preferably in the morning) after a good rest. After 1-1.5 hours, breaks of 10 - 15 minutes are needed, after 3 - 4 hours of work, the rest should be long - about an hour.

An integral part of the scientific organization of mental labor is the mastery of the technique of mental labor.

The time that the student has to complete the curriculum consists of two components: one of them is classroom work at the university according to the schedule of classes, the other is extracurricular independent work. Tasks and materials for independent work are given during classes according to the schedule, in the same classes the teacher controls independent work, and also assists students in the correct organization of work.

Self-study will require intensive mental work, which must not only be properly organized, but also stimulated. At the same time, it is very important to be able to maintain steady attention to the material being studied. The development of attention requires significant volitional efforts. That is why, if a student notices that he is often distracted during independent studies, he needs to force himself to concentrate. Such a procedure must be done constantly, as this is attention training. Sustained attention appears when a person treats the matter with interest.

It is necessary to properly organize your classes in time: 50 minutes - work, 5-10 minutes - break; after 3 hours of work, a break - 20-25 minutes. Otherwise, increasing fatigue will lead to instability of attention. A very significant factor affecting the increase in mental performance is systematic physical education. The organization of active recreation provides for the alternation of mental and physical activity, which completely restores a person's working capacity.

6. Independent work of a student is a necessary link in the formation of a researcher

The progress of science and technology, information technology leads to a significant increase in scientific information, which imposes higher requirements not only on the moral and ethical qualities of a person, but also, in particular, constantly increasing requirements in the field of education - renewal, modernization of general and professional knowledge, skills of a specialist.

Any education should act as a dynamic process inherent in a person and continuing throughout his life. Mastering scientific thought and the language of science is a necessary component in the self-organization of a future research specialist. This is understood not so much as the accumulation of knowledge, but the mastery of scientifically based ways of acquiring it. This, generally speaking, is the

main task of the university.

The specificity of the university educational process, in the organization of which more and more space is given to the independent work of the student, is that it seems to be the last and most adequate link for the implementation of this task. For during the study at the university, the development of the style and skills of educational (cognitive) activity takes place, the rational nature of which will contribute to the constant renewal of the knowledge of a highly qualified university graduate.

However, there are certain difficulties before this path, in particular, the transition of the student from the synthetic process of learning in secondary school to the analytical one in higher school. This is due both to the new content of education (expansion of general education and deepening of professional training) and to new, hitherto unknown forms of training (lectures, seminars, laboratory classes, etc.). The student receives not only the knowledge provided by the program and teaching aids, but he must also become familiar with the ways of acquiring knowledge in such a way as to be able to assess what we know, how we know it and how we have achieved this knowledge. All this is achieved through one's own independent work.

This is also because self-acquired knowledge is more operational, it becomes personal property, as well as a motive for behavior, develops intellectual traits, attention, observation, criticality, and the ability to evaluate. The role of the teacher is mainly to guide the accumulation of knowledge (in relation to first-year students), and in the subsequent years of study, in the senior years, in the joint identification of problems and care for the student's independent search, as well as control over their activities. It should be noted that it is not possible to limit oneself only to the acquisition of knowledge provided for by the program of the discipline studied, it is necessary to constantly deepen the knowledge gained, focusing it on some narrow specific area corresponding to the interests of the student. In-depth study of all subjects provided for by the program is possible in practice, and good organization of work allows you to save time, which creates conditions for a deep, systematic, interested study of the topic independently chosen by the student.

Of course, all the advice, examples, recommendations in this area, given by the teacher, or certain publications, or other sources, do not guarantee any success without the manifestation of one's own activity in this matter, i.e. they do not give ready-made recipes, but should contribute to the analysis of one's own work, its goals, organization in accordance with individual characteristics. Taking into account personal capabilities, existing living and working conditions, skills, on the basis of these recommendations, it is possible to develop an individually justified set of methods, ways, find one's own style or improve it, so that, having studied certain material, have time to assess its significance, suitability and possibilities of its application, in order to ultimately ensure the success of one's studies from future professional activity

7. Methodical recommendations for students on certain forms of independent work

The system of university education implies much greater independence of students in planning and organizing their activities.

Work with literature

When working with literature, it is necessary to select literature, learn how to read it correctly, and keep notes. For the selection of literature in the library, alphabetical and systematic catalogs are used.

It is important to remember that rational skills of working with a book are always a great saving of time and effort.

The correct selection of textbooks is recommended by the teacher who reads the lecture course.

The necessary literature can also be indicated in the methodological developments for this course.

Studying the material from the textbook, you should move on to the next question only after the correct understanding of the previous one, describing on paper all the calculations and calculations (including those that are omitted in the textbook or given in the lecture for independent conclusion).

In the study of any discipline, independent individual work plays a large and important role.

Particular attention should be paid to the definition of the basic concepts of the course. The student should analyze in detail the examples that explain such definitions, and be able to build similar examples independently. It is necessary to achieve an accurate idea of what you are studying. It is useful to make reference notes. When studying the material from the textbook, it is useful to supplement the lecture notes in the notebook (in specially designated margins). There you should also note the questions selected by the student for consultation with the teacher.

It is recommended to highlight the conclusions obtained as a result of the study in the notes so that they are better remembered when rereading the notes.

Experience shows that many students are helped by compiling a list of reference signals containing the most important and most frequently used formulas and concepts. Such a sheet helps to memorize formulas, the main points of the lecture, and can also serve as a permanent reference for the student.

There are two types of reading; primary and secondary. *Primary reading* is attentive, unhurried reading, in which you can dwell on difficult places. After it, not a single incomprehensible tin should remain. The content may not always be understood after the primary reading.

The task of *secondary* reading is the complete assimilation of the meaning of the whole (this reading may not be the second, but the third or fourth).

Reading a scientific text is a part of cognitive activity. Its purpose is to extract the necessary information from the text. The effectiveness of the action largely depends on how conscious the reader is of his own inner attitude when referring to the printed word (to find the necessary information, to assimilate the information fully or partially, to critically analyze the material, etc.).

There are ***four main attitudes in reading a scientific text:***

1. information retrieval (the task is to find, highlight the information sought)
2. assimilative (the reader's efforts are aimed at understanding and remembering as fully as possible both the information presented by the author and the entire logic of his reasoning)
3. analytical-critical (the reader seeks to critically comprehend the material, analyzing it, determining his attitude to it)
4. creative (creates in the reader a readiness in one form or another – as a starting point for his reasoning, as an image for action by analogy, etc. – to use the author's judgments, the course of his thoughts, the result of observation, the developed methodology, to supplement them, to subject them to a new check).

The existence of several types of reading ***is associated with the presence of different attitudes to addressing a scientific text:***

1. Bibliographic – viewing catalog cards, recommendation lists, summary lists of journals and articles for the year, etc.;
2. Viewing – used to search for materials containing the necessary information, usually it is used immediately after working with lists of references and catalogs, as a result of such viewing the reader establishes which of the sources will be used in further work;
3. introductory – implies a continuous, sufficiently detailed reading of the selected articles, chapters, individual pages, the purpose is to get acquainted with the nature of the information, to find out what issues are submitted by the author for consideration, to sort the material;

4. Studying – assumes a thorough mastery of the material; in the course of such reading, the reader's trust in the author, readiness to accept the information presented, the attitude to the most complete understanding of the material is realized;

5. Analytical-critical and creative reading are two types of reading that are close to each other in that they participate in solving research problems. The first of them involves a directed critical analysis of both the information itself and the ways in which it is obtained and presented by the author; the second is the search for those judgments, facts, on which or in connection with which the reader considers it necessary to express his own thoughts.

Of all the types of reading considered, the main one for students is the learning one - it allows them to accumulate knowledge in various fields when working with educational literature. That is why this type of reading should be mastered in the first place. In addition, when mastering this type of reading, the main techniques are formed that increase the effectiveness of working with a scientific text.

The main types of systematized recording of what has been read:

1. Annotation is an extremely brief coherent description of the book (article) viewed or read, its contents, sources, nature and purpose;

2. Planning is a brief logical organization of the text, revealing the content and structure of the studied material;

3. Thesis is a concise reproduction of the author's main statements without involving factual material;

4. Quotation is a verbatim excerpt from the text of excerpts, extracts that most significantly reflect one or another thought of the author;

5. Note-taking is a brief and consistent presentation of the content of what has been read.

A synopsis is a complex way of presenting the content of a book or article in a logical sequence. A synopsis accumulates the previous types of notes, allows you to comprehensively cover the content of a book or article. Therefore, the ability to make a plan, theses, make extracts and other notes determines the technology of compiling a synopsis.

Methodical recommendations for compiling a synopsis:

1. Read the text carefully. Clarify the incomprehensible words in the reference literature. When writing down, do not forget to put the reference data in the margins of the note.

2. Highlight the main thing, make a plan.

3. Briefly formulate the main provisions of the text, note the author's argumentation.

4. Take notes of the material, clearly following the points of the plan. When taking notes, try to express the idea in your own words. Notes should be kept clearly.

5. Write down quotes correctly. When quoting, take into account the conciseness and significance of the thought.

In the text of the synopsis, it is desirable to give not only thesis statements, but also their proofs. When drawing up a synopsis, it is necessary to strive for the capacity of each sentence. The thoughts of the author of the book should be stated briefly, taking care of the style and expressiveness of what is written. The number of additional elements of the synopsis should be logically justified, the notes should be distributed in a certain sequence that corresponds to the logical structure of the work. Margins should be left for clarification and addition.

Mastering the skills of taking notes requires purposefulness and daily independent work from the student.

Laboratory Classes

It should be emphasized that only after mastering the lecture material from a certain point of view (namely, from the point of view from which it is presented at the lectures) it will be consolidated in the laboratory classes both as a result of discussion and analysis of the lecture material, and with the help of completing the tasks of the laboratory work, the tasks set. Under these conditions, the student will not only learn the material well, but also learn how to apply it in practice, and will also receive an additional incentive (and this is very important) for active study of the lecture.

When performing tasks independently, it is necessary to justify each stage of the solution, based on the theoretical provisions of the course. If the student sees several ways to solve a problem (task), then it is necessary to compare them and choose the most rational one. It is useful to draw up a brief plan for solving the problem (task) before starting calculations. The solution of problems or examples should be presented in detail, calculations should be arranged in a strict order, separating auxiliary calculations from the main ones. Solutions, if necessary, should be accompanied by comments, diagrams, drawings and drawings.

It should be remembered that the performance of each educational task should be brought to the final logical answer required by the condition, and, if possible, with a conclusion. The performance of tasks of this type should be continued until the acquisition of solid skills in solving them.

Self-Test

After studying a certain topic from the notes in the notes and textbook, as well as solving a sufficient number of relevant tasks in laboratory classes and independently, the student is recommended, using a sheet of reference materials, to reproduce from memory definitions, conclusions of formulas, formulations of the main provisions and evidence.

If necessary, you need to carefully understand the material again.

Sometimes the insufficiency of assimilation of a particular issue becomes clear only when studying further material. In this case, it is necessary to go back and repeat the poorly mastered material. An important criterion for mastering theoretical material is the ability to solve problems or pass a test on the material covered. However, it should be remembered that the correct solution to the problem can be obtained as a result of the use of mechanically memorized formulas without understanding the essence of theoretical provisions.

Consulting

If in the process of independent work on the study of theoretical material or when performing tasks, the student has questions that cannot be solved independently, it is necessary to contact the teacher to obtain explanations or instructions from him. In his questions, the student should clearly express what he is experiencing difficulties, the nature of this difficulty. Advice should also be sought if there are doubts about the correctness of the answers to the self-test questions.

Preparation for the test with a grade in the discipline "Object-Oriented Programming".

The study of many general professional and special disciplines ends with a test. Preparation for the test contributes to the consolidation, deepening and generalization of knowledge obtained in the process of study, as well as its application to solving practical problems. Preparing for the test, the student eliminates the existing gaps in knowledge, deepens, systematizes and organizes his knowledge.

To receive credit, the student must fully complete the tasks of the laboratory work of the classes, prepare a report on each laboratory work and a report on the results of independent study of topics, according to the curriculum. If there are debts on the current certification in this discipline, the student does not receive credit.

Systematic preparation for classes during the semester will allow you to use the time of the exam

session to systematize knowledge.

Current certification of students is carried out by teachers who conduct laboratory classes in the discipline in the following forms: interview when defending laboratory work with the provision of a written report. Admission to laboratory work occurs if students have a printed version of the report. The defense of the report takes place in the form of an interview. The maximum number of points (according to the five-point assessment system) is received by the student if the design of the report meets the established requirements, and the report fully reveals the essence of the work. The grounds for reducing the grade are:

- poorly performed work on a personal computer,
- the written report is made in a sloppy form and with errors,
- the student does not give an exhaustive answer to the teacher's question,
- Gets confused or finds it difficult to demonstrate work on the computer.

The report can be sent for revision in the following cases:

- negligent execution and with errors,
- abbreviated content of the report.

The criteria for evaluating the interview are given in the Fund of Assessment Tools for the discipline "Object-Oriented Programming".

8. Educational, methodological and information support of the discipline

On this discipline, the teacher recommends the following literature:

8. Educational, methodological and information support of the discipline

8.1. List of basic and additional literature necessary for mastering the discipline (module)

8.1.1. List of basic literature:

Baldzhi, A. S.; Mathematics in Python : a textbook / A.S. Baldzhi, M.B. Khripunova, I.A. Aleksandrova; Financial University under the Government of the Russian Federation, 1, Elements of linear algebra and analytical geometry. - Moscow : Prometheus, 2018. - 76 p. : tabl. - <http://biblioclub.ru/>. - Bibliogr. in the book. - ISBN 978-5-907003-86-6

Borzunov S. V., Kurgalin S. D. : textbook for universities. - St. Petersburg: Lan, 2020. - 444 p. - ISBN 978-5-8114-5489-1

Shkaberina, G. Sh.; Programming. Fundamentals of the Python Language Elektronnyi resurs / Shkaberina G. Sh., Rezova N. L. : textbook. - Krasnoyarsk : SibSU named after Academician M. F. Reshetnev, 2018. - 92 p. - APPROVED BY the Editorial and Publishing Council of the University as a textbook for undergraduate students in the areas of training 09.03.01 "Informatics and Computer Engineering", 09.03.02 "Information Systems and Technologies", 09.03.04 "Software Engineering" of all forms of training

8.1.2. List of additional literature:

Suzi, R.A. Programming language Python Electronic resource: textbook / R.A. Susi. - Programming language Python, 2020-07-28. - Moscow : Internet University of Information Technologies (INTUIT), 2016. - 350 p. - The book is in the basic version of the EBS IPRbooks. - ISBN 5-9556-0058-2

Sheludko, V. M. Osnovy premenirovaniya na yazyke vysokogo urovnya Python Elektronnoye resurs : Uchebnoye posobie [Fundamentals of programming in the high-level language Python]. - Rostov-on-Don, Taganrog : Publishing House of the Southern Federal University, 2017. - 146 p. - The book is in the premium version of EBS IPR BOOKS. - ISBN 978-5-9275-2649-9

Sheludko, V. M. Programming language of high level Python. Functions, data structures, additional modules Electronic resource: Textbook. - Rostov-on-Don, Taganrog: Publishing House of the Southern Federal University, 2017. - 107 p. - The book is in the premium version of EBS IPR BOOKS. - ISBN 978-5-9275-2648-2

8.2. List of educational and methodological support for students' independent work in the discipline (module)

Baldzhi A.S., Khripunova M.B., Aleksandrova I.A. Mathematics in Python : Textbook ; Financial University under the Government of the Russian Federation, 1, Elements of linear algebra and analytical geometry. - Moscow : Prometheus, 2018. - 76 p. : tabl. - <http://biblioclub.ru/>. - Bibliogr. in the book. - ISBN 978-

5-907003-86-6

Suzi, R.A. Programming language Python Electronic resource: textbook / R.A. Susi. - Programming language Python, 2020-07-28. - Moscow : Internet University of Information Technologies (INTUIT), 2016. - 350 p. - The book is in the basic version of the EBS IPRbooks. - ISBN 5-9556-0058-2

Sheludko V. M. Osnovy premenirovaniya na yazyke vysokogo urovnya Python : uchebnoe posobie [Fundamentals of programming in the high-level language Python: a textbook]. - Rostov-on-Don|Taganrog : Publishing House of the Southern Federal University, 2017. - 147 p. : ill. - <http://biblioclub.ru/>. - Bibliogr. in the book. - ISBN 978-5-9275-2649-9

8.3. List of resources of the information and telecommunication network "Internet" required by the electronic library "University Library NLINE" <http://biblioclub.ru>.

EBS«IPRbooks» <http://www.iprbookshop.ru>

NCFU Electronic Catalog <http://catalog.ncfu.ru/catalog/ncfu>.

9. List of information technologies used in the implementation of the educational process in the discipline (module), including a list of software and information reference systems

Information and reference and information and legal systems used in the study of the discipline:

1	www.biblioclub.ru - Electronic Library System "University Library Online"
2	www.eLibrary.ru - Scientific Electronic Library
3	www.iprbookshop.ru - IPRbooks Electronic Library System

Software:

1	Viola Workstation 10
2	Alt Workstation K
3	Viola "Server"
4	Office software package - P7-Office