FINITE MATHEMATICS

Course code	*FUN103*
Course title	*Finite mathematics*
Type of course	*Compulsory*
Stage of study	*Undergraduate*
Year of study	*First*
Semester	*Spring*
ECTS	*6 credits: 24 hrs. of lectures, 24 hrs. of consultations, 112 hrs. of self-study*
Coordinating lecturer	*Kristina Aldošina*
Study form	*Full-time*
Course prerequisites	*–*
Language of instruction	*English*

Annotation

Course covers introduction to linear systems, matrix algebra, linear programming, graph theory, introduction to probabilities, game theory, and various applications.

Aims of the course

This course aims to develop skills for mathematical modelling of basic social and economic phenomena.

Course learning outcomes (CLO)	Learning methods	Assessment methods
CLO1. Ability to operate the main concepts, laws, and techniques of finite mathematics	Lectures, tutorials, exercises, examples, practical sessions in small groups, individual work	Midterm exam, final exam
CLO2. Ability to apply these concepts, laws and techniques in modelling economic and social phenomena	Lectures, tutorials, exercises, examples, development and analysis of mathematical models; practical sessions in small groups, individual work	Midterm exam, final exam

Quality issues

The lecturer assures a variety of teaching methods and testing. The feedback from students will always be highly valued and appreciated. Interim exams enable lecturer and students to realize the weakness and improve their knowledge and skills in those areas.

Cheating issues

The teaching and testing methods are chosen taking into account the purpose of the minimization of cheating opportunities. The ISM regulations on academic ethics are fully applied in the course.

Topics

Week	TOPIC	CONTACT HOURS		Readings (chapters of the main book)
		Theory	Practice[1]	
1	*Introduction to the course.* **I. Linear algebra (1).** Determinants, properties and calculation techniques. Cramer's rule.	2	2	2.1, lecture notes
2	**Linear algebra (2).** Matrices, operations. Representation of data using matrices. Method of inverse matrix.	2	2	2.4 - 2.6,
3	**Linear algebra (3).** Gauss elimination method. Optional: Gauss-Jordan elimination method.	2	2	2.2, 2.3,
4	**Linear algebra (4).** Applied models: rational production plan; Markov chains and stable market shares; Leontief model of balanced economy, flow management (traffic control).	2	2	2.2, 2.3, 2.7, 9.1, 9.2
5	**II. Linear programming (1).** Formulation and graphical solution of linear programming problem. Sensitivity analysis. Integer programming. Applications: optimal plan for two variables, shadow prices, optimal plan for two integer variables.	2	2	3.1 - 3.4, lecture notes
6	**Linear programming (2).** Simplex method for maximization problems. Dual problem. Applications: optimal plan for many variables.	2	2	4.1 - 4.3
7	**III. Probability theory (1).** Sets and counting. Definition of an event. Combinatory. Probability of a random event. Applications: surveys, decisions.	2	2	6.1 - 7.2
8	**Probability theory (2).** Addition and multiplication of probability. Conditional probability. Independent events. Law of total probability. Bayes' theorem. Bernoulli trials. Applications: surveys, decisions, quality control.	2	2	7.3 - 7.6
9	**Probability theory (3).** Discrete random variables and distributions. Expectation, variance, and standard deviation. Binomial and Poisson distributions. Applications: waiting lines and times, expected profit, quality control.	2	2	8.1 - 8.4
10	**IV. Introduction to the game theory.** Non-zero sum games, equilibriums, optimal strategies. Zero-sum games. Strictly determined games. Optimal strategies. Games with mixed strategies for 2×2 matrix games. Expected value of a game. Applications: business and investment decisions.	2	2	9.4, 9.5, lecture notes
11	**V. Graph theory.** Main concepts, metric characteristics, types. Path, circuit, tree. Circuits. Euler's path and circuit. Fleury's algorithm. Hamiltonian circuit, three algorithms. Applications: travelling problems. Three classical applied problems: shortest path, minimal tree and maximal flow.	4	4	Lecture notes
	Total:	**24**	**24**	
Exam session	**FINAL EXAM**	2		

Assessment

The overall assessment of the course will be composed from evaluation of **written** closed book **exam** (covering the whole course), and will count for the **100%** of the final evaluation and will consist of several real-life problems. Only non-text, non-graphical calculators (without solving functions), provided sheet with formulas and language dictionary (without explanations and definitions) will be allowed.

[1] Practices will be organized in form of consultations (workshops). Students will have possibility to solve both skill-forming and applied problems (individually or in groups), ask questions, discuss.

In case of the negative final evaluation, retake is possible. It will cover material of the whole course and will comprise **100%** of the final mark. Structure of the retake is the same as of exam.

Precision of composite evaluations is left intact (up to 2 decimals) until the end of semester and only the final evaluation will be subject to rounding.

Textbooks

Main:

S.T. Tan. Finite mathematics for the Managerial, Life, and Social Sciences. 8th ed. Thomson Brooks/Cole, Thomson Learning, 2006. P.646.

Additional:

1. K. Sydsaeter, P. Hammond. Essential Mathematics for Economic Analysis. 2nd ed. Prentice Hall, 2006, p.714.
2. V. Būda, J. Granskas. Diskretieji matematiniai modeliai. Vilnius, TEV. 2015.
3. Березина Л. Ю. Графы и их применение. Москва, Просвещение. 1979.