

**НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ВОДНОГО ГОСПОДАРСТВА ТА  
ПРИРОДОКОРИСТУВАННЯ**

Навчально-науковий інститут агроекології та землеустрою



Co-funded by  
the European Union



National University of Water  
and Environmental  
Engineering

**05-03-54 S (E)**

<b>СИЛАБУС</b>	Екологічна фізіологія та біохімія гідробіонтів	
<b>SYLLABUS</b>	Ecological Physiology and Biochemistry of Hydrobionts	
Шифр за ОП Code in Degree Programme	OK.5	
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 Educational Component "Ecological Physiology and Biochemistry of Hydrobionts" for Master's Degree Students of the Degree Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture". Rivne. NUWEE. 2024. 15 p.

The Degree Program (DP) on the university website:

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

Syllabus developer:

*e-signature* Yuliia Hrokhovska, Doctor of Agriculture Science, Professor of the Department of Water Bioresources.

Syllabus was approved at the meeting of the Department

Protocol No. 18 of June 24, 2024

Head of the Department of Water Bioresources:

*e-signature* Tatyana Poltavchenko, Ph.D., Associate Professor.

The head of the Degree Program:

*e-signature* Vasyl Sondak, Doctor of Biology Science, Professor.

Approved by the Scientific and Methodological Council for the Quality of the Institute of Agroecology and Land Management (IALM)

Protocol No. 23 of August 27, 2024

Head of the Scientific and Methodological Council of IALM:

*e-signature* Alla Pryshchepa, Doctor of Agricultural Sciences, Professor.

The previous version of the syllabus (*specify code*) 05-03-02S


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## PROGRAM Ecological Physiology and Biochemistry of Hydrobionts

### 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>1<sup>st</sup> year, 2<sup>nd</sup> 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 UNIVERSITY TEACHER

 <p>Lecturer</p>	<p><i>Yuliia Romanivna Hrokhovska, Doctor of Agricultural Sciences, Professor of the Department of Water Bioresources</i></p>
<p>Wikisitet</p>	<p><a href="https://cutt.ly/GgZrFbm">https://cutt.ly/GgZrFbm</a></p>
<p>ORCID</p>	<p><a href="https://cutt.ly/ggZrJ7Z">https://cutt.ly/ggZrJ7Z</a></p>
<p>How to communicate</p>	<p><a href="mailto:y.r.grokhovska@nuwm.edu.ua">y.r.grokhovska@nuwm.edu.ua</a>  <i>Actual announcements on the educational component page in the MOODLE svstem</i>  <a href="https://ep3.nuwm.edu.ua/28749/">https://ep3.nuwm.edu.ua/28749/</a></p>
<p><b>INFORMATION ABOUT THE EDUCATIONAL COMPONENT</b></p>	
<p><b>Goal and tasks</b></p>	
<p><i>The goal of studying this educational component is for students to acquire theoretical knowledge about the physiological and biochemical features of hydrobiont adaptation to the aquatic environment and practical skills in assessing the physiological state of fish based on relevant indicators of individual functional systems.</i></p> <p><i>Tasks: 1) to understand the metabolic processes occurring in the body and the physiological state at different stages of ontogenesis and during various periods of the annual cycle; 2) to comprehend the effects of environmental factors in the aquatic environment on the physiological and biochemical state of fish at different stages of development, during different seasons, in pre-spawning, spawning, post-spawning periods, during wintering, and other critical periods.</i></p>	
<p><b>Link to the course on Moodle</b></p>	
<p><a href="https://ep3.nuwm.edu.ua/28749/">https://ep3.nuwm.edu.ua/28749/</a></p>	
<p><b>Course prerequisite and corequisite information (within the Degree Programme)</b></p>	
<p><i>Prerequisites are provided by the module "Theoretical Foundations of Fish Farming"</i></p>	
<p><b>Competencies</b></p>	

The module "Ecological physiology and biochemistry of hydrobionts" develops the following general (GC), professional (PC), and subject-specific competencies:

**GC5.** Commitment to preserving the natural environment, including the aquatic environment for hydrobionts, in particular fish.

**GC6.** The ability to learn and acquire modern knowledge, in particular in the field of biochemistry and physiology of hydrobionts in the conditions of modern ecological changes of aquatic ecosystems.

**PC1.** The ability to analyze the ecological parameters of hydroecosystems in natural and artificial environments, and to assess anthropogenic impacts based on a critical understanding of issues in agricultural sciences and food, as well as at the intersection of various fields of knowledge.

**PC6.** The ability to identify and use physiological and biochemical changes occurring in the organism of hydrobionts to ensure the efficiency of fish farming technological processes in aquatic bioresources and aquaculture.

### Program learning outcomes (LO)\*

**LO1.** 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.

**LO5.** Develop and implement scientific and applied projects on the problems of aquatic bioresources and aquaculture and related interdisciplinary projects taking into account production, legal, economic, and ecological aspects.

### The structure and content of the educational component

#### **Content module 1. Patterns of metabolic processes and peculiarities of the physiological state of hydrobionts**

#### **Topic 1. Introduction. Metabolic processes in the organism of hydrobionts**

LO1; LO5  
Number of hours:  
lectures - 2.0.  
Literature:1-4, 6

The educational component "Ecological physiology and biochemistry of hydrobionts" and its role in the preparation of a master's in the specialty "Aquatic bioresources and aquaculture".  
The main manifestations of vital activity.  
Metabolic processes in the organism of hydrobionts. Assimilation and dissimilation.  
Chemical composition of the body, biopolymers, and bioregulators.

#### **Topic 2. Carbohydrates in the body of aquatic organisms: structure, functions, and metabolism in anaerobic and aerobic conditions**

LO1; LO5 Number of hours: lectures - 2.0; practice – 1.0 hour Literature: 1, 2, 6	Carbohydrates in the body of aquatic organisms. Carbohydrate metabolism. Catabolism processes in anaerobic and aerobic conditions. Carbohydrate biosynthesis.
<b><i>Topic 3. Lipid metabolism in aquatic organisms under changing environmental conditions</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 1.0 hour Literature: 2, 4, 6	Structure and functions of lipids in the body of aquatic organisms. Simple lipids. Complex lipids. Lipid metabolism.
<b><i>Topic 4. Amino acids and proteins of aquatic organisms: structure, functions, metabolism in the conditions of environmental changes</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 1.0 hour Literature: 2, 4, 6	Chemical structure of aminoacids and proteins. Functions of proteins in the organism of hydrobionts. Metabolism of proteins in the body of hydrobionts.
<b><i>Topic 5. Nucleic acids in aquatic organisms and processes of transmission of genetic information under conditions of environmental changes</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 1.0 hour Literature: 2, 4, 6	Chemical composition and structure of nucleic acids. Molecular mechanisms of genetic information transmission. End products of the breakdown of purine and pyrimidine nucleotides.
<b><i>Topic 6. Physiological and biochemical characteristics of periods of individual development of fish</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1- 5, 8, 10	Phases of the life cycle of cyclostomes and fish. Physiological and biochemical features of the main periods of individual development of fish (embryonic, larval, juvenile, reaching sexual maturity). Physiological and biochemical characteristics of the period of puberty. General signs of fish aging processes. Changes in metabolism during fish ontogenesis.
<b><i>Topic 7. Seasonal dynamics of metabolism in different fish species</i></b>	

LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0 hour Literature: 1- 5, 8	Seasonal changes in protein metabolism. Seasonal changes in fat metabolism. Seasonal fluctuations in carbohydrate content. Seasonal fluctuations of generative metabolism and the "biological clock" in fish. Seasonal rhythms of physiological processes in fish of different ages and sexes.
<b>Topic 8. Physiological and biochemical characteristics of certain periods of the annual biological cycle of fish</b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0. Literature: 1- 5, 10	Introduction. Post-spawning period. Feeding period of fish. Wintering of fish. Pre-spawning period. Spawning period. Seasonal dynamics of metabolism in fish.
<b>Topic 9. Forms of metabolism and the influence of biological and ecological factors on it</b>	
LO1; LO5 Number of hours: lectures - 2.0; Literature: 1- 4, 6	Forms of metabolism. Fisheries differentiation of the metabolism forms.
<b>Content module 2. The influence of the main abiotic factors of the aquatic environment on hydrobionts</b>	
<b>Topic 10. Impact of abiotic factors of the aquatic environment on the physiological and biochemical status of fish</b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0. Literature: 4, 7, 9	The main factors that determine the biological quality and survival of the offspring of valuable fish species. Eurybionts and stenobionts. Critical stages and phases in the ontogenesis of fish. Environmental valence.
<b>Topic 11. The influence of the temperature of the water environment on the physiological and biochemical status and metabolism of the aquatic organisms</b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 4,0 Literature: 1, 4, 9	The influence of water temperature on the life processes of fish. The influence of temperature on fish reproduction processes. The influence of water temperature on the development of fish embryos. The effect of water temperature on the activity of fish spermatozoa.
<b>Topic 12. The value of oxygen dissolved in water to ensure metabolic processes in the body of fish at various stages of their development and growth</b>	



LO1; LO5 Number of hours: lectures - 2.0; practice – 2.0. Literature: 1, 3, 4, 9, 10	Respiration in the processes of embryonic and post-embryonic development of fish. The influence of oxygen conditions of the environment on the growth and vital activity of fish embryos. Relation of roe of different fish species to the level of oxygen in water and reaction of embryos to changes. The influence of dissolved oxygen on the intensity and direction of metabolic processes in fish.
<b><i>Topic 13. The influence of water salinity on the physiological and biochemical status and metabolism of hydrobionts</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 1.0. Literature: 1, 3, 4, 9	Mineralization and salinity of the water environment and ecological groups of hydrobionts. Ecological groups of hydrobionts according to the peculiarities of regulation of water-salt exchange. Peculiarities of reproduction and early development of fish in water of different salinity.
<b><i>Topic 14. Mechanisms of fish adaptation to changes in water salinity</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; practice – 1.0. Literature: 1, 3, 4, 9	Osmoregulators and osmoconformers. Osmoregulation in fish at early stages of development. Osmoregulation in marine bony fishes. Osmoregulation in freshwater fish. Osmoregulation in salmon and sturgeon fish.
<b><i>Topic 15. The influence of carbonic acid and changes in the pH of the water environment on the fish life processes</i></b>	
LO1; LO5 Number of hours: lectures - 2.0; Literature: 1, 3, 4, 9	Carbon dioxide and carbonic acid in aquatic ecosystems and its effect on fish metabolism. Activity of hydrogen ions (pH) and metabolism of aquatic animals.
<b>Teaching methods</b>	



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 are the advantages of osmoregulation mechanisms in bony fish over cartilaginous ones?", "What are the physiological and biochemical bases of the dominance of ostariophyses in freshwater ecosystems?" etc.

To earn additional points, students have the opportunity to give a public presentation on a chosen topic within the educational component.

Professional training is conducted through practical classes held in the specialized laboratory of the Department of Water Bioresources, equipped with microscopes, devices for electricity and water supply, and containers for keeping aquatic organisms (aquariums, plastic trays, bathtubs).

The methods used include animal behavior monitoring, hydrochemical methods (express techniques for measuring dissolved oxygen concentration, pH levels, etc.), dissection, and microscopy of organisms under laboratory conditions. 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 for hydrobiological, hydrochemical, ichthyological, biochemical, ichthyopathological, biotechnological, and other laboratories in accordance with state standards (including the newly established integrated multitrophic aquaculture laboratory created under the AFISHE project), as well as research equipment, instruments, and technical means for carrying out production processes involving aquatic biological resources, aquaculture, and their cultivation technologies. 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 protein content in the body of a migratory fish species before and after spawning): 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, solve a problem on the duration of fish egg incubation): 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 on the duration of egg incubation): 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 – 1 point;
- Presenting at a scientific conference on the subject of the course, publishing theses or a scientific article – 3 points;
- Participating in the All-Ukrainian Student Olympiad – 3 points;
- Participating in the All-Ukrainian Student Research Competition – 3 points.

**Recommended literature (basic, additional)**

### **Basic literature**

1. Farrell A. P., Pieperhoff S. *Encyclopedia of fish physiology: from genome to environment / Editor-in-Chief A. P. Farrel*. London. 2011. Vol. 1-3.
2. Kononsky O.I. *Biochemistry of animals*. K.: Higher School, 2006. 454 p. (in Ukrainian).
3. *Physiology of fish: practical guide / P.A. Dekhtyaryov, I.M. Sherman, Yu.V. Pilypenko, O.O. Yarzhombek, S.G. Vovchenko*. K., Higher School, 2001. 128 p. (in Ukrainian).
4. Yevtushenko M. Yu. *Ecological physiology and biochemistry of hydrobionts: Study guide for master's training in specialty "Aquatic bioresources"*. K.: NAU Publishing Center, 2015. 118 p. (in Ukrainian).

### **Additional literature**

5. Bone Q., Moore R.H. *Biology of fishes*. 2008. 3rd ed. 478 p.
6. Grokhovska Y. R. *Biochemistry of hydrobionts: Interactive complex of educational and methodological support*. Rivne: NUWEE, 2008. 180 p. (in Ukrainian)
7. Grokhovska Y.R., Konontsev S.V. *Fish diversity under human impact: A case study of the Pripyat river basin in Ukraine / Actual problems of natural sciences: modern scientific discussions: Collective monograph*. Riga: Baltija Publishing, 2020. P. 171-187. Mode of access: DOI <https://doi.org/10.30525/978-9934-588-45-7.11>.
8. *Fish Disease: Diagnosis and Treatment*. Edward J. Noga. 2010. Wiley-Blackwell. ISBN 978-0813806976
9. *Hydroecology: textbook for students higher education / M. O. Klymenko, Yu. V. Pylypenko, Yu. R. Grokhovska, O. V. Lyanzberg, O. O. Bedunkova*. Kherson: OLDI-PLUS, 2015. 379 p. [Electronic resource]. Access mode: <http://ep3.nuwm.edu.ua/id/eprint/7515>.
10. Parker R. *Aquaculture Science, Third Edition*. Delmar. 2012. 652 p.

### **Information resources on the Internet**

11. Institute of Hydrobiology of NASU. – URL: <https://hydrobio.kiev.ua/ua/>.
12. Institute of Fisheries of the National Agrarian Academy of Sciences. – URL: <http://if.org.ua/index.php/uk/>.
13. Scientific electronic library of periodicals of the National Academy of Sciences of Ukraine. Browsing by topics "Ecological physiology and biochemistry of aquatic animals", "Ecological physiology and biochemistry of aquatic plants". [Electronic resource]. – URL: <http://dspace.nbuuv.gov.ua/handle/123456789/236>.
14. Website of the journal "Hydrobiological Journal", headings: "Ecological physiology and biochemistry of aquatic animals", "Aquatic toxicology" [Electronic resource]. – URL: <http://hydrobiolog.com.ua>.
15. Website of the journal "Fisheries of Ukraine". [Electronic resource]. – URL: <http://fsu.ua/index.php/uk/arkhiv-zhurnal>.

#### **Methodological support**

16. 05-03-119M. Hrokhovska, Y. R. (2024) Methodical Instructions for the Implementation of Practical Work in the Academic Discipline "Ecological Physiology and Biochemistry of Hydrobionts" for Students of Higher Education of the Second (Master's) Level in the Educational and Professional Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture" of Full-Time and Part-Time Education (in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/30434/>.
17. 05-03-122M. Hrokhovska, Y. R. (2024) Lecture Notes on the Academic Discipline "Ecological Physiology and Biochemistry of Hydrobionts" for Students of Higher Education of the Second (Master's) Level in the Educational and Professional Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture" of Full-Time and Part-Time Education (in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/30435/>.
18. 05-03-123 M. Hrokhovska, Y. R., Parfenyuk, I. O. (2024) Test Tasks for the Current Knowledge Control in the Academic Discipline "Ecological Physiology and Biochemistry of Aquatic Organisms" (Content Module 1) for Students of Higher Education of the Second (Master's) Level in the Educational and Professional Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture" of Full-Time and Part-Time Education (in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/30415/>.
19. 05-03-124M Hrokhovska, Y. R., (2024) Test Tasks for the Current Knowledge Control in the Academic Discipline "Ecological Physiology and Biochemistry of Aquatic Organisms" (Content Module 2) for Students of Higher Education of the Second (Master's) Level in the Educational and Professional Program "Protection, Reproduction, and Rational Use of Hydrobioresources", Field of Study 207 "Aquatic Bioresources and Aquaculture" of Full-Time and Part-Time Education (in Ukrainian) – Access mode: <https://ep3.nuwm.edu.ua/30254/>.

**Combination of learning and research\* (if needed)**



*During their studies, students have the opportunity to participate in departmental scientific research on fisheries and aquaculture issues, with subsequent presentation of results at All-Ukrainian student scientific work contests, and in scientific publications, particularly in the NUWEE Bulletin, as well as at round tables and conferences at the university, regional, and all-Ukrainian levels.*

*The requirements for participation and submission of works can be found on the student scientific work sector page <https://nuwm.edu.ua/naukova-dijalnistj/stud-science>, and the announcements page <https://nuwm.edu.ua/university/ads/nov202009041041>.*

*Students pursuing higher education are involved in research on various fish species to obtain initial data for practical classes. This also applies when selecting a topic for their qualification work or including specific sections in it, in accordance with the course topic – physiological and biochemical processes and the characteristics of hydrobionts in various environmental conditions and under the influence of certain factors. In the educational process, the lecturer's individual and collective scientific achievements, relevant to the content of the educational component, are utilized:*

- 1. Physiological and biochemical foundations for the purification of recirculating aquaculture system (RAS) water from nitrogen and phosphorus compounds;*
- 2. Quality of surface waters in the Pripyat basin: impact of point and diffuse sources of pollution;*
- 3. Adaptation of duckweed (LEMNOIDEAE) to conditions of organic water pollution.*

## **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=839>.

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, the 7-week online course "Biochemical Principles of Energy Metabolism" on the Coursera platform, which focuses on the basics of energy metabolism, can be credited as part of the educational component (provided a certificate is obtained). Link:

<https://www.coursera.org/learn/energy-metabolism>.

#### **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-konsultatsii>.*

*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  
Професор

Юлія ГРОХОВСЬКА

Затверджено

Проректор з науково-педагогічної та  
навчальної роботи

Валерій СОРОКА



документ підписаний КЕП  
Номер документа СИЛ №981  
Підписувач Сорока Валерій Степанович  
Підписувач (дані КЕП):  
Сертифікат 3FAA9288358EC003040000009B6C3700C8C2C100