

# COMPUTER MATHEMATICS (PART 2)

## COURSE SYLLABUS

<b>Code and name of specialty</b>	121 Software Engineering	<b>Institute / faculty</b>	Faculty of Computer Science and Software Engineering
<b>Program name</b>	"Software Engineering"	<b>Department</b>	Software Engineering and Management Information Technologies
<b>Type of program</b>	Educational and Professional	<b>Language of instruction</b>	Ukrainian, English

### LECTURER

<b>Name, E-mail</b>	Nataliia Stratiienko, Nataliia.Stratiienko@kphi.edu.ua
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Ph.D., Associate Professor, Professor of the Department of Software Engineering and Management Information Technologies, NTU «KhPI». Prepared and published more than 60 research papers, training manuals and textbooks (1 training manual recommended by the Ministry of Education and Science of Ukraine, 1 training manual recommended by the Academic Council of NTU "KhPI", 3 articles in publications indexed in Scopus) (Google Scholar: <https://scholar.google.com/citations?user=9cw0zwwAAAAJ&hl=ru>; ORCID: <https://orcid.org/0000-0002-7925-6687>; Scopus: <https://www.scopus.com/authid/detail.uri?authorId=57196007565>).

Leading lecturer of courses: *Fundamentals of the Theory of Algorithms, Algorithms and Data Structures, Computer Mathematics, Fundamentals of Project Management, Formation and Development of IT Project Teams (in Ukrainian and English)*

### GENERAL DESCRIPTION OF THE COURSE

<b>Summary</b>	The course "Computer mathematics (part 2)" is a course in the cycle of professional compulsory training of the specialty 121 "Software Engineering". It is taught in the third semester in the amount of 120 hours (4 ECTS credits), in particular: lectures – 32 hours, laboratory classes – 32 hours, self-study work – 56 hours. The course includes two modules and two modular tests. The study of the discipline ends with the exam.						
<b>Course objectives</b>	The objective of the discipline "Computer mathematics (part 2)" is the formation of a modern system of views in the field of computer mathematics among students, the acquisition of practical skills in the use of formal methods and models of computer mathematics in information processing and description of processes associated with software development.						
<b>Types of classes and control</b>	Lectures, workshops, self-study work (and individual calculation work). Final assessment – exam.						
<b>Term</b>	4						
<b>Student workload (credits) / Type of course</b>	4 / Обов'язковий	<b>Lectures (hours)</b>	32	<b>Workshops (hours)</b>	32	<b>Self-study (hours)</b>	56

<b>Program competences</b>	GC 01. Ability to abstract thinking, analysis and synthesis. GC 05. Ability to learn and master modern knowledge. GC 06. Ability to search, process and analyze information from various sources.
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PC26. Ability to algorithmic and logical thinking.

Learning outcomes	Teaching and learning methods	Forms of assessment (continuous assessment CAS, final assessment FAS)
PO01. Analyze, purposefully search for and select the necessary information and reference resources and knowledge to solve professional problems, taking into account modern advances in science and technology.	Interactive lectures with presentations, discussions, workshops, teamwork, case method, feedback method from students, problem learning	Written individual assignments for workshops (CAS), assessment of knowledge in workshops (CAS), express - survey(CAS), online tests (CAS), final / semester control in the form of a semester exam, in accordance with the schedule of the educational process (FAS )
PO05. Know and apply relevant mathematical concepts, methods of domain, system and object-oriented analysis and mathematical modelling for software development.	Interactive lectures with presentations, discussions, workshops, teamwork, case method, feedback method from students, problem learning	Written individual assignments for workshops (CAS), assessment of knowledge in workshops (CAS), express - survey(CAS), online tests (CAS), final / semester control in the form of a semester exam, in accordance with the schedule of the educational process (FAS )
PO18. Know and be able to apply information technology processing, storage and transmission of data.	Interactive lectures with presentations, discussions, workshops, teamwork, case method, feedback method from students, problem learning	Written individual assignments for workshops (CAS), assessment of knowledge in workshops (CAS), express - survey(CAS), online tests (CAS), final / semester control in the form of a semester exam, in accordance with the schedule of the educational process (FAS )

### ASSESSMENT AND GRADING

Ranges of points corresponding to grades	Total score (points) for all types of learning activities	ECTS grading scale	The national grading scale	Allocation of grade points	<b>100% Final assessment</b> as a result of Final exam (30%) and Continuous assessment (70%). <b>30% Final exam</b> <b>70% Continuous assessment:</b> Workshops (20%) Calculation work (20%) Two module tests (30%)												
	90-100	A	excellent														
	82-89	B	good														
	74-81	C	satisfactory														
	64-73	D	Unsatisfactory (with the exam retake option)														
	60-63	E	Unsatisfactory (with mandatory repetition of the course)														
	35-59	FX															
	0-34	F															

<b>Course policy</b>	Students are required to attend classes as scheduled and comply with ethical conduct. If absent, students will need to complete all tasks to compensate for the missed classes. Participation in workshops requires preliminary preparation and advance processing of all the necessary materials for productive discussions during the session. Written assignments must be submitted on time.
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COURSE STRUCTURE AND CONTENT					
<b>Topic 1</b>	Algebra of Sets	<b>Workshop 1</b>	Algebra of Sets	Самостійна робота	Individual calculation work.
<b>Topic 2</b>	Binary relation	<b>Workshop 2</b>	Binary relation		
<b>Topic 3</b>	Forms of representation and implementation of boolean functions	<b>Workshop 3</b>	Forms of representation and implementation of boolean functions		Studying the course topics with the help of recommended reading, homework
<b>Topic 4</b>	Boolean functions minimization problem	<b>Workshop 4</b>	Post's Classes		
<b>Topic 5</b>	Graphs. Basic concepts and definitions	<b>Workshop 5</b>	Boolean functions minimization problem		
<b>Topic 6</b>	Reachability and connectivity in graphs	<b>Workshop 6</b>	Basic concepts of graph theory.		
<b>Topic 7</b>	Graph colouring	<b>Workshop 7</b>	Matrix representation of graphs		
<b>Topic 8</b>	Tree. Spanning tree	<b>Workshop 8</b>	Graph operations		
<b>Topic 9</b>	Search algorithms for shortest paths in a graph	<b>Workshop 9</b>	Reachability and connectivity in graphs		
<b>Topic 10</b>	Cycles and the traveling salesman problem	<b>Workshop 10</b>	Tree. Spanning tree		
<b>Topic 11</b>	Algorithms for solving flow problems	<b>Workshop 11</b>	Алгоритми пошуку найкоротших шляхів на графі		
		<b>Workshop 12</b>	Hamiltonian paths, contours, and the traveling salesman problem.		
		<b>Workshop 13</b>	Algorithms for solving flow problems		
RECOMMENDED READING					

**Compulsory**

1. Harry Lewis, Rachel Zax. (2019). Essential Discrete Mathematics for Computer Science. Princeton University Press.
2. John Vince. (2020). Foundation Mathematics for Computer Science: A Visual Approach. ( 2nd ed.). Springer.
3. Sergei Kurgalin, Sergei Borzunov. (2019). The Discrete Math Workbook: A Companion Manual for Practical Study. Cham: Springer Nature Switzerland.
4. Висоцька, В. А., Литвин, В. В., Лозинська, О. В. (2020). Дискретна математика: практикум (Збірник задач з дискретної математики): навчальний посібник. Львів: Видавництво «Новий Світ – 2000».

**Recommended**

5. Eric Lehman, F. Thomson Leighton, Albert R. Meyer. (2017). Mathematics for Computer Science. 12th Media Services.
6. Jun Wu. (2018). The Beauty of Mathematics in Computer Science. Chapman & Hall.
7. Jon Pierre Fortney. (2020). Discrete Mathematics for Computer Science: An Example-Based Introduction. London: Taylor & Francis Ltd.
8. Коцовський, В. М. (2020). Основи дискретної математики: навчальний посібник. Ужгород: ПП «АУТДОР- ШАРК».
9. Борисенко, О. А. (2019). Дискретна математика : підручник для студентів вищих навчальних закладів. Суми: Університетська книга.

**Academic integrity**

Graduate students are expected to adhere to the Code of Ethics of Academic Relations and Integrity” of NTU “KhPI”

The content of this syllabus is consistent with the course program.