Syllabus
Course Program

Practical seminar on mathematical methods in software engineering

Specialty
121 – Software Engineering

Institute
Institute of Computer Science and Information Technology

Educational program
Software Engineering

Department
Software Engineering and Management Intelligent Technologies (321)

Level of education
Bachelor's level

Course type
Special (professional), Mandatory

Semester
8

Language of instruction
English, Ukrainian

Lecturers and course developers

Svitlana Solonska

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Ph.D., associate professor at the Department of Software Engineering and Management Intelligent Technologies of NTU «KhPI», associate professor.
Author (co-author) of more than 45 research papers and textbooks,
courses: Practical seminar on mathematical methods in software engineering, Computer Mathematics.
More about the lecturer on the department's website

General information

Summary

The course "Practical seminar on mathematical methods in software engineering" is a discipline in the cycle of professional training in the specialty 121 "Software Engineering". It is taught in the eighth semester in amount of 90 hours (3 ECTS credits), particularly: workshops - 30 hours, self-study- 90 hours. The course provides for the calculation work. The course ends with the report on results of individual calculation work and credit.

Course objectives and goals

Formation of students' practical knowledge and skills necessary to apply mathematical methods for designing software systems.
Acquisition of practical skills in the use of formal methods and models of discrete mathematics in the processing of information and the description of processes associated with software development.

Format of classes

Mini-lectures, workshops, seminars, self-study, calculation work. Final control - credit.

Competencies

К01. Ability to think abstractly, analyze and synthesize.
К02. Ability to apply knowledge in practical situations.
К05. Ability to learn and master modern knowledge.
К06. Ability to search, process and analyze information from various sources.
К14. Ability to participate in software design, including modeling (formal description) of its structure, behavior and processes of functioning.
К20. Ability to apply fundamental and interdisciplinary knowledge to successfully solve software engineering problems.
К26. Ability to think algorithmically and logically.

Learning outcomes

PLO01. Analyze, purposefully search and select information and reference resources and knowledge necessary for solving professional problems, taking into account modern achievements of science and technology.
PLO05. To know and apply relevant mathematical concepts, methods of domain, system and object-oriented analysis and mathematical modeling for software development.
PLO11. Select input data for design, guided by formal methods of requirements description and modeling.
PLO13. Know and apply methods of developing algorithms, designing software and data structures and knowledge.
PLO18. To know and be able to apply information technologies for data processing, storage and transmission.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): workshops - 30 hours, self-study - 60 hours.

Course prerequisites

Discrete Mathematics, Theory of Algorithms.

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

Teaching and learning methods: mini-lectures, workshops, seminars, presentations, self-study.

Program of the course

Topics of the lectures

Topics of the workshops

Topic 1-2. Analysis of initial description of the software system planned to develop.
Choose the topic of individual calculation work, in which mathematical methods will be used. Study of publications in scientific journals, technical conference proceedings.

Topic 3-5. Study of mathematical methods used.
Study of mathematical methods to implement the system, problem formulation.

Topic 6-8. Study of the subject area. Mathematical description of the system.
To analyze whether the chosen topic has been solved earlier using software implementation. Mathematical description of the system.

Topic 8-9. Development of algorithm for solving problem. Software structure development.
Developing algorithm for software system.

Topic 10-12. Software implementation of mathematical methods used.
Designing software.

Topic 13-14. Solving the problem and analyzing the results obtained.
Analyzing the results obtained.

Topic15. Report on the results of individual calculation work.
Implementation of calculation work.

Topics of the laboratory classes

Self-study

Topic 1-2. Choose the topic of individual calculation work, in which mathematical methods will be used. Study of publications in scientific journals, technical conference proceedings.
Topic 3-5. Study of mathematical methods used.
Topic 6-7. Analysis of the subject area.
Topic 8-9. Developing algorithm for software system.
Topic 10-12. Software implementation of mathematical methods used.
Topic 13-14. Analysis of the results obtained.
Topic 15. Implementation of calculation work.

Course materials and recommended reading

1. O'Regan, G. (2023). Mathematical Foundations of Software Engineering. Texts in Computer Science. Springer, Cham.
2. Knuth, D.E. (2022). Art of Computer Programming. Boston: Pearson Education (US).
3. Vince, J.A. (2023). Foundation Mathematics for Computer Science: A Visual Approach, 2nd ed. Springer.
4. Skiena, Steven S. (2020). The Algorithm Design Manual, 3rd ed. Cham: Springer Nature Switzerland AG.
5. Leighton, F.T., Lehman, E., & Meyer, A.R. (2017). Mathematics for Computer Science, 12th Media Services.
6. Blum, A., Hopcroft, J., & Kannan, R. (2020). Foundations of Data Science. Cambridge: Cambridge University Press.
7. Lewis, H.R., & Papadimitriou, C.H. (1998). Elements of the theory of computation, 2nd ed., Pearson.

Assessment and grading

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

100% final evaluation
as a result of final credit (30%) and current evaluation 70%).
30% credit
70% current rating

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	08.06.2023	Head of the department Ihor HAMAIUN
	08.06.2023	Guarantor of the educational program Uliya LITVINOVA