MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
ODESSA NATIONAL UNIVERSITY NAMED I. I. MECHNYKOV
Department of Marine Geology, Hydrogeology, Engineering Geology and Paleontology

"ЗАТВЕРДЖУЮ"
Проректор з науково-педагогічної роботи
_____ Олександр ЗАПОРОЖЧЕНКО
"___" _____ 2022 р.

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE

Engineering and geological processes of the Azov-Black Sea Basin Coastal Zone.
(name of academic discipline)

Level of higher education: __ Third (educational and scientific)_____
Field of knowledge: ___Natural sciences_____
Specialty: __103 "Earth Sciences"_____
(code and name of specialty(s)
Educational & professional/scientific program: __Earth Sciences_

ONU
2022

Work program of the educational discipline "Engineering and geological processes of the Azov-Black Sea basin coastal zone". – Odesa: ONU, 2022. – 12 p.

Developer: Kadurin S.V., PhD in Geology, Associate Professor of the Department Of Marine Geology, Hydrogeology, Engineering Geology and Paleontology.

The Work Program was approved at the meeting of the department

Protocol No. 1 from 1 September 2022

Head of Department _____ (_Євген ЧЕРКЕЗ_)
(signature) (First Name, Surname)

Agreed with the OPP/ONP guarantor _____ (Valentina YANKO)
(First Name, Surname)

Approved by the educational and methodological commission (EMC) of the __Geology-Geography__ Faculty

Protocol No. 1 from 2 September 2022.

Head of EMC _____ (Vitaly SYCH)
(signature) (First Name, Surname)

Revised and approved at the meeting of the Department _____

Protocol No. __ dated "__" _____ 20__ year

Head of Department _____ (_____)
(signature) (First Name, Surname)

Revised and approved at the meeting of the Department _____

Protocol No. __ dated "__" _____ 20__ year

Head of Department _____ (_____)
(signature) (First Name, Surname)

1. Description of the academic discipline

<table>
<tr><td rowspan="2">Name of indicators</td><td rowspan="2">Field of knowledge, direction of training, educational and qualification leve</td><td colspan="2">Characteristics of the academic discipline</td></tr>
<tr><td>full-time education</td><td>evening form of study</td></tr>
<tr><td rowspan="2">Number of credits – 3</td><td>Branch of knowledge
10 Natural sciences
(code and name)</td><td colspan="2" rowspan="2">Selective</td></tr>
<tr><td>Specialty
_ 103 Earth Sciences __
(code and name)</td></tr>
<tr><td>Modules – 3</td><td rowspan="4">Specialization
"Hydrogeology and engineering geology"</td><td colspan="2">year of training:</td></tr>
<tr><td>Content modules – 3</td><td>2-d</td><td>-d</td></tr>
<tr><td>An individual research task: not provided</td><td colspan="2">Semester</td></tr>
<tr><td rowspan="2">Total hours - 90</td><td>3-d</td><td>-d</td></tr>
<tr><td rowspan="11">Weekly hours for full-time education:
classrooms - 4
student's independent work - 5</td><td rowspan="11">Education level:
Philosophy Doctor</td><td colspan="2">Lectures</td></tr>
<tr><td>12 hours</td><td>hours</td></tr>
<tr><td colspan="2">Practical, seminar</td></tr>
<tr><td>10 hours</td><td>hours</td></tr>
<tr><td colspan="2">Laboratory</td></tr>
<tr><td>- hours</td><td>hours</td></tr>
<tr><td colspan="2">Individual work</td></tr>
<tr><td>68 hours</td><td>hours</td></tr>
<tr><td colspan="2">Individual tasks: not provided</td></tr>
<tr><td colspan="2">Type of control:
test</td></tr>
</table>

Tasks: are to introduce students to:
• The subject of marine engineering geology, with its connection with other natural sciences, with the history and current state of marine geological and engineering geological research, with the role of marine engineering geology in complex research and development of sea shelves;
• The main features of the relief and features of the structure of the earth's crust under the seas and oceans;
• General characteristics of the planetary morphostructures of the bottom of the world ocean;
• Geodynamic processes on the shelf and coastal strip of the Black and Azov seas;
• Marine sediments and marine sedimentation processes of the coast of the Black and Azov seas;
• The main regularities of the development of sea shores and the coastal zone of the sea;
• Methods of field work in the coastal zone to study patterns of development of the coastal zone, to study the regime of sediments;
• Peculiarities of engineering and geological research in oceans and seas;
• The composition of engineering and geological studies during the construction of ports, shore fortification structures, offshore oil and gas industry facilities, operational drilling platforms of various types;
• Environmental protection during engineering research in the water area.

The process of studying the discipline is aimed at forming elements of the following **competencies**:
1. **General competences (GC)**
GC 01. Ability to abstract thinking, analysis and synthesis.
GC 04. The ability to generate new ideas (creativity).
GC 07. Ability to communicate on professional topics with experts from other fields.
2. **Special (professional) competences (SC)**
SC 03. The ability to identify, pose and solve research problems in the field of marine geology, paleontology, engineering geology, hydrogeology), evaluate and ensure the quality of the performed research.
SC 04. Ability to initiate, develop and implement complex innovative projects in geology and related interdisciplinary projects, leadership during their implementation.
SC 05. Ability to use the latest information and communication technologies, specialized software in scientific and educational activities.
SC 06. The ability to formulate a scientific problem, working hypotheses of the investigated problem, which involves deep rethinking, application of existing fundamental and creation of new integral knowledge.

Expected learning outcomes.
The final program learning outcomes (LP), the formation of which contributes
educational discipline "Engineering and geological processes of the Azov-Black Sea basin coastal zone "

LO 01. Conceptual scientific and practical knowledge of the latest directions of geological research and their critical understanding for the expansion of the information space and the formation of professional consciousness.
LO 05. Basic knowledge of the methods of scientific research in marine geology, paleontology, engineering geology, hydrogeology and the ability to use them at the appropriate scientific level.
LO 09. Openness to other sciences by including in one's own research elements of sciences related to geology (physics, biology, chemistry, etc.) and using interdisciplinary approaches.
LO 11. Communicating with domestic and foreign colleagues and the public in a dialogue mode in compliance with the ethics of business communication.

As a result of studying the academic discipline, the student must
know:
- Types of the earth's crust under the seas and oceans;
- Planetary morphostructures of the bottom of the world ocean and their characteristics;
- Peculiarities of manifestation of earthquakes, volcanism and gravitational processes in the World Ocean;
- Factors, regularities and features of sediment accumulation on the bottom of oceans and seas, types of sedimentation, formation of physical and mechanical properties of bottom sediments;
- Terminology of the main elements of the coastal zone;
- Methods and technical means of engineering-geological research of bottom soils in natural occurrence;
- Peculiarities of the conditions for engineering and geological surveying in oceans and seas;
- Composition of engineering and geological explorations on the continental shelf;
- Basic requirements for the production of engineering and geological investigations in areas of soil development with special properties.

be able:
• To determine the main and characteristic features of the geomorphological and geological structure of the seas and oceans;
• To use theoretical knowledge during engineering and geological searches in the coastal zone and sea shelf;
• Apply the rules, requirements, methods of engineering and geological research in water areas and the coastal zone of seas and oceans;
• Independently make decisions regarding the optimal location and design of buildings and structures in the coastal zone of the sea;
• Choose sets of measures aimed at ensuring the operational reliability of buildings and structures in the presence of unfavorable engineering and geological processes in the coastal zone;
• Build a relief map of the seabed;
• Build lithological-geological and engineering-geological maps of the selected area of the shelf;

• Perform data processing of physical and mechanical properties of bottom sediments;
• Draw up a program of engineering and geological investigations for the construction of structures in the coastal zone and on the continental shelf;
• Determine the category of complexity of engineering and geological conditions on the shelf.

3. Program of academic discipline

Content module 1. Basic regularities of the development of sea shores and the coastal zone of the sea.
Topic 1. Coastal zone. Terminology of the main elements of the coastal zone. Geomorphological elements of the coastal zone. Dynamic areas of the coastal zone. Elements of hydrodynamics and summer dynamics of the coastal zone. Sediment balance in the coastal zone. Coastal currents. Types of currents. Along coastal sediment flows. Flow parameters. Engineering and geological significance along coastal sediment flows.
Topic 2. Coastal erosion and destruction. Assessment of the threat of coastal erosion. Measures and structures to protect shores from destruction.
Topic 3. Arrival and distribution and differentiation of sedimentary material in the coastal zone of the seas. General remarks about marine sediments and processes of marine sedimentation. Classification of marine sediments. Arrival of terrigenous, chemogenic, soluble, volcanogenic, biogenic material and cosmic dust. The main types of sedimentation in the coastal zone of the seas.

Content module 2. Engineering and geological research in oceans and seas.
Topic 1. Geological and engineering-geological survey of the seabed. The role of engineering-geological surveying in the performance of marine engineering-geological research. Scales of engineering and geological surveys. Peculiarities of conditions for shooting in oceans and seas. Depth measurement methods. Construction of bathymetric maps. Electrical intelligence. Underwater geological mapping. Seismic profiling. Radiometric measurements. Aerial photography and photography of the seabed.
Topic 2. Exploratory work during engineering and geological research on the shelf. Methods and technical means of engineering and geological research of bottom sediments in a natural setting. Offshore drilling. Geophysical methods during engineering and geological searches in the sea. Sampling and obtaining samples of bottom sediments. Field methods of engineering and geological research of bottom soils.
Topic 3. Engineering and geological surveys for the construction of objects on the continental shelf. General regulations for conducting engineering and geological surveys in marine water areas. Composition of engineering surveys for the construction of objects on the continental shelf. Requirements for geotechnical investigations in the areas of distribution of soils with special properties. Lithodynamic studies. Requirements for the composition and content of a scientific and technical report (conclusion) on engineering and geological research on the continental shelf. Determination of the category of complexity of engineering and geological conditions

on the shelf. Environmental protection during engineering and geological research in the water area.

Content module 3. Geological and engineering-geological structure of the coastal zone of the Azov-Black Sea basin.

Topic 1. Geological structure of the Black and Azov seas. Tectonic structure and history of geological formation of the Azov-Black Sea basin. Peculiarities of sediment accumulation on the Black Sea shelf and a series of Pliocene-Quaternary transgressive-regressive cycles in the formation of bottom sediments in the coastal part of the Black and Azov seas.

Topic 2. Geomorphology and types of the shores of the Black and Azov seas. Abrasive, accumulative and transit processes in the coastal strip of the Black and Azov seas. Characteristic morphological forms for each complex of processes. Their spatial distribution within the coastal strip.

Topic 3. Engineering and geodynamic processes in the coastal strip. Formation of an equilibrium underwater coastal slope in different coastal conditions. Processes of erosion and accumulation of bottom sediments. Construction in the coastal regions of the Black and Azov seas. Laying fairways and forming dredging soil dumping zones in the coastal part.

4. The structure of the academic discipline

Names of content modules and topics	Number of hours											
	Full-time						Extramural form					
	In all	including					In all	including				
		L	p	lab	ind	i.w		L	p	lab	ind	i.w
1	2	3	4	5	6	7	8	9	10	11	12	13
Content module 1. Basic regularities of the development of sea shores and the coastal zone of the sea.												
Topic 1. Coastal zone.		2	2			8						
Topic 2. Coastal erosion and destruction.		2	2			8						
Topic 3. Arrival and distribution and differentiation of sedimentary material in the coastal zone of the seas.		2				6						
Together by content module 1		6	4			22						
Content module 2. Engineering and geological research in oceans and seas.												
Topic 1. Geological and		2	2			6						

engineering-geological survey of the seabed.												
Topic 2. Exploratory work during engineering and geological research on the shelf.		2	2			6						
Topic 3. Engineering and geological surveys for the construction of objects on the continental shelf.		2	2			6						
Together by content module 2		6	6			18						
Content module 3. Geological and engineering-geological structure of the coastal zone of the Azov-Black Sea basin.												
Topic 1. Geological structure of the Black and Azov seas.		1				6						
Topic 2. Geomorphology and types of the shores of the Black and Azov seas.		1	2			6						
Topic 3. Engineering and geodynamic processes in the coastal strip.		2	2			8						
Together by content module 3		4	4			20						
Hours at all	90	16	14			60						

5. **Topics of seminar classes**

not provided

6. **Topics of practical classes**

№	Topic name	Hours
1	Construction of a seabed relief map and profiles.	2

	Determination of the main elements of the relief.	
2	Construction of a lithological and geological map of the shelf area.	2
3	Report on the materials of the article (research)	2
4	Data processing of physical and mechanical properties of bottom sediments	4
5	Video films about modern research of the ocean floor and the world experience of coastal protection of sea coasts.	4
	In all	14

7. Topics of laboratory classes

not provided

8. Individual work

Individual work of students (IWS) includes the following types of work:
The student's individual work with a synopsis and literature on all topics of the normative course
The student's individual work on a specific topic of the normative course in the classroom under the guidance of the teacher.
Self-monitoring by students of acquired knowledge from the discipline program with the help of tests recommended by the department.

№	Topic name	Hours
1	Features of the structure of the earth's crust under the seas and oceans	2
2	Geophysical fields in the ocean	2
3	Geological structure of the shelf	2
4	Mid-ocean ridges. Seismicity and volcanism	2
5	Island arcs. Volcanism and seismicity of island arcs.	2
6	Lithological types of sediments. Rocks of the root base of the shelf and loose marine sediments. Mud, classification of mudes.	2
7	Biogenic deposits	4
8	Natural balance in the coastal zone. Factors of disruption of the natural balance in the coastal zone. Sediment balance in the coastal zone.	4
9	Methodology of field work in the coastal zone. Types of research on the study of the regime of sediments and the dynamics of banks.	4
10	Computational methods of determination along coastal sediment flows.	4
11	Beaches. Composition of beach sands. Impact on beaches of artificial coastal structures.	4
12	Accumulative relief forms, conditions of their formation and	4

	engineering and geological significance	
13	Engineering and geological research of the seabed	4
14	Geophysical methods of seabed research.	4
15	Methods of groundwater sampling	4
16	Additional requirements for searches in areas of distribution of specific soils on the shelf	4
17	Environmental protection during engineering research in the water area	4
18	Industrial resources of the shelf	4
	In all	60

9. Teaching methods

During lectures and practical classes, both verbal and informational and visual and demonstrative teaching methods are used. Slides and tables, atlases, geophysical instruments, maps, profiles and typical sections, computer equipment, etc. are used for illustration.

An important method of learning is solving problems and problem situations by students from geophysical research of geological objects, discussions in practical classes.

10.Forms of control and assessment methods (including criteria for evaluating learning outcomes)

Carrying out current and periodic control of students' knowledge. During the current control, the student can receive the maximum mark (5 points) for each topic of the content module and the maximum mark (20 points) for the control paper. For an independent individual task, the maximum score is 20 points. The credit is assessed on a 100-point scale. The final grade in the academic discipline is the total number of points.

11.Questions for final control

1. The aim and objectives of the course.
2. Place of the course among the courses related to the geology of the Black Sea.
3. Describe the main features of the geology of the Black and Azov seas.
4. Processes forming the relief of continental shelves.
5. Geomorphology of the bottom of the Black Sea.
6. Main geological structures of the bottom of the Black and Azov seas.
7. Tectonic structure of the Black and Azov seas.
8. Bottom sediments of the Black and Azov Seas and their lithological characteristics.
9. Stratigraphy of Quaternary bottom sediments.
10. Chemical composition of bottom sediments.
11. Application of aerial methods for geological research of the seabed.
12. Gravitational and biogenic processes on the shelf.
13. Modern geological processes on the continental slope.

14. Dynamic processes in underwater canyons.
15. Catastrophic waves.
16. Abrasive processes of the northwestern coast of the Black Sea.
17. Geological work of bottom and underwater ocean currents.
18. The geological role of organisms in the World Ocean.
19. The influence of the anthropogenic factor on the engineering and geological conditions of the coastal zone.
20. Sampling and obtaining samples of bottom sediments.
21. Physical and mechanical properties of bottom sediments of the Black Sea.
22. Current state and main problems of hydrogeology of the seabed.
23. Environmental protection during engineering research in the water area.
24. Types of shores of the Black and Azov seas.
25. Beaches. Composition of beach sands.
26. Impact on beaches of artificial coastal structures.
27. Accumulative relief forms, conditions of their formation and engineering and geological significance
28. Tectonic structure of the Black and Azov seas.
29. Quaternary history of geological development of the Azov-Black Sea basin.
30. Formation of the underwater profile of the equilibrium relief.
31. Engineering and geodynamic processes in the coastal zone of the Black and Azov seas.

12.Distribution of points received by students

<table>
<tr><td colspan="9">On-going testing and individual work</td><td></td><td>Summ</td></tr>
<tr><td colspan="3">Content module №1</td><td colspan="3">Content module № 2</td><td colspan="3">Content module № 3</td><td>individual work</td><td></td></tr>
<tr><td>T1</td><td>T2</td><td>T3</td><td>T4</td><td>T5</td><td>T6</td><td>T7</td><td>T8</td><td>T9</td><td rowspan="2">20</td><td rowspan="2">100</td></tr>
<tr><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>5</td><td>5</td></tr>
</table>

Evaluation scale: national and ECTS

<table>
<tr><td rowspan="2">The sum of points for all types of educational activities</td><td rowspan="2">ECTS</td><td colspan="2">Evaluation on a national scale</td></tr>
<tr><td>for an exam, course project (work), practice</td><td>For test</td></tr>
<tr><td>90 – 100</td><td>A</td><td>excellent</td><td rowspan="5">counted</td></tr>
<tr><td>82-89</td><td>B</td><td rowspan="2">good</td></tr>
<tr><td>74-81</td><td>C</td></tr>
<tr><td>64-73</td><td>D</td><td rowspan="2">satisfactorily</td></tr>
<tr><td>60-63</td><td>E</td></tr>
<tr><td>35-59</td><td>FX</td><td>unsatisfactory with the possibility of reassembly</td><td>not counted with the possibility of retaking</td></tr>
<tr><td>0-34</td><td>F</td><td>unsatisfactory with mandatory re-study of the discipline</td><td>not credited with mandatory repeated study of the discipline</td></tr>
</table>

13.Educational and methodological support

The program of the educational discipline, textbooks, engineering and geological maps and explanatory note to them, reference notes of lectures, questions for current and final control of knowledge, illustrative materials, etc.

14.Recommended literature

Basic:

1. Safranov T.A., Chugai A.V., Berlinskyi M.A., Nikipelova O.M., Cherkez E.A., Pedan G.S. and others. (2017) State and quality of the natural environment of the coastal zone of the North-Western Black Sea region: monograph / Kharkiv: FOP Panov A.M., 298 p. (in Ukrainian)
2. Bruun, P., (2004). Coast erosion and the development of beach profiles. Technical Memorandum No. 44, Beach Erosion Board, U.S. Army Corps of Engineers.
3. Waves, tides and shallow water processes. Second Ed. Oxford: The Open University, Butterworth-Heinemann, 1999. 227 p. https://doi.org/10.1016/b978-0-08-036372-1.x5000-4

Additional.

1. Dean, R.G., Dalrymple. R.A., 2004. Coastal Processes with Engineering Applications: Cambridge University Press.
2. Green E.P., Mumby P.J. 2000 Remote Sensing Handbook for Tropical Coastal Management. France, Paris: UNESCO. 316 p.
3. Pedan, G., and Dragomyretska, O. (2019) The spatio-temporal characteristics of dangerous geological processes in the coastal zone of the northwestern Black Sea (Ukraine) // The Third Plenary Meeting and Field Trip of INQUA IFG 1709F POCAS, Tehran and Guilan Province, I.R. Iran, 11-18 October 2019.- P.109-112.
4. Wang, P. and Kraus, N.C., (2005). Beach profile equilibrium and patterns of wave decay and energy dissipation across the surf zone elucidated in a large-scale laboratory experiment. Journal of Coastal Research, 21(3), 522–534.

15.Electronic information resources

1. Collection of documents in information systems (libraries, archives, data banks, etc.)
2. Subscriptions to periodicals (some newspapers and magazines issue their complete electronic copies and provide access to them
3. Access to electronic archives and databases.
4. Information base of the Department of General and Marine Geology of ONU.
5. ONU Scientific Library - 24 Preobrazhenska St
6. Mineral resources of Ukraine. Interactive map - https://minerals-ua.info/mapviewer/goruchi-specd.php?pr=0
7. State Geology and Subsoil Service of Ukraine. Work plans and reporting. - https://www.geo.gov.ua/diyalnist/plany-roboty-ta-zvity/