

Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Department of technologies and food safety

Work program (syllabus) of the educational component

Будіпробуб

**SC.5 INFORMATION TECHNOLOGIES AND OPTIMIZATION OF
TECHNICAL AND TECHNOLOGICAL FACILITIES OF THE
PROCESSING INDUSTRY**

Specialty	181 "Food technologies"
Educational program	Food technologies
Level of higher education	Second (master's)

Developer:

Anna HELIKH Ph.D., Assoc. Prof., Department of
Technologies and Food Safety
(surname, initials) (degree and title, position)

Considered and approved at the meeting of the Department of <u>Technologies and Food Safety</u> (name of department)	protocol from <u>04.06.2024</u> No. <u>17</u>
	Head department (signature) <u>Marina SAMILYK</u> (surname, initials)

Agreed:

Guarantor of the educational program
(signature) Fedir PERTSEVOY
(surname)

Dean of the faculty where the educational program is implemented

(signature) Nataliia BOIHOVA
(surname)

The review of the work program was provided by Ph.D., Assoc. Prof.

(signature) Nataliia BOLHOVA
(surname)

Ph.D., Assoc. Prof.

(signature) Vasyl TYSHCHENKO
(surname)

Methodist of the Education Quality Department, licensing and accreditation

(signature) N. Baranik
(surname)

Registered in the electronic database: date: 09.07.2024

I. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	The name is OK	OK Information technologies and optimization of technical and technological objects of the processing industry	
2.	Faculty/department	Food Technologies / Department of Technologies and Food Safety	
3.	The status is OK	Mandatory	
4.	Program/Specialty (programs), the component of which is OK for (<i>to be filled in for mandatory OK</i>)	EP "Food technologies", 181 Food technologies	
5.	NRK level	7-th master's degree	
6.	Semester and duration of study	2nd semester, 15 weeks	
7.	Number of ECTS credits	5	
8.	The total number of hours and their distribution	Contact work (class)	
		Lectures 2	Laboratory 14
8.		Independent work	
		134	
9.	Language of education	English	
10.	Teacher/Coordinator of the educational component	Ph.D., associate professor Helikh A.O.	
11.1	Contact Information	Anna Oleksandrivna Gelikh, associate professor of the Department of Technologies and Safety, 317a, e - mail: anna.helikh@snau.edu.ua	
11.	General description of the educational component	acquisition the ability to optimally select equipment and modes of its operation (time, temperature, pressure, etc.); methods and regimes of heat treatment, recipe composition, to model costs for the production of products that require sufficiently accurate calculation methods and, thus, the use of modern means of computer technology	
12.	The purpose of the educational component	studying the principles of building mathematical models of food technology as objects of design, management and optimization. Verification of the reliability and validity of computer models of the course of technological processes, among which two types can be distinguished: physicochemical (deterministic) models and empirical models based on the processing of experimental data	
13.	Prerequisites for studying OK, connection with other educational components of OP	1. The educational component is the basis for OP "Food Technologies": EC 7 Qualification work (execution and defense) .	
14.	Policy of academic integrity	it is not allowed to copy the conclusions of the protocols of laboratory works from each other, in such a case, the laboratory works will be considered unprotected and need to be revised again. In the case of repeated refinement, the work will not be evaluated for the maximum score.	
15.	Link to the course	https://cdn.snau.edu.ua/moodle/course/view.php?id=4755	

2. LEARNING RESULTS UNDER THE EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Study results for EC: After studying the educational component, the student is expected to be able to.."	Program learning outcomes, which are aimed at the achievement of the OK			How PLO is estimated
	PLO 1	PLO 4	PLO 10	
DRN 1 The ability to set modeling problems, understand their essence and divide them into separate stages for the formation of an algorithm for the development of mathematical models of technological processes.		H	H	Oral defense of practical works Multiple choice final test (modular assessment) Public presentation of the results of own calculations The exam is a multiple choice test
DRN 2 The ability to apply in engineering practice mathematical models and software functions of the working environment MS Office Excel, MathCAD, STATISTICA - as modern methods of solving optimization problems and their graphic interpretation for presentation and visual understanding.	H			Oral defense of practical works Multiple choice final test (modular assessment) Public presentation of the results of own calculations The exam is a multiple choice test
DRN 3 . The ability to verify the reliability and validity of computer models of the course of technological processes, among which two types can be distinguished: physicochemical (deterministic) models and empirical models based on the processing of experimental data.	H		H	Oral defense of practical works Multiple choice final test (modular assessment) Public presentation of the results of own calculations The exam is a multiple choice test

LIST OF COMPETENCES THAT WILL BE IMPROVED / ACQUIRED IN THE PROCESS OF INFORMAL EDUCATION	
CASE STUDY: how to solve complex tasks in business and in life	
<p>General: the presence of innovative perception of the subject, concretization according to three types: perceptual of one's own innovations and innovations or discoveries in general, the ability to see elements of the new in the relative constant and the ability to propose a fundamentally new solution to the problem.</p> <p>Professionals: possession of a system of theoretical and practical knowledge, a set of skills; experience of demonstrating competence in real situations of the technological process; the ability to creatively solve professional tasks, the technologist's level of awareness of his knowledge, abilities, skills, and opportunities necessary for the qualified implementation of innovative activities.</p>	<p>Form for confirmation of study results: Certificate of successful completion of studies indicating the number of hours. The authenticity of the certificate can be checked by the link on it.</p>

3. CONTENTS OF THE EDUCATIONAL COMPONENT (COURSE PROGRAM)

Topic. List of issues to be considered within the topic	Distribution within the general time budget			Recommended Books ¹
	Auditory work		Individual work	
	Lecture	Practice		
Module I				
<p>Lecture class 1. Content, purpose and main tasks of the discipline. General information about modeling. General concepts of optimization of technological processes.</p> <p>1. The main tasks of the course, its relationship with the disciplines of special training.</p> <p>2. Formulation of modeling problems.</p> <p>3. The essence and stages of mathematics modeling.</p> <p>4. Modeling objects. A generalized algorithm for developing mathematical models of technological processes.</p> <p>5. Hierarchical structure of modern food enterprises. General idea about the technological system.</p> <p>6. General concepts of optimization of technological processes.</p>	2			[1-3], [7], [8], [10], [14], [15], [16], [17], [23]

¹ A specific source from the main or additional recommended literature

Practical lesson 1. (part 1) <i>Description of experimental data, their functional relationship. regression equation</i>		4		[9], [1-3], [4], [8], [10], [11], [12]
Self-study questions: <i>Topic 1. Problems of linear programming</i> 1.1. Examples of linear modeling problems 1.2. General and basic problems of linear programming 1.3. Geometric method of solving linear programming problems			5	[1-3], [7], [8], [11], [14], [15], [18], [17], [24]
Lecture session 2. Software functions of the MS working environment Office Excel, MathCAD and STATISTICA used to solve practical problems of food technology modeling. 1. Application of mathematical models and software functions of MS working environment in engineering practice Office Excel, MathCAD, STATISTICA - as modern methods of solving optimization problems and their graphical interpretation for presentation and visual understanding. 2. Processing of the results of the implementation of full and fractional multivariate experiment plans. Analysis of the results and their registration.	2	-		[1-3], [7], [9], [13], [14], [15], [16], [17], [23]
Practical lesson 1 (part 2) <i>Description of experimental data, their functional relationship. Regression equation.</i>		6		[1-3], [7], [8], [10], [14], [15], [16], [17], [24]
Independent work <i>Topic 1. Problems of linear programming</i> 1.4 Methods of solving linear programming problems using modern computer technologies			15	[9], [3], [4], [8], [10], [11], [12]
Lecture session 3. FROM general information about the theoretical prediction of the experiment. 1. Basic concepts and definitions of experimental factors. 2. Checking the reproducibility of experiments. 3. Calculation of the error of the experiment.	4			[1-3], [7], [8], [10], [14], [15], [16], [17], [23]
Practical lesson 2 <i>Application of the method of least squares for approximation of experimental data</i>		12		[8], [3], [4], [8], [10], [16], [17]

Independent work Topic 1. Problems of linear programming 1.5. Simplex method of finding a solution linear programming problems 1.6. Artificial base method			15	[1-3], [7], [8], [10], [14], [15], [16], [17], [20]
Together for module 1	2	6	35	
Module 2				
Lecture lesson 4. Mathematical description and planning experiment . 1. Mathematical description 2. Planning extreme experiment	2			[1-3], [6], [7], [9], [11], [15], [16], [17], [23]
Practical occupation 3 Method of planning multivariate experiments		14		[1-3], [6], [7], [9], [11], [15], [16], [17], [22]
Independent work Topic 1. Problems of linear programming 1.7 The concept of a degenerate solution 1.8 Modified simplex method			15	[6], [8], [9], [11], [15], [16], [17], [21]
Lecture lesson 5. Basics work with full factorial experiment . 1. Method of steep ascent 2. Simplex method 3. Orthogonal central compositional planning 4. Rotatable planning 5. Contour- graphic analysis 6. Examples of linear problems modeling 7. General and basic tasks linear programming 8. Geometric method of solving linear problems programming 9 Methods of solving linear problems programming using modern computer technologies	6			[3], [5], [8], [12], [14], [15], [16], [19], [23]
Practical occupation 4 Analysis equation regressions		10		[1-3], [8], [9], [11], [15], [16], [17], [24]
Independent work Topic 2. Conceptual principles for modeling functional food compositions and culinary products 2.1 Theoretical rationale production culinary products 2.2 Practical basics creation culinary products functional appointment	1		20	[6], [8], [9], [11], [15], [16], [17], [22]
Total for 2 modules	6	24	55	

Informal education (Prometheus)			
CASE STUDY: how to solve complex tasks in business and in life Course program: Introduction: What is the course about and why? Where to start solving the case Structuring the problem: decision tree and the principle of MESE Working with hypotheses Brainstorm Analysis tools How to conduct research and draw conclusions How to set priorities Development recommendations	20		https://prometheus.org.ua / prometheus - plus / case - study /
	In total	14	

4. TEACHING AND LEARNING METHODS

DRN	Teaching methods (work to be carried out by the teacher during classroom classes , consultations)	Number of hours	Learning methods (what types of learning activities should be performed by the student independently)	Number of hours
DRN 1. The ability to set modeling problems, understand their essence and divide them into separate stages for the formation of an algorithm for the development of mathematical models of technological processes.	Problem lectures (questions are raised about the material covered by the teacher, but the lecturer himself answers them, in order to focus students' attention on the main thing) Presentations (demonstration of information on the subject of lectures)	2	Practical classes (fulfillment of tasks in accordance with methodical instructions) Brain attacks during practical work	12
			Individual tasks (independent processing of the information proposed by the teacher)	28
DRN 2. The ability to apply in engineering practice mathematical models and software functions of the working environment MS Office Excel, MathCAD , STATISTICA - as modern methods of solving optimization problems and their graphical interpretation for presentation and visual understanding.	Problem lectures (questions are raised about the material covered by the teacher, but the lecturer himself answers them, in order to focus students' attention on the main thing) Presentations (demonstration of information on the subject of lectures)	-	Practical classes (fulfillment of tasks in accordance with methodical instructions) Brain attacks during practical work Individual tasks (independent processing of the information proposed by the teacher)	18
				32

DRN 3. the ability to check the reliability and reliability of computer models of the course of technological processes, among which two types can be distinguished: physicochemical (deterministic) models and empirical models based on the processing of experimental data.	Problem lectures (questions are raised about the material covered by the teacher, but the lecturer himself answers them, in order to focus students' attention on the main thing)	-	Practical classes (fulfillment of tasks in accordance with methodical instructions) Brain attacks during practical work Individual tasks (independent processing of the information proposed by the teacher)	14
	Presentations (demonstration of information on the subject of lectures)		30	

5. EVALUATION BY THE EDUCATIONAL COMPONENT

5.1. Diagnostic assessment (specified as necessary)

5.2. Summative assessment

5.2.1. To assess the expected learning outcomes, it is provided

No	Methods of summative assessment	Points / Weight in the overall assessment	Compilation date
Module 1 (35 points):			
1	Protection of practical works	5 points / 5%	within 5 days after the class
2	Intermediate testing (multiple choice test)	30 points / 30%	Until the 15th week
Module 2 (35 points):			
3	Protection of practical works	5 points / 5%	within 5 days after the class
4	Intermediate testing (multiple choice test)	30 points / 30%	Until the 15th week
5	Exam (multiple choice test)	30 points / 30%	15week
Unformal education			
6	Completion of training on Prometheus	20 points / 20%	Until the 15th week

5.2.2. Evaluation criteria

Component	Unsatisfactorily <0 points	Satisfactorily 1 points	Good 1,5 points	Perfectly 2,5 points
	Protection of practical works	Task requirements not met	Most of the requirements are met, but individual components are missing or insufficiently disclosed, there is no analysis of other approaches to the issue	All requirements of the task have been fulfilled
Module 1 (35 points):				
1	Protection of practical works	Two laboratory works, each evaluated for a maximum of 2,5 points	within 5 days after the class	
2	Intermediate testing (multiple choice test)	30 test questions, each worth 1 point	Until the 7th week	

Module 2 (35 points):			
4	Protection of practical works	<i>Two laboratory works, each evaluated for a maximum of 2,5 points</i>	within 5 days after the class
5	Intermediate testing (multiple choice test)	<i>30 test questions, each worth 1 points</i>	Until the 15th week
6	Exam (multiple choice test)	<i>30 test questions, each worth 1 points</i>	Until the 15th week
Unformal education			
7	Completion of training on Prometheus	<i>Obtaining a certificate and its identification by a reliable link (20 points)</i>	Until the 15-th week

5.3. Formative assessment:

To assess the current progress in learning and understand the directions for further improvement is provided

No	Elements of formative assessment	Date
1	Oral survey after studying the topic, during practical classes	within 5 days after the class
2	Feedback in the form of discussion of final testing	7, 15 week
3	Feedback in the form of a discussion of the informal education course	after listening to the course up to the 15th week
4	Feedback in the form of discussion of examination testing	Up to 15 weeks

6. EDUCATIONAL RESOURCES (LITERATURE)

Methodical support

1. **Helikh A.O.** Information technologies and optimization of technical and technological objects of the processing industry. Study guide for full-time and part-time students of master's degrees in specialty 181 "Food technologies" // Sumy: SNAU, 2024, 104 p.

2. **Helikh A.O.** Information technologies and optimization of technical and technological objects of the processing industry. Course of lectures for master's students of specialty 181 "Food technologies" of full-time and correspondence forms of study // Sumy: SNAU, 2021, 45 s

3. **Helikh A.O.** Information technologies and optimization of technical and technological objects of the processing industry Methodical recommendations for laboratory classes for master's students of specialty 181 "Food technologies" of full-time and correspondence forms of study // Sumy: SNAU, 2021, 42 p.

Recommended Books

Basic

4. Liu, Y., **Helikh, A.**, Filon, A., & Duan, Z. (2023). Sausage technology for food sustainability : recipe , color , nutrition , structure . *Eastern-European Journal of Enterprise Technologies*, 4 (11(124), 47-58. (**Scopus**) Q3

5. Liu, Y., **Helikh, AO**, Filon, AM, Tang, X.-X., Duan, Z.-H., Ren, A.-Q. (2024). Beetroot (*Beta vulgaris* L. var . *conditiva* Alef .) pretreated by freeze-thaw : influence of drying methods he the quality characteristics . *CYTA- Journal of Food* , 22 (1), 1-12. (**Scopus**) Q2

6. **Helikh A.O.** Optimization of the recipe composition of minced meat products based on molluscs of the genus *Anodonta* according to the criterion of food balance in terms of main nutrients. *Food science and technology*. 2019. Issue 4. Vol. 12, P. 86–94.
7. **Helikh A.** Scientific rationale of the technology of pastes based on freshwater hydrobionts and enriched with selenium. *Food science and technology*. 2020;14(1):110-117.
8. **Helikh A.O.** Optimization of quality indicators of yogurts with the addition of fillers. *Academic notes of the Tauriyya National University named after V.I. Vernadsky Series: Technical sciences*. Volume 31 (70) No. 1: 2020 Part 2. C. 102-108.
9. **Helikh A.O.** Modeling of the recipe composition of protein-carbohydrate semi-finished products. *Hotel and restaurant and tourist consulting*. Volume 3 No. 1: 2020. C. 25-36.
10. **Helikh A.O.** Optimization of ultrasonic alkaline extraction of protein flour isolate from pumpkin seeds by response surface methodology. *Academic notes of the Tauriyya National University named after V.I. Vernadsky Series: Technical Sciences*. Volume 31 (70) No. 1: 2020 Part 2. C. 44-49.
11. Ostapchuk M.V., Stankevich H.M. *Mathematical modeling on a computer: Textbook*. — Odesa: Print, 2020.—313 p.
12. Gao, D., **Helikh, A.**, Duan, Z., Shang, F., Liu, Y. (2022). Development of pumpkin seed meal biscuits. *Eastern-European Journal of Enterprise Technologies* this, 2 (11-116), 36–42. <https://doi.org/10.15587/1729-4061.2022.254940>
13. **Helikh, A.**, Gao D., Zhenhua D. (2022). Study on the application of pumpkin seed protein isolate in sausage production process. *Technology audit and production reserves* — No. 2/3(64). p. 19-23. <https://doi.org/10.15587/2706-5448.2022.255785>
14. **Helikh A. O.**, Kryzhska T. A., Danylenko S.G., Semernya O.V. (2022). Optimization of the rheological parameters of the yogurt structure with the addition of hemp seed protein isolate. *Food resources*. Issue #18. with. 51-60. <https://doi.org/10.31073/foodresources2022-18-05>
15. Optimization of technological processes of the industry: method. recommendations for studying the discipline and performing controls. works for special students 7.05170107, 8.05170107 "Technologies of storage, canning and processing of fruits and vegetables" full-time and part-time education / comp. O.V. Tochkova – K.: NUHT, 2019– 35 p.
16. **Helikh A.**, Kryzhska T., Girichenko S. (2021). Optimizing the parameters of emulsion-type sauces with the addition of protein isolates of plant origin. *Food resources*. Issue #17. with. 54-64. <https://doi.org/10.31073/foodresources2021-17-06>
17. Bondar, A.G. *Mathematical modeling in chemical technology / A.H. Bondar - K.: Higher school, 2021. – 289 p.*
18. Ladyeva, L.R. *Optimization of technological processes / L.R. Ladyeva. - K.: IVC "Polytechnic Publishing House", 2020. - 192 p.*
19. L. Sztangret, L. Rauch, J. Kusiak, P. Jarosz, and S. Malecki, "Modeling of the oxidizing roasting process of zinc sulphide concentrates using artificial neural networks," *Computer Methods in Materials Science*, vol. 11, no. 1, pp. 122–127, 20 22.
20. A. Stanisławczyk, J. Gawad, and J. Kusiak, "Multi scale modeling and optimization of production chains based on metal forming," in *Proceedings of the 8th Conference World Congress on Computational Mechanics (WCCM '08)*, Venice, Italy, 20 22.
21. M. Pietrzyk, L. Madej, and R. Kuziak, "Optimal design of manufacturing chain based on forging for copper alloys, with product properties being the objective function," *CIRP Annals—Manufacturing Technology*, vol. 59, no. 1, pp. 319–322, 2019.
22. J. Kusiak, A. Danielewska-Tulecka, and P. Oprocha, *Optimization. Selected Methods with Examples of Applications*, Polish Scientific Publishers, Warszawa, Poland, 20 23, (Polish).
23. K. Miettinen, *Nonlinear Multiobjective Optimization*, Springer, Berlin, Germany, 20 23.

Auxiliary

24. Optimization of technological processes of the industry: Method, instructions for studying the discipline and performing controls . works for students . special 7.091713 "Technology of sugary substances " forms of education / Composer: V.O. Miroshnyk . - K.: UDUHT, 2019. - 48 p.
25. AE Shiel, D. Weis, and KJ Orians , "Evaluation of zinc, cadmium and lead isotope fractionation during smelting and refining," *Science of the Total Environment* , vol. 408, no. 11, pp. 2357–2368, 20 23 .

Information resources

- 26 . <https://cdn.snau.edu.ua/moodle/course/view.php?ID=4351>