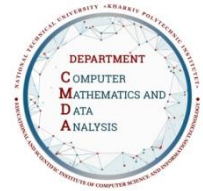




Syllabus Course Program



Introduction to the specialty and engineering activity

Specialty

113 Applied mathematics

Institute

Educational and Scientific 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), Mandatory

Semester

1

Мова викладання

Ukrainian

Lecturers and course developers



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Author of scientific and educational and methodical works. Leading lecturer in the disciplines: "Fuzzy models and methods", "Infrastructure and management of big data", "Decision theory"

General information

Summary

The discipline is aimed at studying the principles of the organization of higher education and the educational process, the peculiarities of the training of specialists in the specialty "Applied mathematics" under the educational program "Intellectual data analysis" at the department of KMAD, the expected competencies and learning outcomes, familiarization with the most common systems of computer mathematics.

Course objectives and goals

The purpose of studying the discipline is to study the principles of the organization of the educational process using modern pedagogical technologies, the features and content of theoretical and practical training of specialists in intellectual data analysis, the acquisition of theoretical knowledge and practical skills in the use of computer mathematics systems, in particular the Scilab system, solving skills mathematical problems and educational problems of mathematical modeling.

Format of classes

Lectures, workshops, calculations, consultations. The final control is in the form of an exam.

Competencies

GC 1. Ability to learn and master modern knowledge.

GC 2. Ability to apply knowledge in practical situations.

GC 7. Ability to search, process and analyse information from various sources.

GC 8. Knowledge and understanding of the subject area and understanding of professional activities.

GC 10. Skills in the use of information and communication technologies.

GC 13. Skills of interpersonal interaction.

GC 14. The ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine.

GC 15. The ability to preserve and enhance moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technique and technology, to use various types and forms of physical activity for active recreation and healthy lifestyle.

Learning outcomes

LO 13. To use specialized software programs in practical work products and software systems for computer mathematics.

LO 14. Demonstrate the ability to self-learn and continue professional development.

LO 15. Be able to organize your own activities and get results within a limited time frame.

LO 16. Demonstrate skills of interaction with other people, ability to work in a team.

LO 17. To be able to collect, process, analyse, systematize scientific and technical information, while avoiding academic dishonesty.

LO 20. Demonstrate professional communication skills, including oral and written communication in Ukrainian and at least one of the official EU languages.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures – 16 hours, practical classes – 16 hours, self-study – 58 hours.

Course prerequisites

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

A feature of teaching is the use of elements of project work.

Program of the course

Topics of the lectures

Topic 1. Specialty "Applied Mathematics"

- The system of higher education of Ukraine.
- Fields of knowledge and specialties.
- National framework of qualifications, educational and qualification levels.
- The "Applied Mathematics" specialty, its content and direction.
- History of applied mathematics at NTU "KhPI".

Topic 2. Specialty standard 113

- Competency approach.
- Competencies and learning outcomes.
- Educational programs.
- Standards of higher education.
- Features of the specialty standard 113 - "Applied mathematics"

Topic 3. Educational program "Intellectual data analysis"

- Educational program "Intellectual analysis of data" at the department of KMAD.
- Program content and focus, program competencies and learning outcomes.
- Educational components, compulsory disciplines and elective disciplines.

Topic 4. Peculiarities of training specialists in the field of data science and engineering

- Peculiarities of scientific and engineering training of specialists in the field of data science and engineering (Data Science and Engineering).
- Professional activity, positions, career.
- Stakeholder requirements for specialist training.

Topic 5. Peculiarities of mathematical and computer training at the department of KMAD

- The connection of the educational program with the needs of the IT industry of Ukraine.
- Computer training at the KMAD department, interdisciplinary direction.
- Combination of theoretical and practical training, dual education.

Topic 6. Project learning

- Project-based learning at the Department of Medical Sciences (Project-based learning).
- The international CDIO initiative and its implementation at the department.
- Engineering orientation of education.
- Content and organization of project training.

Topic 7. Peculiarities of training specialists in intellectual data analysis

- The scientific component of training specialists in intellectual data analysis.
- Basic concepts of artificial and computing intelligence.
- Machine learning, artificial neural networks, deep learning, fuzzy methods of data analysis.

Topic 8. Use of information resources

- Information search.
- Library systems and electronic information resources.
- Search systems.
- Distance learning platforms, common LMS and their use.
- Non-formal and informal education.
- Professional certification.

Topics of the workshops

Topic 1. Requirements for a Data Science specialist. Readiness for project work.

Topic 2. Mathematical packages of applied programs in engineering. Using the Wolfram Alpha online platform for engineering calculations.

Topic 3. Solving typical problems of mathematical analysis using the capabilities of Wolfram Alpha.

Topic 4. Optimization problems, their solution using Wolfram Alpha. Visualization of results.

Topic 5. Mathcad, MATLAB, Scilab packages, comparison of possibilities, peculiarities of using Scilab.

Topic 6. Formation of project teams. Discussion of the task for the mini-project, requirements for the results; standards for the design of supporting documentation, presentations, and reports.

Topic 7. Solving problems with uncertain data.

Topic 8. Protection of project works by teams. Discussion of results.

Topics of the laboratory classes

Laboratory classes are not provided for in the curriculum.

Self-study

During self-study, students study the lecture material, perform calculation tasks (C), prepare for tests and exams. Correctly performed calculation tasks are credited, incorrectly performed - returned for revision. Calculation tasks are evaluated as completed after correcting errors.

Non-formal education

Within the framework of non-formal education according to the relevant Regulation ([z0328-22](#)), the educational component or its separate topics can be taken into account in case of independent completion of professional courses/training, obtaining civic education, online education, professional internship, etc.

In particular, individual topics of this component may be taken into account upon successful completion of the following courses:

- Topic 6. Project learning

https://prometheus.org.ua/course/course-v1:illinois+BOPM101+2024_T2

- Topic 8. Use of information resources

https://prometheus.org.ua/course/course-v1:Prometheus+ITArts101+2017_T1

Course materials and recommended reading

Basic literature

1. Стандарт вищої освіти за спеціальністю 113 «Прикладна математика» для першого (бакалаврського) рівня вищої освіти, затвердженого Наказом МОН України № 1242 від 13.11.2018.

Режим доступу: <https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/12/21/113-%20prikladna-matematika-bakalavr.pdf>

2. Jan Glaubitz. Introduction to Applied Mathematics. Dartmouth College, USA. 2022.

https://math.dartmouth.edu/~m46s21/Script_MATH46_2020.pdf

3. Eric Lehman, Tom Leighton, Albert Meyer. Mathematics for Computer Science. MIT CS, Libre Texts, 2019.

<https://courses.csail.mit.edu/6.042/spring17/mcs.pdf>

<https://www.cs.ucdavis.edu/~rogaway/classes/20/fall21/mit-book.pdf>

4. Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman. Data Science and Machine Learning.

<https://people.smp.uq.edu.au/DirkKroese/DSML/DSML.pdf>

5. John Paul Mueller and Luca Massaron. Machine Learning For Dummies, 2021.

<https://falksangdata.no/wp-content/uploads/2022/01/MachineLearning4dummies.pdf>

6. Методологія наукових досліджень у галузі: практикум [Електронний ресурс] : / уклад.: Н.І. Бурау, В.С. Антонюк, Д.О. Півторак. – КІП ім. Ігоря Сікорського, 2021. - 58 с.

https://ela.kpi.ua/bitstream/123456789/45871/1/Metod_doslid.pdf

Additional literature

7. Edward F. Crawley. Rethinking Engineering Education The CDIO Approach.

<http://dut.udn.vn/Files/admin/files/CDIO/TailieuHoithao/The%20CDIO%20Approach%20-%20Rethinking%20Engineering%20Education.pdf>

8. Gilberto E. Urroz. Introduction to SCILAB. InfoClearinghouse.com

<https://www.scilab.org/sites/default/files/Introduction%20to%20SCILAB%20-%20Gilberto%20E.%20Urroz%20-%202001.pdf>

9. Rachna Verma Arvind Kumar Verma. Introduction to Scilab.

https://www.researchgate.net/publication/328851868_Introduction_to_Scilab

10. Scilab for very beginners. Scilab Enterprises S.A.S

https://www.scilab.org/sites/default/files/Scilab_beginners.pdf

Assessment and grading

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

Description of the final score structure, course requirements, and necessary steps to earn points, especially paying attention to self-study and individual assignments.

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

Approved by

Date, signature
29.08.2024



Head of the Department
Olena AKHIEZER

Date, signature
29.08.2024



Guarantor of the Educational Program
Olena AKHIEZER