**Syllabus**
Course Program

# Algorithmic languages (optional)

Specialty
113 Applied mathematics

Institute
Institute of Computer Science and Information Technology

Educational program
Intelligent Data Analysis

Department
Computer mathematics and data analysis

Level of education
Bachelor's level

Course type
Special (professional), Selective

Semester
4

Language of instruction
Ukrainian

## Lecturers and course developers

**Dmytro Yelchaninov**

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Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Computer Mathematics and Data Analysis

He has 24 years of experience. Author of 150 scientific and educational works. Leading lecturer in the following disciplines: “Methods and tools of computational mathematics”, ‘Principles and paradigms of Python’, ‘Development of web services in Python’, ‘Algorithmic languages’, ‘Mathematical modeling of complex systems’, ‘Design of consolidated information systems’, ‘Fundamentals of business analytics’, ‘Analysis of expert information’.
More about the lecturer on the department's website

## General information

### Summary

The discipline develops the ability to design and develop software using various programming paradigms: generalized, object-oriented, functional, logical, with appropriate models, methods and algorithms of computation, data structures and control mechanisms.

### Course objectives and goals

Mastering the principles and paradigms of the Python language.

### Format of classes

Lectures, laboratory classes, calculations, self-study, consultations. The final control is an exam.

### Competencies

GC 6. Ability to think abstractly, analyze and synthesize.
SC 5. Ability to develop algorithms and data structures, software tools and program documentation.

SC 9. Ability to use modern software programming and testing technologies.

### Learning outcomes

LO 9. To build algorithms those are efficient in terms of computational accuracy, stability, speed, and system resource consumption for numerical study of mathematical models and solving practical problems.
LO 11. Be able to apply modern technologies of programming and software development, software implementation of numerical and symbolic algorithms.

### Student workload

The total volume of the course is 180 hours (6 ECTS credits): lectures – 32 hours, laboratory work – 48 hours, self-study - 100 hours.

### Course prerequisites

Successful completion of the course requires knowledge and skills in the following courses: "Algorithmization and Programming", "Object-Oriented Programming".

### Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively with the use of multimedia technologies. The Python programming language is used in laboratory work.

## Program of the course

### Topics of the lectures

Topic 1. Introduction to Python. Variables and data types
Topic 2. Operators
Topic 3. Branching, selection, and looping instructions
Topic 4. Numbers
Topic 5. Strings and binary data
Topic 6. Regular expressions
Topic 7. Lists, tuples, sets, and ranges
Topic 8. Dictionaries
Topic 9. Working with date and time
Topic 10. Functions
Topic 11. Modules, packages, and import
Topic 12. Objects and classes
Topic 13. Exceptions and their handling
Topic 14. Iterators, containers, and enumerations
Topic 15. Working with files and directories
Topic 16. Working with Windows mechanisms

### Topics of the workshops

There are no workshops in the curriculum.

### Topics of the laboratory classes

Topic 1. Introduction to Python. Variables and data types
Topic 2. Operators
Topic 3. Branching, selection, and looping instructions
Topic 4. Numbers
Topic 5. Strings and binary data
Topic 6. Regular expressions
Topic 7. Lists, tuples, sets, and ranges
Topic 8. Dictionaries

Topic 9. Working with date and time
Topic 10. Functions
Topic 11. Modules, packages, and import
Topic 12. Objects and classes
Topic 13. Exceptions and their handling
Topic 14. Iterators, containers, and enumerations
Topic 15. Working with files and directories
Topic 16. Working with Windows mechanisms

### Self-study

A calculation task for the development of an algorithm and programming using Python.

### Non-formal education

Programming for Everybody (Getting Started with Python)
https://www.coursera.org/learn/python

## Course materials and recommended reading

1. Sundnes, J. (2020). Introduction to Scientific Programming with Python. Simula SpringerBriefs on Computing, vol 6. Springer, Cham. https://doi.org/10.1007/978-3-030-50356-7
2. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers (2021). Learn Python the right way. Ritza. https://www.dbooks.org/learn-python-the-right-way-5670579292/
3. Linge, S., Langtangen, H.P. (2020). Programming for Computations - Python. Texts in Computational Science and Engineering, vol 15. Springer, Cham. https://doi.org/10.1007/978-3-030-16877-3
4. Python 3 documentation. https://docs.python.org/3/
5. Introduction to Programming in Python. https://introcs.cs.princeton.edu/python/home/
6. Python for Everybody. https://www.py4e.com/lessons

## Assessment and grading

### Criteria for assessment of student performance, and the final score structure

To evaluate the work of students during the semester, the final grade is calculated as the sum of the grades for the control measures (maximum 100 points):
a) completion of tasks in laboratory classes: the maximum grade is 80 points;
b) completion of a calculation task: the maximum grade is 15 points;
c) passing the exam: the maximum grade is 5 points.

### Grading scale

| Total points | National | ECTS |
|---|---|---|
| 90–100 | Excellent | A |
| 82–89 | Good | B |
| 75–81 | Good | C |
| 64–74 | Satisfactory | D |
| 60–63 | Satisfactory | E |
| 35–59 | Unsatisfactory (requires additional learning) | FX |
| 1–34 | Unsatisfactory (requires repetition of the course) | F |

## Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU «KhPI»: to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU «KhPI» are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

# Approval

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|---|---|---|---|
| Approved by | Date, signature<br>29.08.2024 |  | Head of the Department<br>Olena AKHIIEZER |
| | Date, signature<br>29.08.2024 |  | Guarantor of the Educational Program<br>Olena AKHIIEZER |