Silabus Selective Component SC

Mathematical Methods in Economic Research

Name of the discipline:	Mathematical Methods in Economic Research
Higher education level:	first (Bachelor's degree)
Moodle course page:	http://dl.khadi.kharkov.ua
Scope of the sample component	3 credits (90 hours)
Final control form	Credit
Consultations:	on schedule
Department name:	Department of higher mathematics
Language of instruction:	English
Course manager:	Yarkho Tetiana Oleksandrivna, Doctor of Pedagogical Sciences, Professor; Emelyanova Tetiana Viktorivna, Candidate of Physical and Mathematical Sciences,
Contact phone number:	
	(057)707-37-37
E-mail:	vmatem@khadi.kharkov.ua

Summary of the educational component:

The purpose of studying the discipline is: special mathematical training of applicants for technical and transport specialties in the direction of forming the ability to identify the optimal method of action in solving organizational management problems in conditions of technical and economic restrictions.

Subject of the discipline: methods of linear programming (geometric, simplex, artificial basis method, dual simplex-method for solving linear programming problems; distribution method and method of potentials for solving transport problems); methods of queuing theory (solving problems in single-channel and multi-channel systems with failures and unlimited queue, systems with fixed service time).

The main objectives of the discipline are:

- study of economic and mathematical models of problems and statements of linear programming problems;

- study of the theoretical foundations of linear programming methods;

- formation of abilities of theoretical application of linear programming methods: geometric, simplex, artificial basis method, dual simplex method, potential method and their practical implementation in the process of solving professional problems of technology and transport;

- study of the possibilities of applying standard application software packages to solving linear programming problems;

- formation of concepts about queuing systems, their main parameters and tasks of queuing theory;

- formation of the ability to determine the performance indicators of single-channel and multi-channel CFR with failures, single-channel and multi-channel CFR with a limited queue; CFR with a limited waiting time;

- formation of abilities of certain limit probabilities of states and parameters of Real bench testing systems, technical and transport systems for car maintenance, unloading of building materials.

Prerequisites for studying the educational component: mandatory mathematical discipline of The Bachelor's degree "Higher Mathematics", disciplines: "Probability Theory", "Introduction to Probability and Statistical Analysis".

Competencies that the applicant acquires: General competencies: ability to communicate in the state language; ability to search, process and analyze information from various sources;

ability to generate new ideas (creativity);

ability to abstract thinking, analysis, synthesis, comparison and classification, concretization and generalization;

ability to apply knowledge in practical situations;

ability to express a personal logically constructed and reasoned point of view;

ability to recognize and resist illogical and false arguments and statements.

Special mathematical competencies

knowledge, understanding of the essence of readiness to interpret and recognize mathematical objects and their properties;

mastering the symbolic aspect of mathematics;

knowledge of standard and standard mathematical problem statements;

ability to solve classical and applied mathematical problems of a reproductive nature;

ability to solve classical and applied mathematical problems that involve elements of creativity and research;

the ability to comprehend and adjust the acquired special competencies in order to increase their effectiveness.

Learning outcomes according to the educational program:

knowledge of mathematical models of typical economic problems and statements of linear programming problems.

knowledge of the theoretical foundations of linear programming methods.

ability to theoretically apply linear programming methods: geometric, simplex, artificial basis method, dual simplex method, potential method.

ability to practically implement linear programming methods in the process of solving professional problems of engineering and transport.

knowledge of basic concepts regarding queuing systems, their main parameters and tasks of queuing theory.

ability to determine the performance indicators of single-channel and multi-channel CFOs with Queue-Limited failures and limited waiting times.

ability to determine the maximum probabilities of states and parameters of Real bench testing systems, technical and transport systems for car maintenance, unloading of building materials.

Thematic plan

N₂	Toria nome (LC, DD, SD)	Number of hours	
	Topic name (LC, PK, SK)		Zaochne
1	LC1 Methods of linear programming. Setting linear programming		
	problems (LP). Theoretical foundations of LP methods. Geometric	2	2
	method for solving LP problems.		
	PR1 Construction of economic and mathematical models of typical		
	practical problems of engineering and transport. Solving LP		2
	problems using the geometric method.		
	SR1 Convex sets in n-dimensional space. Geometric content of a set		
	of solutions for linear inequalities and a compatible system of linear	6	6
	inequalities. Properties of the LP problem.		
2	LC2 Is a simplex method for solving linear programming problems.		2
	Simplex method algorithm.	2	2
	PR2 Solving the main LP problem by the Simplex Method with the condition of maximizing the objective function F.		2
	3	LC3 Artificial basis method (two-stage simplex method)	2
PR3 Ssolving LP problems using the artificial basis method.		2	2
SP3 Special cases of the Simplex Method. Simplex-method solution		8	8

	of problems with violation of the conditions of compatibility of the		
	constraint system and unity of the finite solution.		
	LC4 Theory of duality. The first, second, and third duality theorems.	2	2
4	PR4 Solving LP problems using the dual simplex method.	2	2
4	SR4 Economic content of direct and dual problems, duality		(
	theorems, objectively determined estimates.	0	0
	LC5 Transport problem of linear programming. Problem statement.		
	Methods for finding the initial basic distribution of supplies (the first	2	2
	reference plan). Method of potentials for finding the optimal basic	Z	2
5	distribution of supplies.		
5	PR5 Solving transport problems using the potential method (closed	2	2
	methods). Special cases in solving a transport problem.	2	۷
	SR5 Unbalanced transport task. Unbalanced transport task with	10	10
	additional conditions (privileges). M is the solution method.	10	10
	LC6 Methods of queuing theory. Basic SS parameters and QT tasks.	2	2
	Event graph. The Kolmogorov Equation.	2	2
	PR6 Plotting state graphs of systems consisting of several nodes.		
6	Drawing up systems of Kolmogorov equations. Finding the limit	2	2
	probabilities for systems based on state graphs.		
	SR6 Limit probabilities of SS States. A cyclical process. Structure of	6	6
	the queuing process.	Ũ	Ű
	LC7 Single-channel and multi-channel SS with failures. Erlang's	2	2
	Task. Single-channel and multi-channel SS with unlimited queue.		
_	PR7 Determination of performance indicators of service channels.	_	_
7	Finding parameters of a two-channel service station with an	2	2
	unlimited queue.		
	SR7 SS with a fixed service time. Finding parameters of the road	6	6
	material unloading system with a fixed maintenance time.		
	LC8 Single-channel and multi-channel CFR with a limited queue.	2	2
	Closed SS. SS with limited waiting time.		
	PR8 Calculation of parameters of the paid parking registration	2	2
8	system (with a limited queue). Determination of parameters of the	2	2
	multi-venicle bench testing system.		
Together	SR8 Determination of the maximum probabilities of vehicle	0	0
	maintenance system States, parameters: average queue length,	8	ð
		1(1(
	DD	10	10
		10	10
	36	58	29

Training methods:

- * lectures, practical exercises, explanations, etc.;
- * standard calculation works;
- * standardized tests;
- * tasks for in-depth creative training;
- * test papers;
- * presentations of completed tasks and research;
- * student presentations and presentations at scientific events;
- * final comprehensive tests.

Evaluation system and requirements

1 Current academic performance:

1.1 the current success of applicants for performing educational types of work in training sessions and for

performing tasks of independent work is evaluated using a four-point Assessment Scale, followed by recalculation to a 100-point scale. When evaluating current academic performance, all types of work provided for in the curriculum are taken into account.

1.2 lectures are evaluated by determining the quality of performance of specified tasks.

1.3 practical exercises are evaluated by the quality of performing a control or individual task, performing and completing practical work.

1.4 assessment of the current academic performance of higher education applicants is carried out at each practical lesson (laboratory or seminar) on a four-point scale ("5", "4", "C", "2") and are entered in the academic performance log.

- "excellent": the applicant has perfectly mastered the theoretical material, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

- "good": the applicant has mastered the theoretical material well, has the main aspects from the original sources and the recommended literature of the RI, presents it in an argumentative manner; has practical skills, expresses his thoughts on certain problems, but admits certain inaccuracies and errors in the logic of presenting the theoretical content or when analyzing the practical one;

- "satisfactory": the applicant has mainly mastered the theoretical knowledge of the educational topic or discipline, is guided in the primary sources and recommended literature of the RI, but does not answer convincingly, confuses concepts, does not answer additional questions uncertainly, does not have stable knowledge; answering questions of a practical nature, shows inaccuracy in knowledge, does not know how to evaluate facts and phenomena, connect them with the future profession;

- "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, almost does not navigate in primary sources and recommended literature, there is no scientific thinking, practical skills are not formed.

2 Final assessment:

An applicant for Higher Education receives a credit in the last lesson in the discipline based on the results of the current assessment. The average score for current activities is converted to points on a 100-point scale.

Higher education applicants who have an average current grade in the discipline below "3" (60 points) can improve their current score in the last lesson by passing tests in the discipline.

Assessment of applicants ' Knowledge by testing is carried out on a scale of:

- "Excellent": the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided for in the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum. (at least 90% of correct answers);

- "Very good": the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are mostly formed, all the training tasks provided for in the training program are completed, the quality of most of them is estimated by the number of points close to the maximum. (82% to 89% of correct answers);

- "Good": the theoretical content of the course is fully mastered, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the training tasks provided for in the training program are completed, the quality of None of them is evaluated with a minimum number of points, some types of tasks are completed with errors (from 74% to 81% of correct answers);

- "Satisfactory": the theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills of working with the mastered material are mostly formed, most of the training tasks provided for in the training program are completed, some of the completed tasks may contain errors (from 67% to 73% of correct answers);

- "Satisfactory enough": the theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills of working with the mastered material are mostly formed, most of the training tasks provided for in the training program are completed, some of the completed tasks may contain errors (from 60% to 66% of correct answers);

- "Unsatisfactory": the theoretical content of the course is partially mastered, the necessary practical skills of work are not formed, most of the provided training programs for training tasks are not completed, or the quality of their performance is estimated by a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of performing educational tasks(with the possibility of re-passing)(less than 60% of correct answers);

- "Unacceptable" - the theoretical content of the course is not mastered, necessary

practical work skills are not formed, all completed training tasks contain gross errors, and additional independent work on the course material will not lead to any significant improvement in the quality of

training tasks.(with a mandatory repeat course).

Table-correspondence of final rating ratings in points to national scale and ECTS scale ratings

	Rating on the national scale (exam, credit)	Rating on the ECTS scale		
Rating		Grade	Criteria	
90-100	Excellent	A	"Excellent" - the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided for in the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum.	
82 – 89	Good	В	"Good" - the theoretical content of the course is fully mastered, without gaps, the necessary practical skills of working with the mastered material are mostly formed, all the training tasks provided for in the training program are completed, the quality of most of them is estimated by the number of points close to the maximum.	
75 – 81		С	"Good" - the theoretical content of the course is fully mastered, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the training tasks provided for in the training program are completed, the quality of performance of any of them is not evaluated with a minimum number of points, some types of tasks are performed with errors	
67 – 74	Satisfactory	D	"Satisfactory" - the theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills of working with the mastered material are mostly formed, most of the training tasks provided for in the training program are completed, some of the completed tasks may contain errors.	
60 - 66		Ε	"Enough" - the theoretical content of the course is partially mastered, some practical work skills are not formed, many of the training tasks provided for in the training program are not completed, or the quality of performance of some of them is estimated by a number of points close to the minimum.	
35 – 59	Unsatisfactory	FX	"Unsatisfactory" - the theoretical content of the course is partially mastered, the necessary practical skills of work are not formed, most of the provided training programs for educational tasks are not completed, or the quality of their performance is estimated by a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of performing educational tasks(with the possibility of re-passing)	
1 – 34		F	"Unacceptable" -the theoretical content of the course is not mastered, the necessary practical skills are not formed, all completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of training tasks.(with a mandatory repeat course)	

Course policy:

- the course involves working in a team, the environment in the classroom is friendly, creative, open to constructive criticism;

- mastering the discipline involves mandatory attendance at lectures and practical classes, as well as independent work;

- independent work involves the study of individual topics of the academic discipline, which are submitted in accordance with the program for independent study, or were considered briefly;

- all tasks provided for in the program must be completed on time;

- when studying the course, applicants for higher education must adhere to the rules of academic integrity set out in the following documents: "Rules of academic integrity of participants in the educational process of KHNADU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf),

"Moral ethical code of participants in the educational process of **KHNADU** and (https://www.khadi.kharkov.ua/fileadmin/P Standart/pologeniya/stvnz 67 01 MEK 1.pdf).

- cheating during test papers and tests is prohibited (including using mobile devices). Mobile devices can only be used during online testing.

Recommended literature:

1. Навчальний посібник "Лінійне програмування" для бакалаврів спеціальностей 051 «Економіка», 071 «Облік і оподаткування», 073 «Менеджмент», 076 «Підприємництво, торгівля та біржова діяльність» денної та заочної форм навчання / Укладачі: Волков В. Е., Максимова О. Б., Макоєд Н. О. - Одеса: ОНАХТ, 2018. — 115 с.

2. Катренко А. В. Дослідження операцій. Підручник, 3-тє вид., випр. і доп. – Львів: "Магнолія-2006", 2018. – 549 c.

3. Терентьєв О. О. Дослідження операцій: навчальний посібник / О. О. Терентьєв, О. В. Доля, О. I. Баліна. – К.: 2020. –116 с.

4. Фартушний І. Д. Курс дослідження операцій: навчальний посібник / І. Д. Фартушний, М. Г. Охріменко, І. Ю. Дзюбан. – К.: НТУУ «КПІ», 2016. – 212 с.

5. Теорія систем масового обслуговування : навч. посібник / А. Л. Литвинов ; Харків. нац. ун-т міськ. госп-ва ім. О. М. Бекетова. – Харків : ХНУМГ ім. О. М. Бекетова, 2018. – 141 с.

6. Імітаційне моделювання систем масового обслуговування: навч. посіб. [для студентів техн. спец. вищ. навч. закл.] / В. Б. Толубко, А.Д. Кожухівський, В.В. Вишнівський, Г.І. Гайдур, О.А. Кожухівська. – Київ: ДУТК, 2018. - 175 с.

7. Дмитрієв І. А. Математичні методи в економічних дослідженнях / І. А. Дмитрієв, О. І. Дмитрієва, Т. В. Ємельянова, І. Ю. Шевченко, Т. О. Ярхо. – Харків: ФОП Бровін О. В., 2021, 180 с.

Additional sources:

1. distance learning course

Developer (s)

syllabus of the academic discipline

thich the

Teriana YARKHO_

Teriana EMELIANOVA

Head of the Department of Higher Mathematics

Teriana YARKHO