

Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Engineering and Technology
Department of Technical Service

Work program (syllabus) of the educational component

EC 4 – Methodology of conducting scientific research

(mandatory)

Implemented within the framework of the Food Technology educational program

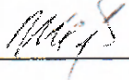
(name)


in specialty 181 "Food Technology"

(code, name)

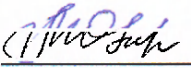
third (educational and scientific level) level of higher education


Sumy – 2023

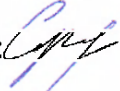
Developers: , Tarelnyk V.B., Doctor of Technical Sciences, Professor, Head
(signature) of the Department of Technical Sciences
(surname, initials) (academic degree and title, position)

Reviewed, approved and ratified at a meeting of the Technical Service Department (name of the department)	minutes of June 5, 2023 No. 17	
	Manager departments <u></u> (signature)	<u>Tarelnyk V.B.</u> (last name, initials)

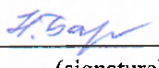
Agreed:

Guarantor of the educational program  O.Yu. Melnyk
(signature) (full name)

Dean of the Faculty  N.V. Bolhova
(signature) (full name)

A review of the work program (attached) was provided by:  O.G. Sereda
(Full name)

 M.Yu. Dumanchuk
(Full name)

Methodologist of the Department of Educational Quality,
licensing and accreditation  N.M. Baranik
(signature)

Registered in the electronic database: date: 16.06. 2023.

Information on reviewing the work program (syllabus):

Educational the year in which are introduced changes	Number of the appendix to the work program with a description of the changes	Changes reviewed and approved		
		Date and number minutes of the meeting departments	Head of the Department	Guarantor educational programs

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	Name EC	Methodology of conducting scientific research		
2.	Faculty/department	Faculty of Engineering and Technology/Department of Technical Service		
3.	Status EC	<u>Mandatory</u>		
4.	Program/Specialty (programs)	Educational and scientific program "Food Technologies" in specialty 181 "Food Technology"		
5.	EC can be offered for (to be filled in for selective ECs)			
6.	NQF level	Level 8		
7.	Semester and duration study	Daily 2nd semester, 14 weeks		
8.	Number of ECTS credits	3		
9.	Total hours and their distribution	Contact work (classes)		
		Lectures	Practical /seminar	Laboratory
		18	18	54
10.	Language of instruction	Ukrainian		
11.	Teacher/ Coordinator educational component	Tarelnyk Vyacheslav Borisovich, Doctor of Technical Sciences, Professor, Head of the Department of Technical Service Consultation hours– every Monday from 10:00 to 12:00, room 302m		
11.1	Contact information	viacheclav.tarelnyk@snau.edu.ua		
12.	General description of the educational component	The discipline is aimed at forming in the students a system of theoretical knowledge on the methodology of scientific research, mastering the conceptual and categorical apparatus of scientific activity, mastering theoretical knowledge on the classification of sciences, scientific and technical potential, organization of scientific and research activity in Ukraine and the world. It will be useful for future specialists to acquire skills of critical thinking, search and processing of information from various sources, synthesis of complex ideas for solving theoretical and applied engineering problems in accordance with the topic of their own research.		
13.	Purpose of the educational component	It consists in obtaining knowledge by applicants regarding the study of basic concepts of science and scientific knowledge, methodology, organization and features of scientific research in the field of mechanical engineering, choosing a topic for scientific research, searching for necessary sources of information, formalizing the results of scientific research, compiling a report on scientific work, requirements for various types of publications, and writing a doctoral thesis.		
14.	Prerequisites for studying EC, connection with other educational components of ESP	The discipline is a prerequisite for EC 6 "Modeling and Planning of a Scientific Experiment" and EC 12 "Methodology of Preparing Scientific Papers in a Foreign Language"		

15.	Academic Integrity Policy	If a candidate submits another candidate's work as their own, such work is canceled and retaken. In case of cheating, retake the corresponding assignment. In case of using text borrowings without proper citation (academic plagiarism), the work will be canceled.
16.	Link to the course in Moodle system	https://cdn.snau.edu.ua/moodle/course/view.php?id=2184

2. LEARNING OUTCOMES BY EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Learning outcomes for EC: After studying the educational component, the applicant is expected to be able to...	Program learning outcomes that the EC aims to achieve (indicate the number according to the numbering given in the ESP)				How is the PLO assessed?
	PLO3	PLO4	PLO5	PLO7	
DLO1. Apply methodological foundations at all stages of scientific research, to formulate problems, reveal the topic and solve the tasks of the dissertation work.		X	X		Multiple choice test
DLO2. Search for the necessary information, process it, and summarize it using modern digital technologies.	X	X			Individual task
DLO3. Organize and carry out applied scientific research using standard methods.		X	X		Individual task
DLO4. Process the results of research and formulate conclusions.	X		X	X	Individual task
DLO5. Format the results of research work in accordance with the requirements for a report, publication, and dissertation.				X	Individual task Analytical review with presentation

PLO3. Use modern tools and technologies for searching, processing and analyzing information on food technology problems, in particular, statistical methods for analyzing large-scale and/or complex data, specialized databases and information systems.

PLO4. Plan, organize and carry out experimental and/or theoretical research in the field of food technology using modern tools and equipment, information technology and software.

PLO5. Have advanced conceptual and methodological knowledge, demonstrate research skills in the field of food technology and at the border of subject areas, sufficient to conduct scientific and applied research in order to obtain new knowledge and/or implement innovations at the level of modern world achievements in science and technology.

PLO7. Critically analyze the results of one's own research in the field of food technology and the results of other researchers in the context of the entire complex of modern knowledge on the problem under study, and ensure the protection of intellectual property.

3. CONTENT OF THE EDUCATIONAL COMPONENT (COURSE PROGRAM)

Topic. List of issues to be addressed within the topic	Distribution within the general time budget			Recommended reading	
	Classroom work		Independent work		
	Lec	Pr / Sem/	Lab.		
Topic 1. Science and scientific research in the modern world. The emergence and evolution of science. Theoretical and methodological principles of science. Types and features of scientific research. Methodology and methods of scientific research. Organization of scientific activity in Ukraine.	2	-		6	1-4, 6-10, 16,17,20
Topic 2. Choosing a direction of scientific research and stages of research. The concept of a scientific problem. The concept of a research topic and its formulation. Defining the subject and object of research. The purpose and objectives of the research. The procedure for conducting scientific research. Stages of research.	2	-		6	3, 7-9, 19-21
Topic 3. Search, accumulation and processing of scientific information. General characteristics of information. Types of information sources. Information support for scientific research. Search for necessary information. Search for information in the library. Computer technologies for information search. Procedure for processing and grouping information.	2	6		6	5,7,16,20,22
Topic 4. Conducting theoretical research. Experimental research. The essence, purpose, tasks and stages of theoretical research. Methods of theoretical research. The use of mathematical methods in research. The essence, purpose, functions of a scientific experiment. Classification of experiments. Methodology of experimental research. General requirements for conducting an experiment. Typical errors in conducting an experiment. The experimenter's workplace and organization of the experiment.	4	6		8	1-4, 7-12, 14-18, 20
Topic 5. Processing of research results. Fundamentals of the theory of random errors and methods for estimating random errors in measurements. Methods for graphical processing of experimental results. Analytical processing of experimental results. Elements of the theory of experimental planning.	2	4		6	1,2,7-9,16-18, 22

Topic 6. Formatting the results of scientific work. Types of scientific publications. Scientific monograph. Scientific article. Abstracts of a scientific report (communication). Scientific report (communication). Rules for formatting publications. Using Microsoft Word to format large-scale scientific works (monographs, dissertations, abstracts, textbooks).	2	2		4	1-9, 16,19, 21, 22
Topic 7. Implementation and effectiveness of scientific research. Approbation and publication of scientific research results. Implementation of scientific research results. Effectiveness of scientific research.	2	-		6	1-4, 22
Topic 8. Execution and defense of dissertations. Dissertation works and their types. General methodology for performing dissertation research. Designing a dissertation. Abstract of the dissertation and the methodology for its writing and design. Procedure for awarding the degree of Doctor of Philosophy. Preliminary examination (pre-defense) of the dissertation at the department (department). Procedure for submitting a dissertation to a specialized academic council. Public defense of the dissertation. Preparation of documents for submitting an attestation file.	2	-		12	1-9,13, 16, 19, 21
Total	18	18		54	

4. TEACHING AND LEARNING METHODS

ALO	Teaching methods(work that will be carried out by the teacher during classroom lessons, consultations)	Number of hours	Teaching methods(what types of learning activities should the student perform independently)	Number of hours
<i>ALO1.</i> Apply methodological foundations at all stages of scientific research, to formulate problems, reveal the topic, and solve the tasks of the dissertation.	Problem lecture, thematic discussion, "Round table", discussion of current issues.	6	Independent work with the textbook, study of theoretical material.	10
<i>ALO2.</i> Search for the necessary information, process it, and summarize it using modern digital technologies.	Multimedia lecture, teacher consultations, discussions current questions.	10	Independent work with the textbook, completion of individual tasks.	11
<i>ALO3.</i> Organize and carry out applied scientific research using standard methods.	Multimedia lecture, "brainstorming", discussion of current issues.	8	Personalized learning, Independent work with the textbook, completion of individual tasks.	11
<i>ALO4.</i> Process the results of the	Flipped classroom,	6	dependent work with	11

research and formulate conclusions.	learning through action, teacher consultations, thematic discussion.		the textbook, learning through research.	
<i>ALO5.</i> To formalize the results of research work in accordance with the requirements for a report, publication, and dissertation.	Multimedia lecture, teacher consultations, discussion of current issues.	6	Independent work with the textbook, study of theoretical material.	11
<i>Total hours</i>		36		54

5. EVALUATION BY EDUCATIONAL COMPONENT

5.1. Diagnostic assessment (indicated as needed)

5.2. Summative assessment:

5.2.1. To assess the expected learning outcomes, there are

No.	Summative assessment methods	Points / Weight in the overall score	Date of compilation
1.	Multiple choice test	<i>10 points / 10%</i>	<i>For 4 weeks</i>
2.	Completing an individual task	<i>25 points / 25%</i>	<i>At 8 weeks</i>
3.	Completing an individual task	<i>25 points / 25%</i>	<i>At 10 weeks</i>
4.	Completing an individual task	<i>25 points / 25%</i>	<i>At 12 weeks</i>
5.	Analytical review with presentation (credit)	<i>15 points / 15%</i>	<i>At 14 weeks</i>

5.2.2. Evaluation criteria

Component	Unsatisfactorily	Satisfactorily	Good	Perfectly
Multiple choice test	<i><5 points</i>	<i>5-6 points</i>	<i>7-8 points</i>	<i>9-10 points</i>
	Less than 60% correct answers	60% - 74% correct answers	75% - 89% correct answers	90-100% correct answers
Execution of individual this task	<i><11 points</i>	<i>11-15 points</i>	<i>16-21 points</i>	<i>22-25 points</i>
	Little awareness regarding the problem, a brief description is provided. Does not demonstrate independent thinking regarding the chosen topic.	The problem is mostly described (without analysis), the main points are not sufficiently substantiated, the argumentation is not sufficiently consistent, the presentation is absent or presented superficially. The literature reviewed is only recommended by the teacher	Demonstrated understanding, depth and/or detail of the problem; the main problematic aspects are well-founded, the arguments are consistent; different points of view are explored, the presentation is meaningful and consistent.	The problem is sufficiently deeply and/or in detail revealed, Different views on the problem are analyzed; all main points are presented, arguments are consistent and weighty; different points of view are analyzed, and own proposals are given.
Analytical review with presentation (credit)	<i><6 points</i>	<i>6-8 points</i>	<i>9-11 points</i>	<i>12-15 points</i>
	Task requirements not met	Majority requirements are met, but individual components are missing or insufficiently disclosed, there is no analysis of other approaches to the issue	All task requirements met	All task requirements have been met, creativity and thoughtfulness have been demonstrated, and an original solution to the problem has been proposed.

5.3. Formative assessment:

To assess current progress in learning and understand areas for further improvement,

No.	Elements of formative assessment	Date
1	Written test with elements of problem tasks	4 - week
2	Verbal feedback from teacher and students while completing an individual task	During classes
3	Verbal feedback from teacher and students regarding the analytical review with presentation	14 - week

6. LEARNING RESOURCES (LITERATURE)

6.1. Main sources:

1. Understanding research methods: An overview of the essentials, tenth edition./ by M.L. Patten, M., Routledge Taylor & Francis Group, New York, 2017 – 352p.
2. Silva, Joao Gilberto Correa da. "Scientific Research Methods." International Journal of Science and Research (IJSR), vol. 11, no. 10, 2022, pp. 334-350, <https://www.doi.org/10.21275/SR221004074851>
3. Buchanan, D., & Bryman, A. (2007, July). Contextualizing methods choice in organizational research. *Organizational Research Methods*, 10 (3), 483-501. <https://doi.org/10.1177/1094428106295046>
4. Choy, L. T. (2014). The strengths and weaknesses of research methodology: Comparison and complimentary between qualitative and quantitative approaches. *IOSR Journal of Humanities and Social Science*, 19 (4), 99-104. <https://doi.org/10.9790/0837-194399104>
5. Collis, J., & Hussey, R. (2013). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students* (4th ed.). London: Macmillan International Higher Education. ResearchGate
6. Dumay, J. C. (2008). *2 Research Methods and Research Sites Employed*. Sydney, Australia: SeS Library, USYD.
7. Holden, M. T., & Lynch, P. (2004). Choosing the appropriate methodology: Understanding research philosophy. *The Marketing Review*, 4 (4), 2-18. <https://doi.org/10.1362/1469347042772428>
8. J. Ellis, T., & Levy, Y. (2009). Towards a guide for novice researchers on research methodology: Review and proposed methods. *Issues in Informing Science and Information Technology*, 6, 323-337. <https://doi.org/10.28945/1062>
9. Kirsch, G., & Sullivan, P. A. (1992). *Methods and Methodology in Composition Research*. Carbondale, IL: SIU Press. Google Books
10. Mills, J., & Birks, M. (2014). *Qualitative Methodology: A Practical Guide*. Thousand Oaks, CA: Sage. ResearchOnline
11. SHU Library (2020, January 28). Research guides: Organizing academic research papers: 6. The methodology. SHU Library Research Guides Fairfield, CT: Sacred Heart University.
12. Surbhi, S. (2016, December 8). Difference between research method and research methodology. Key Differences.

13. Steinhaus S. Comparison of Mathematical Programs for Data Analysis (Edition 5.03) [Електронний ресурс] – Munchen/Germany. – 64 p. – Режим доступу : <https://bit.ly/3p5A34x>
14. Häse, F., Aldeghi, M., Hickman, R.J., Roch, L.M., Christensen, M., Liles, E., Hein, J.E., Aspuru-Guzik, A. Olympus: A benchmarking framework for noisy optimization and experiment planning (2021) Machine Learning: Science and Technology, 2 (3), art. no. 035021. <https://doi.org/10.1088/2632-2153/abedc8>

6.2. Additional sources:

15. V. B. Tarelnyk, O. P. Gaponova, Ie. V. Konoplianchenko, N. V. Tarelnyk, M. Y. Dumanchuk, M. O. Mikulina, V. O. Pirogov, S. O. Gorovoy, and N. K. Medvedchuk, Development the Directed Choice System of the Most Efficient Technology for Improving the Sliding Bearings Babbitt Covers Quality. Pt. 1. Peculiarities of Babbitt Coating Technologies, Metallofiz. Noveishie Tekhnol., 44, No. 11: 1475–1493 (2022) (in Ukrainian). <https://doi.org/10.15407/mfint.44.11.1475>
16. V. B. Tarelnyk, O. P. Gaponova, Ie. V. Konoplianchenko, N. V. Tarelnyk, M. Y. Dumanchuk, V. O. Pirogov, T. P. Voloshko, and D. B. Hlushkova, Development the Directed Choice System of the Most Efficient Technology for Improving the Sliding Bearings Babbitt Covers Quality. Pt. 2. Mathematical Model of Babbitt Coatings Wear. Criteria for Choosing the Babbitt Coating Formation Technology, Metallofiz. Noveishie Tekhnol., 44, No. 12: 1643–1659 (2022) (in Ukrainian). <https://doi.org/10.15407/mfint.44.12.1643>
17. V. Melnyk, V. Vlasovets, Ie. Konoplianchenko, V. Tarelnyk, M. Dumanchuk, Vas. Martsynkovskyy, Yu. Semirnenko, S. Semirnenko. Developing a system and criteria for directed choice of technology to provide required quality of surfaces of flexible coupling parts for rotor machines. Journal of Physics: Conference Series. 1741 (2021) pp. 012030-1 – 012030-15. <https://doi.org/10.1088/1742-6596/1741/1/012030>
18. Ie. Konoplianchenko et al. Mathematical Modeling a Process of Strengthening Steel Part Working Surfaces at Carburizing Thereof by Electroerosive Alloying Method. (2018) AIP Conf. Proc. 2017: 020008-1–020008-14. <https://doi.org/10.1063/1.5056271>
19. V. Tarelnyk, Ie. Konoplianchenko, N. Tarelnyk, A. Kozachenko, "Modeling Technological Parameters for Producing Combined Electrospark Deposition Coatings", Materials Science Forum, Vol. 968, pp. 131-142, 2019. <https://doi.org/10.4028/www.scientific.net/MSF.968.131>
20. Закон України “Про вищу освіту”
21. Закон України „Про наукову і науково-технічну діяльність”
22. Закон України «Про інноваційну діяльність»

6.3 English-language Internet sources

Search engines

BibSonomy– Share bookmarks and lists of literature.

Biohunter– Literature search, data statistics, reading, sorting, storing, field expert identification, journal finder.

CaptoMe– Metadata platform with rich biomedical content and information

management tools for research.

CiteUlike– Search, organize, and share scholarly papers.

Colwiz– Create citations & bibliography and set up research groups on the cloud to share files & references.

ContentMine– Uses machines to liberate 100,000,000 facts from the scientific literature.

Data Elixir– A weekly collection of the best data science news, resources, inspirations from around the web.

DeepDyve– Instant access to the journals you need.

EvidenceFinder– Enriches literature exploration by suggesting questions alongside search results.

F1000Prime– Leading biomedical experts helping scientists to discover, discuss and publish research.

Google Scholar– Provides a way to broadly search for scholarly literature across disciplines and sources.

Labia– A suite of web apps for researchers, an online app for finding, commenting, rating, managing papers.

LazyScholar– Chrome extension to help literature search.

LiteracyTool– Educational platform (discovery, understanding, and exploration of scientific topics of interest).

Mendeley– A unique platform comprising a social network, reference manager, article visualization tools.

Microsoft Academic Search– Find information about academic papers, authors, conferences, journals.

MyScienceWork– Diffuse scientific information and knowledge in a free and accessible way.

Nowomics– Follow genes, proteins and processes to keep up with the latest papers relevant to research.

Paperity- Aggregator of open access papers and journals.

Paperscape– Visualize the arXiv, an open, online repository for scientific research papers.

PubChase– Life sciences and medical literature recommendations engine.

Pubget– Search engine for life-science PDFs.

PubNiche– A scientific research news curator.

PubPeer– Search for publications and provide feedback and/or start a conversation anonymously.

ReadCube– Read, manage & discover new literature.

Research Professional– Source of intelligence on funding opportunities and research policy.

Scicurve– Transforms systematic literature review into interactive and comprehensible environment.

Sciencescape– Innovation in the exploration of papers and authors.

Scientific Journal Finder(SJFinder) – A collection of tools including a journal search engine and rating.

SciFeed– Uses various data sources and natural language processing to identify

important scientific advances.

SciVal Funding– Comprehensive source of funding information.

Scizzle– Curator that automatically finds new and relevant research papers.

Sparrho– Personalized recommendation engine for science.

SSRN– Multi-disciplinary online repository of scholarly research and related materials in social sciences.

Stork– Notifies users of new publications and grants based on the users' own keywords.

Symplur– Connecting the dots in healthcare social media.

Wiki Journal Club– Open, user-reviewed summaries of the top studies in medical research.

Zotero– Helps you collect, organize, cite, and share research sources.

Online organizers

Docollab– Helps to manage scientific research, collaborate with colleagues and publish findings.

Elabftw– Electronic lab notebook made by researchers, for researchers, with usability in mind.

ELabJournal– GLP-compliant Electronic Lab Notebook and lab management tool.

Evernote– A place to collect inspirational ideas, write meaningful words, move important projects forward.

Findings App– Lab notebook app that allows to organize experiments, keep track of results, manage protocols.

Hivebench– Hosted numeric laboratory notebook tool to manage protocols, experiments, share with team.

Journal Lab– A community of scientists who share open summaries and peer review of articles.

LabArchives– Web-based product to enable researchers to store, organize, and publish their research data.

Labfolder– Simple way to document research and to organize protocols and data ([blog post](#)).

LabGuru– Supports day to day activities of a research group (vision, execution, knowledge, logistics).

Laboratory Logbook– Document projects running in a lab, manage experimentally obtained data, metadata.

sciNote– Open source lab notebook with workflows and modular functionalities ([blog post](#)).

Sumatra– Automated electronic lab notebook for computational projects.

Tools for collaborative experimentation

Emerald Cloud Lab– A web-based life sciences lab, developed by scientists for scientists.

ScienceExchange– Marketplace for shared lab instrumentation.

TetraScience– Allows you to monitor & manage experiments from anywhere.

Transcript– A remote, on-demand robotic life science research lab with no hardware to buy or software to install.

Addgene– Plasmid sharing platform.

Antibody Registry– Gives researchers a way to universally identify antibodies used in the course of research.

Biospecimens– Platform for biospecimen-based research.

Duke human heart– Repository for cardiovascular research scientists, including tissue samples.

ELabInventory– Web laboratory inventory management system designed for life science research labs.

Nanosupply– Platform facilitating sourcing and sharing of advanced materials for research and education.

Sample of Science– Peer-Sharing Platform for Scientific Samples.

Electronic laboratories

BioBright– For better understanding of experimental conditions by connecting sensors to instruments.