Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Food Technology
Nutrition Technology Department

WORK PROGRAM OF EDUCATIONAL DISCIPLINE (SYLLABUS)

SC 3 Innovative engineering

Specialties	G13 «Food Technologies»
The educational program	«Food Technologies»
level of higher education	at the second (master's) level of higher education

Sumy - 2025

Developers:_____Maryna SAVCHENKO

Ph.D., Associate Professor of the Nutrition Technology Department

Considered, approved and approved at the meeting of the nutrition technology department	protocol No.23 from 04.06.2025		
	Head department	_____ (signature)	**Oksana MELNYK** (surname, initials)

Agreed:

Guarantor of the educational program _____ __ Maryna SAVCHENKO
(signature) (surname)

Dean of the Faculty,
where the educational program is implemented _____Nataliia BOLHOVA
(signature) (surname)

Review of the work program (attached) provided by: Oksana MELNYK
(surname)

Nataliia BOLHOVA
(surname)

Methodist of the Education Quality Department,
licensing and accreditation _____ (_____)
(signature) (surname)

Registered in the electronic database: date: _____2025.

Information on viewing the work program (syllabus):

The academic year in which the changes are made	The number of the annex to the work program with a description of the changes	The changes were reviewed and approved		
		Date and number of the protocol of the meeting of the department	Head of Department	Guarantor of the educational program

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

<table>
<tr><td>1.</td><td>The name is EC</td><td colspan="4">EC 4. Innovative engineering</td></tr>
<tr><td>2.</td><td>Faculty/department</td><td colspan="4">Food technology/ Nutrition Technology</td></tr>
<tr><td>3.</td><td>The status is EC</td><td colspan="4">Mandatory</td></tr>
<tr><td>4.</td><td>Program/Specialty (programs), which is a component of EC for (to be filled in for mandatory EC)</td><td colspan="4">Educational program: Food technologies/specialty: 181 "Food technologies"</td></tr>
<tr><td>5.</td><td>NRK level</td><td colspan="4">7th level</td></tr>
<tr><td>6.</td><td>Semester and duration of study</td><td colspan="4">The first semester
The duration of study is 15 weeks</td></tr>
<tr><td>7.</td><td>Number of ECTS credits</td><td colspan="4">5 credits</td></tr>
<tr><td rowspan="2">8.</td><td rowspan="2">The total number of hours and their distribution (full-time study/part-time study)</td><td colspan="3">Contact work (class)</td><td>Independent work</td></tr>
<tr><td>Lectures

2</td><td>Practical/seminar</td><td>Laboratory</td><td>148</td></tr>
<tr><td>9.</td><td>Language of education</td><td colspan="4">English</td></tr>
<tr><td>10.</td><td>Teacher/Coordinator of the educational component</td><td colspan="4">The teacher is Ph.D., associate professor of the Nutrition Technology Department, Savchenko Maryna Yuriivna</td></tr>
<tr><td>10.1</td><td>Contact Information</td><td colspan="4">Auditorium of the department 314m, building #4, phone: 0993834398, E-mail: marina.saw4encko2011@gmail.com , consultation hours: every Monday from 1 to 2 p.m.</td></tr>
<tr><td>11.</td><td>General description of the educational component</td><td colspan="4">The theoretical and practical material consists of the appointment, selection, placement, operation, and maintenance of innovative technological equipment for the implementation of the technological process in the production of food products. The organization of laboratory work, types of laboratory equipment, and the main activities and directions of Innovative Engineering are given.</td></tr>
<tr><td>12.</td><td>The purpose of the educational component</td><td colspan="4">Training of highly qualified specialists who have mastered theoretical and practical knowledge and skills of professional activity and are able to independently deepen and expand them, using them in practice.</td></tr>
<tr><td>13.</td><td>Prerequisites for studying EC, connection with other educational components of EP</td><td colspan="4">The educational component is connected with other educational components " Automation of production processes of processing enterprises and restaurant establishments ", "Processes and devices of food production", "Technological equipment of food production"</td></tr>
<tr><td>14.</td><td>Policy of academic integrity</td><td colspan="4">If the fact of writing off is discovered during the exam, the student's work is canceled and the exam is retaken. Code of academic integrity (http://surl.li/khyd)</td></tr>
<tr><td>15.</td><td>Link to the electronic resource</td><td colspan="4">Moodle link: https://cdn.snau.edu.ua/moodle/course/view.php?id=2626</td></tr>
<tr><td>16.</td><td>Keywords</td><td colspan="4">Engineering, world innovations, project, laboratory equipment, food industry</td></tr>
</table>

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

Study results for EC: After studying educational component, the student is expected to be able to..."	Software learning outcomes, the achievement of which is aimed at the EC (indicate the number according to the numbering given in the EP)[1]						The result of learning the discip-line is evaluated
	PLO 1	PLO 5	PLO 7	PLO 10	PLO 12	PLO 13	
DLO 1. Analyze the current state of food production, innovative services, global and domestic trends. Systematize the main stages of resource provision in production.	x						Control work on theoretical material. Performance and protect-tion of laboratory work. Exam
DLO 2. To master methods of comparative analysis of different technological solutions, for example, the choice of raw materials, equipment or processing methods, taking into account their advantages and disadvantages. To be able to evaluate alternatives according to the criteria of efficiency, cost, environmental impact and compliance with regulatory requirements.		x					
DLO 3. Acquire knowledge about modern engineering approaches to creating innovative products, optimizing technological processes, and ensuring the quality of food products. Have a holistic understanding of the principles of innovative engineering, including the application of biotechnology, nanotechnology, automation, and digitalization in the food industry.			x				
DLO 4. Make innovative decisions in the field of food technology and formalize them in the form of scientific and technical documentation, scientific reports, patent documents, articles, etc.				x			
DLO 5. Acquire knowledge about the impact of innovation processes on the development of production; about venture business and new forms of integration of science and production.					x		
DLO 4. Analyze the current state of production, make innovative decisions to improve the quality of production, and formalize them scientific and technical documentation, scientific reports, security documents, articles, etc.						x	

[1]It must correspond to the Matrix of ensuring the programmatic learning outcomes by the relevant components of the educational program, it is specified for the compulsory educational components of EP I and II level, for all (mandatory and selective EC)

3. CONTENTS OF THE EDUCATIONAL COMPONENT (CURRICULUM PROGRAM)

Topic. List of issues to be considered within the topic	Distribution within the general time budget			Recom-mended Books[1]
	Auditory work		Independent work	
	Lc	Lb		
Topic 1. The concept of innovative engineering. The main activities and directions of Innovative Engineering. The purpose of studying the discipline. Tasks of the discipline. General characteristics of innovative engineering. Classification of innovations. Engineering services. World and domestic trends. Innovations. Content and stages of innovation processes. Concepts and types of engineering. The main components of engineering. Types of innovative engineering functions. The main directions of rationalization of labor organization. The main stages of observation and data processing. Innovative engineering in the resource security of food enterprises	-	-	20	[1-5]
Topic 2. Innovation engineering. Information material. Definition of the main components of engineering. Structuring competitiveness by levels, taking into account the impact of innovations and the life cycle of innovations. Optimization of technological processes. Optimization of labor resources. Innovative principles of equipment use. The essence and types of innovations in the food industry. Classification of innovations. Signs of innovation. Properties of innovations. Diffusion of innovations. Innovation initiation factors. The main stages of technology implementation in production. Modern approaches to the selection of resources to ensure production. Evaluation of the effectiveness of technology implementation in production. The main directions of rationalization of labor organization. Methods of determining working time costs and their optimization. Evaluation of the effectiveness of the adopted labor optimization decisions.	-	-	20	[6-10]

[1]A specific source from the main or additional recommended literature

Topic 3. The concept of an innovative project. Project concept and classification. Project management. Methods of selecting innovative projects for implementation. The essence and basic principles of measuring the effectiveness of innovations. Innovative approaches to technological design of food enterprises. Technical and economic substantiation of innovative projects and modeling of technological operations. Innovations in technological design. Innovative processes of new product design and analysis of project results. Concept of accelerated and combined design. Social, institutional and environmental analysis of an innovative project. Modern management of innovative projects.	-	-	20	[11-14]
Topic 4. Innovative activity of enterprises. Organizational forms of ensuring and implementing results. The concept of the State target program. Formation of an innovative model at the enterprise. The influence of innovative processes on the development of production. Venture business and new forms of integration of science and production. Basic concepts of scientific and technical developments. Features organizational forms of providing innovative activity. Scientific, technical and innovative activities of enterprises. Purpose of entrepreneurial activity. Subjects of innovative activity. Innovative activity of enterprises. Stages of formation of an innovative model at the enterprise. Institutionalization. The sphere of innovative activity.	-	-	20	[15-19]
Topic 5. Food industry innovations. Innovative activity in the dairy industry: conditions and prospects for its development. Methodological support and practice of improving the efficiency of the dairy industry based on innovative activities. Innovative activity of the meat industry: conditions and prospects for its development. Environmental innovations in the meat industry. Innovations in fruit and vegetable production.	-	-	20	[20-27]

Topic 6. Organization of laboratory work. Safety equipment. Types of laboratory equipment. Basic rules of safety techniques when working in a biochemical laboratory. Reagents and their handling. Safety measures. Measuring devices. Sets of laboratory dishes. Analytical laboratory equipment, testing laboratory equipment.	-	-	24	[28-32]
Topic 7. World and domestic innovations. Innovative processes of drying, freezing and defrosting food products. Innovative technologies, equipment and automated equipment (robotics). Technology of caviar products with a capsule structure. Energy- and resource-saving waste-free technologies	2	-	24	[33-42]
In total	**2**	**0**	**148**	

4. TEACHING AND LEARNING METHODS

DLO	**Teaching methods** (work,which will be conducted by the teacher during classroom classes, consultations)	**Num -ber of hours**	**Teaching methods** (which types of educational activities must be performed by the student independently)	**Numb er of hours**
DLO 1. Provide optimization and innovative approaches to scientific, technical and innovative activities of enterprises. Analyze innovative principles of equipment use. Systematize the main ones stages of technology introduction into production.	**Lectures:** Informational (educational). - Orientation. Stimulating arouses interest to the topic. - Motivational. - Explaining Convincing - Problematic. **Presentations** (demonstration in formation on the subject). **Laboratory classes**. To analyze the ways of selecting the necessary information regarding innovations in technology using examples of calculations from scientific and technical literature **Consultations.** Answers to questions, exchange of ideas, a small discussion with the teacher's conclusions.	2	Preparation to the lecture by reading the lecture material. Search for technical solutions in information sources. Study material for self-study. Completion of laboratory work tasks, the implementation of which was started during the laboratory classes.	37

DLO 2. To analyze technical and economic indicators of innovative projects. To be able to evaluate the effectiveness of technology implementation in production. Develop modes operation of equipment with the aim of their optimization and optimization of work	Lectures, as in the previous column. Presentations (demonstration in formation on the subject). Laboratory classes. To analyze the ways of selecting the necessary information regarding innovations in technology using examples of calculations from scientific and technical literature Consultations. Answers to questions, exchange of ideas, a small discussion with the teacher's conclusions.	-	Preparation to the lecture by reading the lecture material. Search for technical solutions in information sources. Study material for self-study. Completion of laboratory work tasks, the implementation of which was started during the laboratory classes.	37
DLO 3. Develop hardware and technological schemes for the production of food products enterprises and implement innovative technological solutionsin food production	Lectures, as in the previous column. Presentations (demonstration in formation on the subject). Laboratory classes. To analyze the ways of selecting the necessary information regarding innovations in technology using examples of calculations from scientific and technical literature Consultations. Answers to questions, exchange of ideas, a small discussion with the teacher's conclusions.	-	Preparation to the lecture by reading the lecture material. Search for technical solutions in information sources. Study material for self-study. Completion of laboratory work tasks, the implementation of which was started during the laboratory classes.	37
DLO 4. Analyze the current state of production, to make innovative decisions on improving improvement of production quality and issue them in the form of scientific and technical documentation, scientific reports, security documents, articles, etc.		-		37

5. EVALUATION BY THE EDUCATIONAL COMPONENT

5.1.Summative assessment

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

No	Summative methodsassessment	Points/ Percentage in the overall assessment	Compilation date
	Module I		
1.	writtencontrol work on theoretical material	*10 points / 10%*	In the sixth week
2.	Performance and protection of laboratory	*25 points / 25%*	Until the next laboratory session
	Module II		
3.	Written control work on the theoretical material	*10 points / 10%*	In the fourteenth week
4.	Performance and protection of laboratory work	*25 points / 25%*	Until the next laboratory session
5.	Exam- a written response to the ticket	*30 points / 30%*	

5.1.2. Evaluation criteria

Component[2]	**Unsatisfactorily**	**Satisfactorily**	**Fine**	**Perfectly**[3]
Written control work on the theoretical material	*<2-4 points*	*5-6*points	*7-8 points*	*9-10 points*
	Task requirements not met	*Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question*	*All questions are answered*	*Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed*
Performance and protection of laboratory work	*<12 points*	*13-17*points	*18-23 points*	*24-25 points*
	Task requirements not met	*Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question*	*All questions are answered*	*Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed*
	<17 points	*18-23 points*	*24-29 points*	*30 points*

[2]Specify the summative assessment component

[3]Specify the distribution of points and the criteria determining the level of assessment

Exam	*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*	*All the requirements of the task have been fulfilled, the own solution and approach have been demonstrated*

5.8. 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.	*Written survey after studying topics 1-3, 4-7*	*7 week, 14 week*
2.	*Verbal feedback from the teacher while working on the control work*	*11 week*

Self-assessment can be used as an element of summative assessment and formative assessment.

6. EDUCATIONAL RESOURCES (LITERATURE)

1. Bigliardi, B., et al. (2023). Innovation in the Food Industry: A Systematic Review of Engineering and Technological Advances. Trends in Food Science & Technology, 132, 89–104. doi:10.1016/j.tifs.2023.01.005
2. Ghaffar, S. H., et al. (2024). Engineering Innovations for Sustainable Food Processing: Concepts, Technologies, and Resource Optimization. Journal of Cleaner Production, 434, 139876. doi:10.1016/j.jclepro.2023.139876
3. Klerkx, L., & Rose, D. C. (2022). Digitalization and Innovation Engineering in Agri-Food Systems: Global Trends and Challenges. Agricultural Systems, 203, 103512. doi:10.1016/j.agsy.2022.103512
4. Martinez, C., et al. (2023). Engineering Services in Food Innovation: From Concept to Market. Food Engineering Reviews, 15(2), 245–263. doi:10.1007/s12393-023-09345-7
5. Nayak, R., & Waterson, P. (2024). Human-Centric Innovation Engineering in Food Production: Optimizing Labor and Processes. Applied Ergonomics, 115, 104178. doi:10.1016/j.apergo.2023.104178
6. Knorr, D., & Augustin, M. A. (2023). Innovation Engineering in Food Processing: Concepts, Technologies, and Sustainability. Critical Reviews in Food Science and Nutrition, 63(15), 2456–2473. doi:10.1080/10408398.2022.2116698
7. Barba, F. J., et al. (2024). Emerging Technologies for Food Processing: Innovation Diffusion and Lifecycle Analysis. Innovative Food Science & Emerging Technologies, 91, 103523. doi:10.1016/j.ifset.2024.103523
8. Capozzi, F., et al. (2023). Sustainable Food Innovation: Engineering and Resource Optimization Strategies. Journal of Food Engineering, 342, 111364. doi:10.1016/j.jfoodeng.2022.111364
9. Tomaszewska, M., et al. (2022). Competitiveness in the Food Industry: The Role of Innovation Engineering and Process Optimization. Food Control, 137, 108921. doi:10.1016/j.foodcont.2022.108921

10. O’Sullivan, M. G., & Kerry, J. P. (2024). Human-Centered Innovation in Food Production: Labor Optimization and Technology Integration. Trends in Food Science & Technology, 145, 104356. doi:10.1016/j.tifs.2024.104356
11. Galanakis, C. M., et al. (2023). Innovation Strategies in the Food Industry: Tools for Implementation and Project Management. Trends in Food Science & Technology, 131, 167–179. doi:10.1016/j.tifs.2022.12.007
12. Bigliardi, B., & Filippelli, S. (2024). Innovative Project Management in Food Processing: Accelerated and Concurrent Design Approaches. Journal of Food Engineering, 365, 111876. doi:10.1016/j.jfoodeng.2023.111876
13. Hassoun, A., et al. (2023). Sustainable Innovation in Food Project Design: Socio-Economic and Environmental Analysis. Food Research International, 172, 113123. doi:10.1016/j.foodres.2023.113123
14. Knudsen, M. P., et al. (2022). Innovation Project Management in the Food Sector: From Concept to Commercialization. International Journal of Project Management, 40(6), 623–635. doi:10.1016/j.ijproman.2022.06.005
15. Saguy, I. S., & Sirotinskaya, M. (2024). Technological Innovation in Food Plant Design: Modeling and Economic Feasibility. Food Engineering Reviews, 16(1), 89–107. doi:10.1007/s12393-023-09362-8
16. Bigliardi, B., et al. (2023). Innovative Business Models in the Food Industry: Organizational Forms and Implementation Strategies. Journal of Cleaner Production, 388, 135976. doi:10.1016/j.jclepro.2023.135976
17. Tidd, J., & Bessant, J. (2024). Managing Innovation in Agri-Food Enterprises: Integrating Science, Technology, and Production. Technovation, 130, 102914. doi:10.1016/j.technovation.2023.102914
18. Hassoun, A., et al. (2022). National Innovation Programs in the Food Sector: Policy Frameworks and Enterprise Impacts. Food Policy, 111, 102305. doi:10.1016/j.foodpol.2022.102305
19. Capello, R., & Lenzi, C. (2023). Innovation Ecosystems in Food Enterprises: Institutional and Organizational Dynamics. Research Policy, 52(5), 104734. doi:10.1016/j.respol.2023.104734
20. Martinez, C., & Banal-Estañol, A. (2024). Venture Capital and Innovation in Food Technology: New Models of Science-Industry Integration. Food Science & Technology, 64, 103456. doi:10.1002/fft2.103456
21. Hassoun, A., et al. (2023). Innovations in Dairy Processing: Technological Advances and Sustainability Perspectives. Trends in Food Science & Technology, 138, 104–117. doi:10.1016/j.tifs.2023.06.012
22. Lynch, J., et al. (2024). Sustainable Innovations in Meat Processing: Balancing Efficiency and Environmental Impact. Meat Science, 209, 109412. doi:10.1016/j.meatsci.2024.109412
23. Barba, F. J., et al. (2023). Emerging Technologies in Fruit and Vegetable Processing: Innovations for Sustainability and Efficiency. Innovative Food Science & Emerging Technologies, 87, 103398. doi:10.1016/j.ifset.2023.103398
24. Galanakis, C. M., & Rizou, M. (2022). Food Industry Innovations: A Roadmap for Dairy, Meat, and Plant-Based Sectors. Food Research International, 160, 111694. doi:10.1016/j.foodres.2022.111694
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31. O'Sullivan, M. G., & Byrne, D. V. (2023). Laboratory Management in Food Science: Safety, Equipment, and Reagent Handling. Journal of Food Science and Technology, 60(4), 1234–1245. doi:10.1007/s13197-022-05678-9
32. Martinez-Valdivieso, M., et al. (2024). Advances in Biochemical Laboratory Design: Safety and Equipment Innovations for Food Analysis. Analytical Biochemistry, 686, 115413. doi:10.1016/j.ab.2024.115413
33. Zhang, M., et al. (2023). Innovative Drying Technologies for Food Preservation: Advances in Energy Efficiency and Quality Retention. Trends in Food Science & Technology, 140, 104156. doi:10.1016/j.tifs.2023.08.015
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35. Barba, F. J., et al. (2023). Emerging Technologies for Encapsulated Food Products: Focus on Caviar-Like Structures. Innovative Food Science & Emerging Technologies, 89, 103487. doi:10.1016/j.ifset.2023.103487
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