

НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ВОДНОГО ГОСПОДАРСТВА ТА ПРИРОДОКОРИСТУВАННЯ

Навчально-науковий інститут агроекології та землеустрою



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the European Union



National University of Water
and Environmental
Engineering

05-03-60S (E)

СИЛАБУС SYLLABUS	Технічне оснащення аквакультури Technical equipment of aquaculture	
Шифр за ОП Code in Degree Programme	OK.6	
Освітній рівень Level of Education	Магістерський (другий) Master's (second)	
Галузь знань Field of Knowledge	20	Аграрні науки та продовольство Agricultural Sciences and Food
Спеціальність Field of Study	207	Водні біоресурси та аквакультура Aquatic Bioresources and Aquaculture
Освітня програма Degree Programme	Охорона, відтворення та раціональне використання гідробіоресурсів Protection, reproduction and rational use of hydrobioresources	

RIVNE – 2024

The syllabus of the academic discipline "**Technical equipment of aquaculture**" for master's degree students of the educational program

"Protection, reproduction and rational use of hydrobioresources", specialty 207 Aquatic bioresources and aquaculture. Rivne. NUWEE. 2024. 17 p.

Educational Program (EP) on the university website:

<https://ep3.nuwm.edu.ua/28749/>

Syllabus developer: *academic degree, academic title, and position*
Konontsev Serhii Viktorovych, Doctor of Technical Sciences, Associate Professor, Professor of the Department of Aquatic Bioresources

Syllabus was approved at the meeting of the Department of Water Bioresources Protocol No. 18 of June 24, 2024

Head of the department: *Tatyana Poltavchenko, Ph.D., Associate Professor, Head of the Department of Water Bioresources.*

The head (guarantor) of the EP: *Vasyl Sondak, Doctor of Biology Science, Professor of the Department of Water Bioresources*

Approved by the scientific and methodical quality council of NNIAZ
Protocol No. ___ dated "___" _____ 202__


Head of the Scientific and Methodological Council for the Quality of the Institute of Agroecology and Land Management (NNIAZ):
Alla Pryshchepa, Doctor of Agricultural Sciences, Professor, Director the Institute of Agroecology and Land Management

The previous version of the syllabus (*specify code*) –

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PROGRAM « <i>Technical equipment of aquaculture</i> »	
OVERVIEW	
Level of education	<i>Master's (second)</i>
Degree program	<i>Protection, reproduction and rational use of hydrobioresources</i>
Field of Study	<i>207 Aquatic Bioresources and Aquaculture</i>

Study year, semester	<i>1nd year 1st semester</i>
Number of credits	<i>5 ECTS credits</i>
Lectures:	30
Practicals /Laboratory classes:	20
Independent work:	100
Coursework:	-
Form of education	<i>full-time/part-time</i>
Type of Summative Assessment	<i>examination</i>
Language of instruction	<i>Ukrainian</i>

INFORMATION ABOUT THE DEVELOPER	
	<p><i>Konontsev Serhii, Doctor of Technical Sciences, Associate Professor, Professor of the Department of Water Bioresources</i></p>
Lecturer	
Wikisitet	specified URL: https://cutt.ly/9QrWuMl
ORCID	specified URL: https://cutt.ly/dQrQ7fQ
How to communicate	s.v.konontsev@nuwm.edu.ua https://exam.nuwm.edu.ua/my/

INFORMATION ABOUT THE EDUCATIONAL COMPONENT
Purpose and tasks

The purpose of the module is the formation of knowledge about the purpose, design and principle of operation of technological equipment for aquaculture, skills in the calculation and design of mechanized and automated production processes related to fish feeding, their cultivation at all stages of development, control and support in a given range of water parameters environment. **Tasks:**

1. Expand knowledge about facilities for growing aquaculture objects
2. Form knowledge about structures and the principle of operation of mechanization and automation tools in industrial fish farming.
3. To develop knowledge about technologies of water preparation and purification of polluted water in circulating aquaculture, to form skills in selecting the necessary equipment and designing complexes of automated feeding, water purification facilities, control and maintenance of the main physico-chemical parameters of water.

Link to the course on Moodle

https://exam.nuwm.edu.ua/course/view.php?id=839

Course prerequisite and corequisite information (within the Degree Programme)
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<i>Prerequisites are provided by the module "Intensive Technologies in Aquaculture".</i>
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Competencies

The module "Technical equipment of aquaculture" develops the following general (GC), professional (PC), and subject-specific competencies:

GC1. The ability to use information and communication technologies both to analyze the prospects of introducing innovations in production and to identify risks arising in the process of implementing an innovative project; justification of investment costs and the need for additional resources for the implementation of the innovation

GC2. The ability to search, process and analyze information from various sources, in particular when designing, implementing modern technologies and the latest techniques in the production of aquaculture products, forecasting the main economic and production indicators of innovation.

GC3. Ability to abstract thinking, analysis and synthesis, including search, development and implementation of innovations that increase the efficiency of production of fish farming products, create a new product on the aquaculture market and beyond, mastering the latest technologies in fish farming.

PC10. The ability to clearly and unambiguously convey one's own knowledge, conclusions and arguments on the problems of aquatic biological resources and aquaculture to specialists and non-specialists, in particular to persons who are studying.

PC11. The ability to design technological maps and manage production processes that are complex and require new strategic approaches in the field of aquatic bioresources and aquaculture.

Program learning outcomes (LO)*

LO 1. Have specialized conceptual knowledge that includes modern scientific achievements in the field of aquatic bioresources and aquaculture and is the basis for original thinking and conducting research.

LO 3. Search for the necessary information using a variety of resources: journals, databases, open data and other resources, analyze and evaluate this information

LO 7. To develop, implement and apply effective technological processes of production of aquaculture products, to ensure its quality.

LO 13. The ability to design recirculation systems for industrial and decorative aquaculture, carry out calculations of modern technological equipment, justify the economic feasibility of the adopted technological decisions.

LO 15. To analyze the impact of parameters of the aquatic environment on the health of fish and to develop measures to preserve the quality of water in open reservoirs, to apply modern water purification and water treatment technologies in closed aquaculture systems, to reduce the negative impact of aquaculture on the environment.

The structure and content of the educational component	
<i>Content module 1. Basic technological equipment of aquaculture</i>	
Topic 1. The main directions of mechanization and automation in the production of aquaculture products	
LO1; LO7 Number of hours: lectures - 2.0. Literature: 1-5	The educational component "Technical equipment of aquaculture" and its role in the preparation of masters in the specialty "Aquatic bioresources and aquaculture". Importance of mechanization and automation in fisheries and aquaculture. Classification of machines and mechanisms used in fish farms.
Topic 2. Designs and forms of cages for growing aquaculture objects	
LO1; LO3; LO15 Number of hours: lectures - 2.0 hour Literature: 2-4, 6, 8	Purpose, designs and classification of fish cages. Influence of abiotic factors in nursery farms. Peculiarities of growing aquaculture objects in open and submerged gardens.
Topic 3. Designs and shapes of fish pools	
LO1; LO3; LO13 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 3, 4, 5	Basic forms and materials for the manufacture of modern fish pools. Peculiarities of operation of pools in the open air and within the production premises. Calculation of basin management for the cultivation of aquaculture facilities.
<i>Topic 4. Pipelines and their fittings in aquaculture systems</i>	
LO1; LO13 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 3, 4, 5	Purpose and classification of pipelines and water trays. Pipe fittings, designs and purpose. Types of pipe connections and characteristics of materials in the aspect of aquaculture farms
Topic 5. Aquaculture pumping equipment	
LO1; LO3; LO7 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1, 4, 5	Types of pumps used in aquaculture, their areas of application and comparative characteristics. Basic technical parameters of pumps. Selection of pumping equipment for various tasks in aquaculture.

Topic 6. Mechanisms for combating the overgrowth of aquatic and air-aquatic plants	
LO1; LO7; LO15 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 4, 8	Types of machines for combating the overgrowth of the coastal strip. Designs and principle of action of working bodies of mowers. Technical characteristics of self-propelled and floating mowers. The main methods of hanging the working body.
Topic 7. Deepening of the bed and removal of sediments in non-dischargeable reservoirs for fishing purposes	
LO1; LO7; LO15 Number of hours: lectures - 2.0 hour Literature: 2, 3, 4, 7	<i>Purpose and design of dredgers. The structure of the working bodies of the dredger. Day development of reservoirs and canals with the help of excavators of various types and designs. Differences between periodic and continuous working bodies.</i>
Topic 8. Reclamation, pond slope planning and channel cleaning in fish farms	
LO1; LO7 Number of hours: lectures - 2.0 hour Literature: 2, 3, 4, 7	<i>Machines for reclamation, the structure of their working bodies. Types of equipment for pond bed planning. The structure of the side digging dragline.</i>
Content module 2. Mechanization and automation of production processes in aquaculture	
Topic 9. Equipment for aeration of water in fish farms	
LO3; LO7; LO15 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 5, 7	<i>The value of aeration in intensive aquaculture. Methods of aeration of water in open water aquaculture and recirculation systems. Designs of mechanical and pneumatic aerators. Administration of technical oxygen in RAS.</i>
Topic 10. Mechanization of feed manufacturing processes for the needs of aquaculture	
LO3; LO7 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1, 2, 3, 4	<i>Technological techniques and operations in the production of compound feed for aquaculture. The main equipment of lines for the production of compound feed, their structure and purpose. Differences between extruded and granulated compound feed.</i>

Topic 11. Automated feeding in RAS

LO3; LO7; LO13 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 3, 4, 5	<i>Importance of automation of feeding processes in recirculating aquaculture systems. Basic methods of automation of feeding processes. Designs and features of operation of auto feeders for RAS. Automated feeding lines in groups of pools of the same type.</i>
Topic 12. Mechanized and automated feeding in open ponds and cage lines	
LO3; LO7; LO15 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1-4, 7	<i>Means of mechanization for feeding fish in ponds and open basin farms. Machines for loading and internal transport of fodder. Automated feeding in open garden farms.</i>
Topic 13. Mechanized fishing of reservoirs and fish overloading	
LO3; LO7 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 4, 8	<i>Catching fish in open water bodies and in RAS pools. Methods of concentration of fish. Mechanized overloading of aquaculture products.</i>
Topic 14. Tools for sorting and accounting for aquaculture facilities	
LO3; LO7 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 4, 6	<i>Importance of sorting aquaculture products. Designs of installations for sorting fish in conditions of open water bodies and RAS. Advantages and disadvantages of different types of sorting lines. Designs of fish accounting equipment.</i>
Topic 15. Internal and external transport of live fish	
LO3; LO7 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 2, 3, 4, 6	<i>Methods of internal transport of live fish within the RAS and in open water bodies. Designs of installations for vertical transport of fish. Construction of live fish tankers based on motor vehicles.</i>

Teaching methods

Teaching is conducted through lectures (multimedia, interactive), seminars, practical work, and consultations with the instructor.

The forms of theoretical education include lectures and seminars. Lectures are delivered using explanatory and illustrative methods, multimedia presentations, handouts, and tables. Seminar sessions utilize methods such as oral questioning, discussions, debates, and presentations. The discussion of problematic issues is encouraged, for example, "What technical parameters of pumps are the most important when selecting equipment for pumping water within the RAS?", "How are the processes of mechanized feeding in the RAS fundamentally different from feeding fish in open water bodies?". To earn additional points, students have the opportunity to give a public presentation on a chosen topic within the educational component.

The form of professional training is practical classes, which are held in a specialized laboratory of the Department of Water Bioresources, equipped with devices for electricity and water supply, containers for keeping hydrobionts (aquariums, plastic pools, bathtubs).

The research method is used when students perform individual tasks. Students use methodical material prepared by the teacher: presentations, lecture notes, methodical instructions for practical classes and independent work.

The research method is applied when students perform individual tasks. Students use methodological materials prepared by the instructor: presentations, lecture notes, and methodological guidelines for practical classes and independent work.

During the course, students are encouraged to participate in the department's scientific research work, prepare scientific articles, and present reports at scientific conferences and round tables.

Student-centered learning, problem-based learning, interactive self-learning, information technologies, the credit-transfer system of learning organization, e-learning in the Moodle system, and research and observation-based learning are all integrated into the teaching process.

Tools, equipment, software

Modern equipment of the integrated multitrophic aquaculture laboratory: pools and trays made of polypropylene, pumping and air-blowing equipment, automatic feeders, a line for the production of extruded compound feed for fish (including the newly established integrated multitrophic aquaculture laboratory created under the AFISHE project).

During lectures and practical classes, a multimedia projector, a laptop, library and internet resources, Google Sheets and Google Forms (corporate subscription), study guides, monographs, and scientific and popular articles are used.

The procedure for evaluating program learning outcomes/learning outcomes

Evaluation is carried out using two grading scales (excellent, good, satisfactory, unsatisfactory) and a 100-point scale.

Types of assessment: current and final. Students take current (modular) and final assessments at the Educational and Scientific Center for Independent Assessment of NUWEE.

The assessment of students' knowledge is conducted in accordance with the "System for Evaluating the Learning Outcomes of Higher Education Applicants (Semester Current and Final Control) with Amendments and Additions" (<http://ep3.nuwm.edu.ua/21123>).

Forms of assessment include: oral questioning, defense of practical work, verification of practical work reports, and computer-based testing.

The educational component concludes with an exam, where the points for practical and independent work (a total of 60 points) and the exam (40 points) are combined.

The results of the two module tests (20 + 20 = 40 points) during the semester may be counted as the exam result if they are completed on time and successfully.

To pass successfully, the combined score for current and modular assessments must exceed 60 points, with a maximum of 100 points.

The modular control and exam will be conducted in the form of testing on the university's educational platform MOODLE.

Intermediate (current) assessment is conducted on the NUWEE educational platform in the form of two modules.

The current module control No. 1 consists of 24 random test tasks of three levels of difficulty: Level 1 (choose one correct answer among the proposed options): 20 x 0.5 points = 10 points; Level 2 (choose one, two, or more correct answers among the proposed options, identify an incorrect statement among the proposed ones): 3 x 2.0 points = 6 points; Level 3 (identify the name and function of a compound based on an image, solve a problem to calculate the equilibrium concentration of dissolved oxygen; identify the incorrect statement among the proposed ones): 1 x 4.0 points = 4 points.

The current module control No. 2 consists of 24 random test tasks of three levels of difficulty: Level 1 (choose one correct answer among the proposed options): 20 x 0.5 points = 10 points; Level 2 (choose one, two, or more correct answers among the proposed options, identify an incorrect statement among the proposed ones, match pairs): 3 x 2.0 points = 6 points; Level 3 (identify the incorrect statement among the proposed options): 1 x 4.0 points = 4 points.

The final control (exam) is conducted on the NUWEE educational platform. The exam consists of 40 random test tasks of three levels of difficulty: Level 1 (choose one correct answer among the proposed options): 30 x 0.9 points = 27 points; Level 2 (choose one, two, or more

correct answers among the proposed options, identify an incorrect statement among the proposed ones, match pairs, solve a problem etc): 9 x 1.0 points = 9 points; Level 3 (identify the incorrect statement among the proposed options): 1 x 4.0 points = 4 points.

Students can earn **additional points** for the following activities:

- Preparing a presentation or a short report on a course-related topic – 3 point;
- Presenting at a scientific conference on the subject of the course, publishing theses or a scientific article – 8 points;
- Participating in the All-Ukrainian Student Olympiad – 5 points;

Participating in the All-Ukrainian Student Research Competition – 5 points.

Bibliography (primary, secondary)

Basic literature

1. Kononenko R.V., Kononenko I.S., Mushyt S.O. Technical means in aquaculture: manual: KOMPRINT, 2018. 310 p.
2. Odd-Ivar Lekang. Aquaculture Engineering, Third Edition : Published by John Wiley & Sons Ltd., 2020. 525 p.
3. Bregnballe J. A. Guide to Recirculation Aquaculture. An introduction to the new environmentally friendly and highly productive closed fish farming systems: FAO and EUROFISH, 2015. 97 p.
4. Modern aquaculture: from theory to practice: a practical guide / Sharylo Yu.E. etc. K.: "Prostobuk", 2016. 119 p.
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Additional literature

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7. Sherman I.M., Rylov V.G. Production technology of fishery products: a textbook. Kyiv: "Higher Education", 2005. 351 p.
8. Aquaculture: Farming Aquatic Animals and Plants. John S. Lucas, Paul C. Southgate, Craig S. Tucker (Editors). 2019. Wiley-Blackwell. ISBN 978-1119230861.
9. Andryushchenko A.I., Vovk N.I. Aquaculture of artificial ponds. Part II. Industrial aquaculture: a textbook. Kyiv, 2014. 586 p.
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Information resources on the Internet

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14. Megalodon. Information and analytical platform for the development of fish farming: <https://fishindustry.com.ua/>
15. Food and Agriculture Organization (FAO). – URL: <https://www.fao.org/>
16. Guidelines for Sustainable Aquaculture. Committee on Fisheries. Thirty-sixth Session, 8-12 July 2024. FAO, Rome, Italy. – URL: <https://openknowledge.fao.org/handle/20.500.14283/np423en>.
17. Institute of Hydrobiology of NASU. – URL: <https://hydrobio.kiev.ua/ua/>.
18. Institute of Fisheries of the National Agrarian Academy of Sciences. – URL: <http://if.org.ua/index.php/uk/>.

Methodical support

1. **05-03-140M** Konontsev, S. V. (2024) Synopsis of lectures on the academic discipline "Technical equipment of aquaculture" for students of higher education of the second (master's) level under the educational and professional program "Protection, reproduction and rational use of hydrobioresources" specialty 207 "Water bioresources and aquaculture" full-time and part-time education. (in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/31060/>
2. **05-03-141M** Konontsev, S. V. (2024) Methodological instructions for the implementation of practical work in the academic discipline "Technical equipment of aquaculture" for students of higher education of the second (master's) level under the educational professional program "Protection, reproduction and rational use of hydrobioresources" specialty 207 "Water bioresources and aquaculture" full-time and part-time education.(in Ukrainian)– Access mode: <https://ep3.nuwm.edu.ua/31062/>
3. **05-03-142M** Konontsev, S. V. and Korbutyak, V. M. (2024) Test tasks of the current control of knowledge from the academic discipline "Technical equipment of aquaculture" (content module 1) for students of higher education of the second (master's) level according to educational - professional program "Protection, reproduction and rational use of hydrobioresources" specialty 207 "Aquatic bioresources and aquaculture" full-time and part-time study.(in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/31063/>
4. **05-03-143M** Konontsev, S. V. and Korbutyak, V. M. (2024) Test tasks of the current control of knowledge from the academic discipline "Technical equipment of aquaculture" (content module 2) for students of higher education of the second (master's) level under the educational and professional program "Protection, reproduction and rational use of hydrobioresources" specialty207 "Aquaticbioresources and

aquaculture" full-time and part-time study. (in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/31066/>

Combination of learning and research* (if needed)

Graduates of higher education are involved in the implementation of scientific research topics, have the opportunity to research the technological parameters of modern equipment in laboratory conditions to support the main physico-chemical parameters of water, feed, etc. In the case of choosing the subject of the graduation qualification work, or including separate sections in its content, according to the subject of the course - innovative objects of aquaculture, the latest technology in RAS and the effectiveness of its application; during the practical work, applicants have the opportunity to obtain scientific research results for their inclusion in the qualification work.

In the educational process, the obtained individual and collective scientific achievements of the lecturer, which are related to the content of the educational component, are used:

- Innovative water purification technologies in recirculating aquaculture systems;
- Modern technical equipment for intensive aquaculture;
- Cultivation of feed organisms and cleaning agents within integrated multitrophic aquaculture;

Within the framework of individual studies, students have the opportunity to use the material base of the laboratory of integrated multitrophic aquaculture, namely at

- study of the cultivation of fodder organisms in a closed circle of RAS;
- determining the effectiveness of adding various ingredients to compound feed produced by the extrusion method;
- research on the effectiveness of innovative methods of water aeration in aquaculture conditions;
- economic justification of the introduction of automation schemes of the main production processes in aquaculture.

During training, students are shown the development of systems for biological treatment of circulating water of fish farms, implemented by S.Konontsev in production, as well as technologies of integrated multitrophic aquaculture in freshwater recirculation systems

TEACHING AND LEARNING POLICIES

List of social, "soft" skills (soft skills)

The components of the module contribute to the development of universal skills that enable quick adaptation to new conditions, changing fields of employment, and solving non-standard tasks in production and environmental protection: critical thinking, environmental literacy, curiosity, determination, perseverance, teamwork, responsibility, creativity, and self-directed learning for professional and personal growth.

Deadlines and rescheduling

Announcements regarding deadlines for submitting parts of the educational discipline are published on the course page on the MOODLE platform according to the calendar:

<https://exam.nuwm.edu.ua/calendar/view.php?view=month&course=6502>

The deadlines for submitting intermediate control modules and the final control (exam) are established according to the Regulation on the semester's current and final control of educational achievements of higher education students. Link: <http://ep3.nuwm.edu.ua/15311/>.

Retaking of modules is carried out in accordance with the rules of the Center for Independent Assessment, announcement by the link:

<https://exam.nuwm.edu.ua/mod/forum/view.php?id=1>.

Retaking of modules is allowed with the permission of the dean's office in the presence of valid reasons (e.g., medical leave).

Elimination of academic debt and re-study of the discipline are carried out in accordance with the "Procedure for the elimination of academic debts at NUWEE". Link: <http://ep3.nuwm.edu.ua/4273/>.

If a student disagrees with the assessment results, an appeal can be submitted to the NNIAZ dean's office on the day the test is taken, clearly stating the nature of the issue. A printed copy of all the student's answers during the attempt must be attached to the appeal. The director of the NNI convenes an appeal commission to consider the complaint, to which the student and a representative of the Center for Independent Assessment are invited, in accordance with the Procedure for appeals from students and other individuals studying at the National University of Water and Environmental Engineering <http://ep3.nuwm.edu.ua/15467/>.

Non-formal and informal education (if needed)

Students have the right to have their learning outcomes from non-formal and informal education credited according to the relevant regulations. <http://ep3.nuwm.edu.ua/18660/>. In particular, free courses on the Coursera platform. Link: <https://www.coursera.org>.

Rules of academic integrity

The principles of academic integrity are outlined on the NUWEE "Education Quality Department" website:

<https://nuwm.edu.ua/sp/akademichna-dobrochesnistj>.

It is prohibited to cheat or discuss questions with fellow students during all control measures, including modular and final assessments. If such violations are detected, the student loses the right to continue performing tasks, which may result in a reduction of the overall grade or the failure to pass the entire course, necessitating the re-study of the educational component.

Information on academic integrity, plagiarism, the student honor code, etc., is provided on the website of the National Agency for Quality Assurance of Higher Education <https://naqa.gov.ua/>; and on the NUWEE "Quality of Education" page <http://nuwm.edu.ua/sp/akademichnadobrochesnistj>.

Attendance requirements

It is mandatory to make up missed classes without valid reasons (e.g., medical leave, mobility, etc.). This can be done during consultations, the schedule of which is published on the Department of Water Bioresources page: <https://nuwm.edu.ua/nni-az/kaf-vb/hrafik-konsultatsij>.

With a medical certificate or a certificate of academic mobility, the student is exempted from making up missed practical classes. Missed lectures must be independently studied by students on the educational platform on the page of the relevant educational component <https://exam.nuwm.edu.ua/course/view.php?id=839>.

During classes, students may use mobile devices only to search for information related to the module and calculators for solving tasks, except during control measures.

Автор
Доцент

Сергій КОНОНЦЕВ

Затверджено

Проректор з науково-педагогічної та
навчальної роботи

Валерій СОРОКА



документ підписаний КЕП
Номер документа СИЛ №1272
Підписувач Сорока Валерій Степанович
Підписувач (дані КЕП):
Сертифікат 3FAA9288358EC003040000009B6C3700C8C2C100