

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
ADMIRAL MAKAROV NATIONAL UNIVERSITY OF SHIPBUILDING

Faculty of Marine Economics and Ecology  
Department of Ecology and Environmental Technologies

**APPROVED**



Proctor-Recto for Academic Affairs

*S. O. Slobodian*  
S. O. Slobodian

***ACADEMIC DISCIPLINE WORKING PROGRAMME***  
**PROTECTION AND DEVELOPMENT OF LARGE-SCALE WETLANDS**

higher education level — second (Master's)

discipline type — elective

language of instruction — English

Mykolaiv – 2026

Academic Discipline Working Programme "Protection and Development of Large-Scale Wetlands"

"H" 2026. – 17 pages

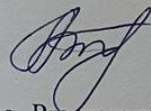
Developers: the working programme was developed within the international CRES-Network project "Climate Change Resilient Natural Resource Management Network", implemented by Ukrainian universities in cooperation with Technische Universität Dresden and Brandenburg University of Technology Cottbus-Senftenberg with the support of the German Academic Exchange Service (DAAD), by the following team of authors:

- Admiral Makarov National University of Shipbuilding: H. H. Trokhymenko, Dr Sc (Engineering), Professor; N. I. Magas, PhD (Engineering), Associate Professor; O. A. Litvak, PhD (Economics), Associate Professor; S. S. Melnychuk, PhD (Biology), Associate Professor; V. M. Nedoroda, PhD, Lecturer; N. V. Hurets, Senior Lecturer;
- Kherson State Agrarian and Economic University: V. I. Pichura, Dr Sc (Agriculture), Professor; L. O. Potravka, Dr Sc (Economics), Professor; P. M. Boiko, PhD (Biology), Associate Professor; T. O. Boiko, PhD (Biology), Associate Professor.

The draft Academic Discipline Working Programme "Protection and Development of Large-Scale Wetlands" was considered at a meeting of the Department of Ecology and Environmental Technologies.

Minutes No. 5 dated 13 May 2026.

Head of Department

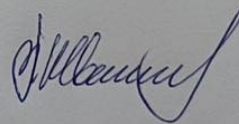


Ganna TROKHYMENKO

The draft Academic Discipline Working Programme "Protection and Development of Large-Scale Wetlands" was considered by the Methodological Commission of the Faculty of Marine Economics and Ecology.

Minutes No. 5 dated 16 May 2026.

Chair



Viacheslav IVATA

The draft Academic Discipline Working Programme "Protection and Development of Large-Scale Wetlands" was agreed with the Academic Affairs Office.

Head of Office

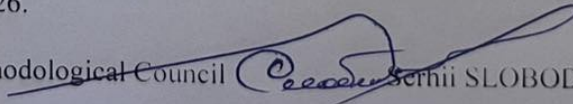


Andrii LABARTKAVA

The Academic Discipline Working Programme "Protection and Development of Large-Scale Wetlands" was approved by the Academic and Methodological Council of Admiral Makarov National University of Shipbuilding.

Minutes No. 6 dated 24 June 2026.

Chair of the Academic and Methodological Council



Serhii SLOBODIAN

© NUS, 2026

## CONTENTS

|                                                                                           |    |
|-------------------------------------------------------------------------------------------|----|
| Introduction.....                                                                         | 4  |
| 1. Description of the Academic Discipline.....                                            | 4  |
| 2. Aim of the Academic Discipline .....                                                   | 5  |
| 3. Prerequisites for Studying the Discipline .....                                        | 5  |
| 4. Expected Learning Outcomes.....                                                        | 5  |
| 5. Academic Discipline Programme .....                                                    | 6  |
| 6. Teaching Methods, Learning-Outcome Assessment Tools and Demonstration<br>Methods ..... | 11 |
| 7. Forms of Current and Final Assessment.....                                             | 12 |
| 8. Criteria for Assessing Learning Outcomes.....                                          | 15 |
| 9. Tools, Equipment and Software.....                                                     | 15 |
| 10. Recommended Information Sources.....                                                  | 16 |

# INTRODUCTION

## Abstract

The academic discipline “Protection and Development of Large-Scale Wetlands” is aimed at developing students’ systematic knowledge of the structure, functions, protection, monitoring, restoration, and sustainable management of wetlands. The course covers international and national wetland-protection frameworks, ecosystem functions, plant and animal biodiversity, the effects of pollutants and microplastics, and modern approaches to assessing the ecological status of surface water bodies in accordance with European Union water-policy requirements.

Particular attention is paid to the inventory and monitoring of wetland biological resources, the use of GIS, satellite and climate data, the assessment of flood and climate risks, nature-based solutions, riparian landscape restoration, and the rehabilitation of degraded wetland and aquatic ecosystems. The course has an applied focus and includes practical assignments in bioindication, water-quality assessment, microplastic spectral analysis, spatio-temporal monitoring, and the justification of sustainable river-basin management measures.

Keywords: wetlands, biodiversity, water quality, microplastics, environmental monitoring, remote sensing, flood risk, ecosystem restoration, climate change.

## 1. DESCRIPTION OF THE ACADEMIC DISCIPLINE

|                                               |                                                                                                           |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Higher education degree                       | Master’s degree                                                                                           |
| Elective-course list                          | Elective Course 4                                                                                         |
| Year of study, semester                       | Year 1, Semester 2                                                                                        |
| Language(s) of instruction                    | English                                                                                                   |
| Mode of study                                 | Full-time                                                                                                 |
| Course workload, credits/hours                | 6 ECTS credits / 180 hours                                                                                |
| <b>Distribution of hours by type of study</b> |                                                                                                           |
| Full-time mode                                | Lectures – 30; practical classes – 30; independent work – 120                                             |
| Part-time mode                                | —<br>—                                                                                                    |
| Form of assessment                            | Pass/fail assessment                                                                                      |
| Working-programme webpage                     | <a href="https://nuos.edu.ua/studentu/vibirkovi-kursi/">https://nuos.edu.ua/studentu/vibirkovi-kursi/</a> |

**\*In accordance with Clause 2.4 of the Regulations on Elective Disciplines at Admiral Makarov National University of Shipbuilding.**

## **2. AIM OF THE ACADEMIC DISCIPLINE**

The aim of the academic discipline “Protection and Development of Large-Scale Wetlands” is to develop students’ systematic knowledge and practical skills in assessing, protecting, monitoring, restoring and sustainably managing wetlands, taking into account their ecosystem functions, biodiversity, anthropogenic pressures and climate-change impacts.

The discipline develops the ability to apply biological, physicochemical, geoinformation and remote-sensing methods; assess water quality and the ecological status of water bodies; analyse pollution, microplastics, flood and climate risks; and design nature-based measures for restoration, rehabilitation and climate-resilient management of wetland ecosystems within river basins.

## **3. PREREQUISITES FOR STUDYING THE DISCIPLINE**

There are no prerequisites for studying the discipline.

## **4. EXPECTED LEARNING OUTCOMES**

The academic discipline is intended to develop the following learning outcomes:

- identify the main types, structure, functions and ecosystem services of wetlands, as well as international and national frameworks for their protection and sustainable use;
- explain the functioning of plant and animal communities in wetland ecosystems and the effects of anthropogenic, hydrological and climatic factors on their resilience;
- apply approaches to assessing water quality and the ecological status of surface water bodies using physicochemical and biological indicators in accordance with the principles of the EU Water Framework Directive;
- identify major sources of pollution in aquatic and wetland ecosystems, analyse risks associated with microplastics and interpret instrumental-analysis results;
- use GIS, satellite imagery, spectral indices and open information resources for wetland inventory, mapping and spatio-temporal monitoring;
- assess climate-change impacts on hydrological regimes and flood frequency and intensity, and justify nature-based measures for reducing flood risk.

## **5. ACADEMIC DISCIPLINE PROGRAMME**

### **Content Module 1. Ecological Foundations, Biodiversity and Assessment of Wetland Condition**

Topic 1. Protection of Large-Scale Wetlands [1–4].

Topic 2. Ecology of Wetlands in the Context of Important Functions [1, 2, 4].

Topic 3. Plant Biodiversity as a Keystone for Wetland Ecosystem Stability [1, 2].

Topic 4. Wetland Fauna: Its Role in Biodiversity Conservation and Environmental Education [1, 2].

Topic 5. Pollutants in Water and Wetland Ecosystems [2, 4, 5].

Topic 6. Microplastics in Aquatic Ecosystems: Sources, Impacts and Solutions [2, 4, 5].

Topic 7. EU Water Directives: Monitoring the Condition of Water Bodies [5].

### **Content Module 2. Monitoring, Restoration and Climate-Resilient Wetland Management**

Topic 8. Monitoring the State of Wetland Biological Resources [1, 2, 5].

Topic 9. Application of Wetland Bioresources Monitoring for Sustainable Management and Resilience [1, 3, 5].

Topic 10. Impact of Climate Change on Flood Frequency and Intensity [6, 7].

Topic 11. Strategies for Sustainable Flood Protection and Risk Management [3, 6, 7].

Topic 12. Riparian Landscape Restoration [1, 3].

Topic 13. Conservation and Restoration of Aquatic Ecosystems [1, 3, 5].

Topic 14. Wetland Restoration and Rehabilitation Measures [1, 3].

Topic 15. Wetlands in the Context of Climate Change Adaptation and Sustainable Development [2, 3, 7].

## Thematic Plan of the Academic Discipline

| Content modules and topics                                                                        | Number of hours |           |           |          |           |           |           |          |          |          |
|---------------------------------------------------------------------------------------------------|-----------------|-----------|-----------|----------|-----------|-----------|-----------|----------|----------|----------|
|                                                                                                   | full-time       |           |           |          |           | part-time |           |          |          |          |
|                                                                                                   | total           | including |           |          |           | total     | including |          |          |          |
|                                                                                                   |                 | lec.      | prac.     | lab.     | indep.    |           | lec.      | prac.    | lab.     | indep.   |
| 1                                                                                                 | 2               | 3         | 4         | 5        | 6         | 7         | 8         | 9        | 10       | 11       |
| <b>Content Module 1. Ecological Foundations, Biodiversity and Assessment of Wetland Condition</b> |                 |           |           |          |           |           |           |          |          |          |
| Topic 1. Protection of Large-Scale Wetlands                                                       | 13              | 2         | 2         | -        | 9         | -         | -         | -        | -        | -        |
| Topic 2. Ecology of Wetlands in the Context of Important Functions                                | 13              | 2         | 2         | -        | 9         | -         | -         | -        | -        | -        |
| Topic 3. Plant Biodiversity as a Keystone for Wetland Ecosystem Stability                         | 13              | 2         | 2         | -        | 9         | -         | -         | -        | -        | -        |
| Topic 4. Wetland Fauna: Its Role in Biodiversity Conservation and Environmental Education         | 12              | 2         | 2         | -        | 8         | -         | -         | -        | -        | -        |
| Topic 5. Pollutants in Water and Wetland Ecosystems                                               | 13              | 2         | 2         | -        | 9         | -         | -         | -        | -        | -        |
| Topic 6. Microplastics in Aquatic Ecosystems: Sources, Impacts and Solutions                      | 13              | 2         | 2         | -        | 9         | -         | -         | -        | -        | -        |
| Topic 7. EU Water Directives: Monitoring the Condition of Water Bodies                            | 13              | 2         | 2         | -        | 9         | -         | -         | -        | -        | -        |
| <i>Total for Content Module 1</i>                                                                 | <b>90</b>       | <b>14</b> | <b>14</b> | <b>-</b> | <b>62</b> | <b>-</b>  | <b>-</b>  | <b>-</b> | <b>-</b> | <b>-</b> |
| <b>Content Module 2. Monitoring, Restoration and Climate-Resilient Wetland Management</b>         |                 |           |           |          |           |           |           |          |          |          |
| Topic 8. Monitoring the State of Wetland Biological Resources                                     | 11              | 2         | 2         | -        | 7         | -         | -         | -        | -        | -        |
| Topic 9. Application of Wetland Bioresources Monitoring for Sustainable Management and Resilience | 11              | 2         | 2         | -        | 7         | -         | -         | -        | -        | -        |
| Topic 10. Impact of Climate Change on Flood Frequency and Intensity                               | 11              | 2         | 2         | -        | 7         | -         | -         | -        | -        | -        |
| Topic 11. Strategies for Sustainable Flood Protection and Risk Management                         | 12              | 2         | 2         | -        | 8         | -         | -         | -        | -        | -        |
| Topic 12. Riparian Landscape Restoration                                                          | 12              | 2         | 2         | -        | 8         | -         | -         | -        | -        | -        |
| Topic 13. Conservation and Restoration of Aquatic Ecosystems                                      | 11              | 2         | 2         | -        | 7         | -         | -         | -        | -        | -        |

| Content modules and topics                                                                 | Number of hours |           |           |          |            |           |           |          |           |           |
|--------------------------------------------------------------------------------------------|-----------------|-----------|-----------|----------|------------|-----------|-----------|----------|-----------|-----------|
|                                                                                            | full-time       |           |           |          |            | part-time |           |          |           |           |
|                                                                                            | total           | including |           |          |            | total     | including |          |           |           |
|                                                                                            |                 | lec.      | prac.     | lab.     | indep.     |           | lec.      | prac.    | lab.      | indep.    |
| <b>1</b>                                                                                   | <b>2</b>        | <b>3</b>  | <b>4</b>  | <b>5</b> | <b>6</b>   | <b>7</b>  | <b>8</b>  | <b>9</b> | <b>10</b> | <b>11</b> |
| Topic 14. Wetland Restoration and Rehabilitation Measures                                  | 11              | 2         | 2         | -        | 7          | -         | -         | -        | -         | -         |
| Topic 15. Wetlands in the Context of Climate Change Adaptation and Sustainable Development | 11              | 2         | 2         | -        | 7          | -         | -         | -        | -         | -         |
| <i>Total for Content Module 2</i>                                                          | <b>90</b>       | <b>16</b> | <b>16</b> | -        | <b>58</b>  | -         | -         | -        | -         | -         |
| <i>Total for the course</i>                                                                | <b>180</b>      | <b>30</b> | <b>30</b> | -        | <b>120</b> | -         | -         | -        | -         | -         |

### Practical-Class Topics

| Practical Class Topics                                                                     |                                                                                                                                                         |                 |           |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|
| No.                                                                                        | Topic title                                                                                                                                             | Number of hours |           |
|                                                                                            |                                                                                                                                                         | Full-time       | Part-time |
| Content Module 1. Ecological Foundations, Biodiversity and Assessment of Wetland Condition |                                                                                                                                                         |                 |           |
| 1                                                                                          | Topic 1. Comparison of the Largest Wetland Systems in Europe and the World                                                                              | 2               | -         |
| 2                                                                                          | Topic 2. Assessment of the Impact of Anthropogenic Pressure on the Ecological Functions of Wetlands                                                     | 2               | -         |
| 3                                                                                          | Topic 3. Assessment of Wetland Plant Biodiversity Using Species Richness Indices                                                                        | 2               | -         |
| 4                                                                                          | Topic 4. Contribution of Wetland Fauna to Maintaining Ecological Balance and Preserving Biodiversity                                                    | 2               | -         |
| 5                                                                                          | Topic 5. Assessment of Water Quality Using the Universal Indicator — the Water Pollution Index                                                          | 2               | -         |
| 6                                                                                          | Topic 6. Identification of Microplastics Using Fourier Transform Infrared and Raman Spectroscopy                                                        | 2               | -         |
| 7                                                                                          | Topic 7. Assessment of the Ecological Status of Surface Water Bodies According to the Methodology of the EU Water Framework Directive (WFD, 2000/60/EC) | 2               | -         |
| Total for Content Module 1                                                                 |                                                                                                                                                         | 14              | -         |
| Content Module 2. Monitoring, Restoration and Climate-Resilient Wetland Management         |                                                                                                                                                         |                 |           |
| 8                                                                                          | Topic 8. Inventory and Characterisation of the Main Components of Wetlands                                                                              | 2               | -         |
| 9                                                                                          | Topic 9. Spatio-Temporal Monitoring of Wetlands Using GIS and Satellite Data                                                                            | 2               | -         |
| 10                                                                                         | Topic 10. Assessment of the Impact of Climate Change on Flood Frequency and Intensity                                                                   | 2               | -         |
| 11                                                                                         | Topic 11. Development of a Nature-Based Flood Protection Strategy for a Local Community                                                                 | 2               | -         |
| 12                                                                                         | Topic 12. Riparian Habitat Identification and Typology Mapping                                                                                          | 2               | -         |
| 13                                                                                         | Topic 13. Methods of Aquatic Ecosystem Restoration: Modern Approaches and Technologies                                                                  | 2               | -         |
| 14                                                                                         | Topic 14. Analysis of Pollution Sources and Assessment of Wetland Degradation to Justify Rehabilitation Measures                                        | 2               | -         |
| 15                                                                                         | Topic 15. Assessment of Climate Change Impacts on Wetlands and Their Role in Sustainable River Basin Management                                         | 2               | -         |
| Total for Content Module 2                                                                 |                                                                                                                                                         | 16              | -         |
| Total hours                                                                                |                                                                                                                                                         | 30              | -         |

### Independent-Work Topics

| Independent Work Topics                                                                    |                                                                                                                                                                                         |                 |           |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|
| No.                                                                                        | Topic title                                                                                                                                                                             | Number of hours |           |
|                                                                                            |                                                                                                                                                                                         | Full-time       | Part-time |
| Content Module 1. Ecological Foundations, Biodiversity and Assessment of Wetland Condition |                                                                                                                                                                                         |                 |           |
| 1                                                                                          | Topic 1. International Agreements, National and Regional Efforts, and Educational Activities to Protect Large-Scale Wetlands                                                            | 2               | -         |
| 2                                                                                          | Topic 2. Research into the Role of Wetlands in Maintaining Biodiversity                                                                                                                 | 2               | -         |
| 3                                                                                          | Topic 3. Research of Plant Communities as Bioindicators of Aquatic Environment Quality. Methods of Studying Species Biodiversity of Wetland Plants                                      | 2               | -         |
| 4                                                                                          | Topic 4. Study of Animal Indicators of the Ecological State of Wetlands                                                                                                                 | 2               | -         |
| 5                                                                                          | Topic 5. Methods of Surface Water Quality Assessment                                                                                                                                    | 2               | -         |
| 6                                                                                          | Topic 6. Methods of Microplastic Identification in Aquatic Systems and Their Potential Impact on Human Health                                                                           | 2               | -         |
| 7                                                                                          | Topic 7. Monitoring and Evaluation of the Ecological Status of Surface Water Bodies in Accordance with the Principles and Requirements of the EU Water Framework Directive (2000/60/EC) | 2               | -         |
| Total for Content Module 1                                                                 |                                                                                                                                                                                         | 14              | -         |
| Content Module 2. Monitoring, Restoration and Climate-Resilient Wetland Management         |                                                                                                                                                                                         |                 |           |
| 8                                                                                          | Topic 8. Review of Open Information Resources and Databases for Wetland Research                                                                                                        | 2               | -         |
| 9                                                                                          | Topic 9. Monitoring Changes in Wetland Vegetation and Water Surfaces Using Satellite Data                                                                                               | 2               | -         |
| 10                                                                                         | Topic 10. Assessment of Climate Change Impacts on Flood Regimes and Risk Management Strategies                                                                                          | 2               | -         |
| 11                                                                                         | Topic 11. Sustainable Flood Risk Management: From Structural Protection to Resilience-Based Approaches                                                                                  | 2               | -         |
| 12                                                                                         | Topic 12. Critical Review of Riparian Restoration Failures                                                                                                                              | 2               | -         |
| 13                                                                                         | Topic 13. The Impact of Climate Change on the Condition of Aquatic Ecosystems                                                                                                           | 2               | -         |
| 14                                                                                         | Topic 14. Review of Modern Approaches and Successful Practices in Wetland Restoration                                                                                                   | 2               | -         |
| 15                                                                                         | Topic 15. Review of Open Climate Information Resources and Databases                                                                                                                    | 2               | -         |
| Total for Content Module 2                                                                 |                                                                                                                                                                                         | 16              | -         |
| Total hours                                                                                |                                                                                                                                                                                         | 30              | -         |

### Independent Work

Distribution of independent-work hours for full-time students:

- preparation for lectures – 1 hour per lecture;
- preparation for practical classes – 2 hours per class;
- preparation for assessment activities – 30 hours per assessment.

### Independent-Work Tasks

| No.          | Task                                            | Number of hours |           |
|--------------|-------------------------------------------------|-----------------|-----------|
|              |                                                 | Full-time       | Part-time |
| 1            | Preparation for lectures                        | 15              | -         |
| 2            | Preparation for practical classes               | 30              | -         |
| 3            | Preparation for current module assessment       | 15              | -         |
| 4            | Independent study of selected discipline topics | 30              |           |
| 5            | Preparation for the final pass/fail assessment  | 30              | -         |
| <b>Total</b> |                                                 | 120             | -         |

## 6. TEACHING METHODS, LEARNING-OUTCOME ASSESSMENT TOOLS AND DEMONSTRATION METHODS

Teaching methods include:

for all types of classes:

- working with scientific, regulatory and methodological literature, international databases and open geospatial resources;
- explanation – systematic presentation of relationships among hydrological, biological, physicochemical and socio-economic processes in wetland ecosystems;
- discussion – consideration of wetland protection, restoration, climate adaptation and sustainable-use issues;
- case-study method – analysis of real cases of degradation, pollution, flooding, restoration and wetland management;

for lectures:

- problem-based lecture – presentation of theoretical material through ecological and management problems requiring integrated analysis;
- visualisation – use of maps, satellite imagery, spectra, graphs, diagrams, video materials and digital models;
- analysis of international experience – comparison of wetland protection, monitoring and restoration approaches in different countries and river basins;

for practical classes:

- practical work – completion of bioindication, calculation, laboratory-analytical, geoinformation and remote-sensing tasks;

- project-based method – development of maps, analytical reports, nature-based solutions, rehabilitation plans and risk-management measures.

Learning outcomes are assessed and demonstrated through practical-work reports; thematic maps and analytical tables; interpretation of spectra and satellite data; justification of nature-based and restoration solutions; a module test; and a final pass/fail assessment.

## **7. FORMS OF CURRENT AND FINAL ASSESSMENT**

Student achievement is assessed using the University's 100-point grading system.

The final course grade comprises current-assessment results and the final pass/fail assessment. Each component has a defined weighting in the overall grading system. A student may earn up to 60 points for current work, including practical assignments and the current module assessment.

The final pass/fail assessment accounts for 40 points. The final course grade is the sum of the points awarded for current work and the final assessment.

Current assessment is conducted during every practical class and on the basis of completed independent-work tasks. It evaluates students' theoretical preparation for the relevant topic, including independently studied material, and the practical skills acquired while completing practical assignments.

Course credits may be awarded only after the learning outcomes specified in the working programme have been achieved, as confirmed by one of the positive grades established under applicable regulations.

## Forms and Grading of Student Learning Assessment

### Practical Classes

| Points                                                                          | Assessment criteria                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3                                                                               | The work is completed independently and submitted by the deadline; the aim and tasks are clearly formulated. The student independently identifies the type of task and an appropriate method of completion. The report meets the requirements and contains well-supported conclusions. |
| 2                                                                               | The work is completed independently but submitted after the deadline. The student follows the instructions, occasionally requiring consultation with the lecturer. The report meets the requirements.                                                                                  |
| 1                                                                               | The work is submitted after the deadline and completed under the lecturer's guidance. The report contains inaccuracies in the conclusions and errors.                                                                                                                                  |
| 0                                                                               | The work was not completed.                                                                                                                                                                                                                                                            |
| <i>Maximum score for this component: 45 points (15 assignments × 3 points).</i> |                                                                                                                                                                                                                                                                                        |

### Current Module Assessment in the Form of a Test

| Correct answers, %                                                                     | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|----------------------------------------------------------------------------------------|-----|----|----|----|----|----|----|----|----|----|
| Points                                                                                 | 15  | 14 | 12 | 11 | 9  | 8  | 6  | 5  | 3  | 2  |
| <i>Maximum score for this component (full-time mode): 15 points (one module test).</i> |     |    |    |    |    |    |    |    |    |    |

### Final Pass/Fail Assessment

The final assessment consists of written responses to test items and two control questions.

#### Test (20 points)

| Correct answers, % | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|--------------------|-----|----|----|----|----|----|----|----|----|----|
| Points             | 20  | 18 | 16 | 14 | 12 | 10 | 8  | 6  | 3  | 1  |

### Control Question (1 question – 10 points)

| Points | Assessment criteria                                                                                                                                                 |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9-10   | A correct answer demonstrating knowledge of the material, logical presentation, relevant examples and calculations where required, and a well-supported conclusion. |
| 7-8    | A correct answer with some lack of logical sequence.                                                                                                                |
| 5-6    | A correct answer, but the presentation is inconsistent and lacks examples and justification of the conclusion.                                                      |
| 3-4    | An incorrect answer that nevertheless demonstrates partial knowledge of the material and command of the main terms.                                                 |
| 1-2    | The answer is incorrect.                                                                                                                                            |
| 0      | No answer is provided.                                                                                                                                              |

| Form of assessment           | Maximum points            |           |
|------------------------------|---------------------------|-----------|
|                              | Full-time                 | Part-time |
| Practical-class work         | 15 × 3 points = 45 points | -         |
| Current module assessment    | 1 × 15 points = 15 points | -         |
| Final assessment (pass/fail) | 40 points                 | -         |
| <b>Total</b>                 | <b>100 points</b>         | -         |

## 8. CRITERIA FOR ASSESSING LEARNING OUTCOMES

| Programme element         |     | Full-time                   |            | Part-time    |        |
|---------------------------|-----|-----------------------------|------------|--------------|--------|
|                           |     | Type of work                | Points     | Type of work | Points |
| CM 1                      | T1  | Practical Assignment No. 1  | 3          | —            | —      |
|                           | T2  | Practical Assignment No. 2  | 3          | —            | —      |
|                           | T3  | Practical Assignment No. 3  | 3          | —            | —      |
|                           | T4  | Practical Assignment No. 4  | 3          | —            | —      |
|                           | T5  | Practical Assignment No. 5  | 3          | —            | —      |
|                           | T6  | Practical Assignment No. 6  | 3          | —            | —      |
|                           | T7  | Practical Assignment No. 7  | 3          | —            | —      |
| Current module assessment |     | Test items                  | 15         | —            | —      |
| CM 2                      | T8  | Practical Assignment No. 8  | 3          | —            | —      |
|                           | T9  | Practical Assignment No. 9  | 3          | —            | —      |
|                           | T10 | Practical Assignment No. 10 | 3          | —            | —      |
|                           | T11 | Practical Assignment No. 11 | 3          | —            | —      |
|                           | T12 | Practical Assignment No. 12 | 3          | —            | —      |
|                           | T13 | Practical Assignment No. 13 | 3          | —            | —      |
|                           | T14 | Practical Assignment No. 14 | 3          | —            | —      |
|                           | T15 | Practical Assignment No. 15 | 3          | —            | —      |
| Final assessment          |     | Pass/fail assessment        | 40         | —            | —      |
| <b>Total points</b>       |     | <b>-</b>                    | <b>100</b> | —            | —      |

## 9. TOOLS, EQUIPMENT AND SOFTWARE

1. Multimedia projection equipment and computers or laptops with Internet access and facilities for working with presentation and cartographic materials.
2. Software and online platforms: Microsoft Office or equivalent software, QGIS/Ar-cGIS, Copernicus Data Space Browser, Copernicus Climate Data Store, NASA POWER and GloFAS.
3. Methodological materials, satellite and climate data, educational water-quality datasets, FTIR and Raman spectra, regulatory documents and library resources.

## **10. RECOMMENDED INFORMATION SOURCES**

### **Core Literature**

1. Mitsch, W. J., & Gosselink, J. G. (2015). *Wetlands* (5th ed.). John Wiley & Sons.
2. Millennium Ecosystem Assessment. (2005). *Ecosystems and Human Well-being: Wetlands and Water Synthesis*. World Resources Institute.
3. Ramsar Convention Secretariat. (2002). *Principles and Guidelines for Wetland Restoration* (Resolution VIII.16). Ramsar Convention on Wetlands.
4. UNESCO World Water Assessment Programme. (2023). *The United Nations World Water Development Report 2023: Partnerships and Cooperation for Water*. UNESCO.
5. European Parliament and Council. (2000). Directive 2000/60/EC establishing a framework for Community action in the field of water policy (Water Framework Directive). Official Journal of the European Communities.
6. European Parliament and Council. (2007). Directive 2007/60/EC on the assessment and management of flood risks. Official Journal of the European Union.
7. Intergovernmental Panel on Climate Change. (2023). *Climate Change 2023: Synthesis Report*. IPCC.

### **Supplementary Literature**

1. Andriienko, T. L. (2006). *Wetlands and Peatlands of Ukraine: Monograph*. Kyiv: Naukova Dumka. (in Ukrainian)
2. Khilchevskyi, V. K. (2022). *Hydroecological Aspects of Wetland Monitoring: Textbook*. Kyiv: Obrii. (in Ukrainian)
3. United Nations Environment Programme, & Food and Agriculture Organization of the United Nations. (2021). *Ecosystem Restoration for People, Nature and Climate*. UNEP and FAO.
4. Camprodon, J., Guardis, P., & Ordeix, M. (Eds.). (2022). *Technical Handbook for the Conservation and Restoration of Riparian Areas*. Forest Science and Technology Centre of Catalonia.
5. Khan, M. H. R. B., et al. (2023). Evaluation of the surface water quality using global water quality index models: Perspective of river water pollution. *Scientific Reports*. <https://doi.org/10.1038/s41598-023-47137-1>
6. Jaywant, S. A., & Arif, K. M. (2024). Remote sensing techniques for water quality monitoring: A review. *Sensors*, 24, 8041. <https://doi.org/10.3390/s24248041>
7. Primpke, S., Wirth, M., Lorenz, C., & Gerdts, G. (2018). Reference database design for the automated analysis of microplastic samples based on FTIR spec-

troscopy. *Analytical and Bioanalytical Chemistry*, 410(21), 5131–5141.  
<https://doi.org/10.1007/s00216-018-1156-x>

### **Online Information Resources**

1. Convention on Wetlands (Ramsar Convention) – official documents, guidance and the Global Wetland Outlook. URL: <https://www.ramsar.org/>
2. Ramsar Sites Information Service (RSIS) – the official global database of wetlands of international importance. URL: <https://rsis.ramsar.org/>
3. European Environment Agency – data and reports on water, biodiversity, climate risks and ecosystem restoration. URL: <https://www.eea.europa.eu/>
4. Copernicus Data Space Ecosystem – access to Sentinel satellite data and Earth-observation analysis tools. URL: <https://dataspace.copernicus.eu/>
5. Copernicus Climate Data Store and Global Flood Awareness System – climate reanalysis, projections and flood monitoring. URL: <https://cds.climate.copernicus.eu/>; <https://global-flood.emergency.copernicus.eu/>
6. NASA POWER – global meteorological and solar-energy datasets for environmental and climate analysis. URL: <https://power.larc.nasa.gov/>
7. Water Code of Ukraine and other legal instruments governing water protection and use. URL: <https://zakon.rada.gov.ua/laws/show/213/95-%D0%B2%D1%80#Text>