IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE

Ecology and technology of plant polymers

Hydrology

Working program of the discipline (Syllabus)

Details of the discipline

Level of higher education	***the first (educational and professional)***
Field of study	*10 Natural Sciences*
Speciality	*101 Ecology*
Educational program	*Environmental safety*
Discipline status	*Normative*
Form of study	*full-time/remote/mixed*
Year of preparation, semester	*2 year, 4 semester*
Volume of discipline	*4 ECTS credits (120 hours)*
Semester control/ control measures	*Test*
Schedule of classes	*3 hours a week (2 hours of lectures and 1 hour of practical classes)*
Language of teaching	*Ukrainian*
Information about thecourse instructors / teachers	Lecturer: *https://eco-paper.kpi.ua/pro-kafedru/vykladachi/radovenchik-yaroslav-vyacheslavovich.html* Practical: *https://eco-paper.kpi.ua/pro-kafedru/vykladachi/radovenchik-yaroslav-vyacheslavovich.html*
Course placement	*https://do.ipo.kpi.ua/course/view.php?id=3173*

The program of the discipline

1. Description of the discipline, its purpose, subject of study and learning outcomes

The hydrosphere belongs to the main components of the environment, therefore it significantly affects the general state of the environment and human health. The hydrosphere is of particular importance today, during a period of significant global deterioration in water quality and a shortage of drinking water in many regions of the globe. Water is the main natural resource for both industry and population. Understanding the main processes occurring in the hydrosphere, knowledge and analysis of its components is an integral part of the future specialist in ecology and environmental protection.

The subject of the discipline "Hydrology" *– key processes and factors affecting the formation of various hydrological objects and determine their characteristics.*

The purpose of the discipline "Hydrology"

The purpose of studying the discipline is to form in students a full range of knowledge about the types and characteristics of various water bodies of both natural and artificial origin, the study of the main processes taking place in the hydrosphere and methods of their analysis and control. In accordance with the goal, the preparation of bachelors requires the formation of the following competencies among students:

- *the ability to critically understand basic theories, methods and principles of natural sciences.*

*According to the requirements of the program of the discipline "**Hydrology**", students after mastering it must demonstrate the following learning outcomes:*

- *to understand the basic environmental laws, rules and principles of environmental protection and nature management;*

- *to understand the basic concepts, theoretical and practical problems in the field of natural sciences that are necessary for analysis and decision-making in the field of ecology, environmental protection and optimal use of nature;*
- *to raise the professional level by continuing education and self-education.*

2. Prerequisites and post-requisites of the discipline (place in the structural and logical scheme of training in the relevant educational program)

The study of the discipline "***Hydrology****" is based on the principles of integration of various knowledge gained by students in the study of natural and engineering disciplines. Discipline* "***Gidrology***" *provides disciplines "Design of water use systems", "Technoecology", "Environmental monitoring".*

3. Contents of the course

Section 1. Fundamentals of Hydrology

Topic 1.1. Water is life.

Entry. Theories of water formation. Properties of water and ice. Water resources of the Earth. The water cycle in nature. History of Hydrology. Fundamental concepts of hydrology. Basic laws of movement of natural waters.

Topic 1.2. Hydrology of groundwater.

Groundwater classification. Characteristics of the main types of groundwater. Basic laws of groundwater movement. Formation of groundwater and its connection with surface waters. Water balance in underground horizons. Features of the use of groundwater. Environmental problems of aquifers.

Topic 1.3. Hydrology of rivers.

Basic concepts of river hydrology. Types of rivers and their distribution on Earth. Water balance of the river basin. Fluctuations in river flow. Basic laws of water movement and sediments. The main factors of the change of course. The effect of seasonal temperature changes. The influence of man on river flow. Ecological problems of rivers.

Topic 1.4. Hydrology of lakes.

Lakes, their formation and distribution on Earth. Classification of lakes. The main hydrological processes in the lakes. Balance of water masses of the lake. The main types of reservoirs and their distribution. Water, thermal and ice conditions of reservoirs. The impact of lakes and reservoirs on river flow. Ecological problems of lakes and reservoirs.

Topic 1.5. Hydrology of swamps.

The origin of the marshes and their types. The structure of swamps and the stages of their development Hydrological regime of swamps. The role of swamps in hydrological processes on land. Environmental problems of swamps.

Topic 1.6. Hydrology of glaciers.

The origin of glaciers and their classification. The structure of glaciers and their development. The balance of ice and water in glaciers. The main processes in glaciers. The use of glaciers by man. Ecological problems of glaciers.

Topic 1.7. Hydrology of the seas and oceans.

Seas and oceans, their classification. Waters of the oceans and their properties. The structure and relief of the bottom of the oceans. Bottom sediments. Sea ice, its formation and properties. Water circulation in the oceans. Water level in the seas and oceans. Resources of the oceans and their use by mankind. Ecological problems of the seas and oceans.

Section 2. Basics of hydrometry

Topic 2.1. Measurement of the main parameters of water flows.

Measurement of water levels. Processing of water-measuring observations. Measurement of flow rate. Measurements of depths. Measurement of solid runoff. Determination of water consumption and sediments.

4. Learning Materials and Resources

Basic literature

1. Radovenchyk V.M., Ivanenko O.I., Gomel M.D. Fundamentals of general hydrology and hydrometry / Textbook/ - 2008. – 152 p.

2. O.O. Efremova, O.M. Korzhyk, V.V. Rybak. Fundamentals of Hydrology and Surface Water Protection: Textbook / - Lviv: Novyi Svit 2000 Publishing House, 2019. - 138 p.

3. L.M. Arkhipova, Y.O. Hydrology: textbook. manual / – Ivano-Frankivsk: IFNTUOG, 2015. – 276 p.

4. V.G. Smirnova. Hydrology / textbook / - Kyiv: Condor, 2018. - 170 p.

5. Yushchenko Y.S. General hydrology / textbook for students of higher educational institutions /- Chernivtsi: Chernivtsi National University, 2017. - 591 p.

6. Myskovets I. Y. Fundamentals of general hydrology: a textbook. - Lutsk: LNTU, 2016. – 306 p.

7. Radovenchyk Y.V. Methodical instructions for the implementation of independent work on the discipline "Hydrology" for the direction of training: 6.040106 "Ecology, environmental protection and balanced environmental management". – K.: NTUU "KPI", 2013. – 10 p.

8. Radovenchyk Y.V. Methodical instructions for practical work, performance of independent work and course work on the discipline "Fundamentals of hydrometry" for the direction of training: 6.040106 "Ecology, environmental protection and balanced environmental management". – K.: NTUU "KPI", 2013. – 36 p.

Further reading

9. Hrytsenko A.V. Surface waters of Ukraine and scientific and practical foundations for improving the efficiency of their protection. – Kharkov: RIP "Original", 2004. – 142 p.

10. General hydrology: textbook / V.K. Hilchevsky, O.G. Obodovsky, V.V. Grebin and others. – K.: Publishing and printing center "Kyiv University", 2008. – 399 p.

11. Levkivsky S.S., Khilchevskiy V.K., Obodovsky O.G. and others. General hydrology. – K.: Phytosociocenter, 2000.

10. Goncharov V.V. Hydrology and hydrometry. – K.: KISI, 1999. – 109 p.

11. Peleshenko V.I., Zakrevskiy D.V. Hydrogeology with the basics of engineering geology. – Ch. 1. – K.: VPC "Kyiv University", 2002.

12. Yushchenko Yu.S., Gryn G.I., Masikevych Yu.G. General hydrology. – Chernivtsi: Zelena Bukovyna, 2005.

13. EU Water Framework Directive. 2000/60/EC. Basic terms and their definitions. – K.: 2006.

14. Water management in Ukraine / Ed. A.V. Yatsyk, V.M. Khoreva. – Kyiv: Genesis, 2000.

Information resources on the Internet

15. Ministry of Environmental Protection and Natural Resources of Ukraine - https://mepr.gov.ua/

16. State Water Cadastre - http://geoportal.davr.gov.ua

17. Industrial ecology. Community of environmental specialists - http://www.eco.com.ua/

18. State Agency of Water Resources of Ukraine - https://www.davr.gov.ua/

19. Electronic archive of scientific and educational materials KPI them. Igor Sikorsky - https://ela.kpi.ua/

Educational content

5. Methods of mastering the discipline (educational component)

Lectures

Lectures are aimed at:

- *providing modern, holistic, interdependent knowledge of the discipline "Hydrology", the level of which is determined by the target installation for each specific topic;*
- *ensuring in the process of the lecture the creative work of students together with the teacher;*
- *education of students' professional and business qualities and the development of their independent creative thinking;*
- *formation of students' necessary interest and provision of direction for independent work;*
- *determination at the modern level of development of science in the field of processes in the hydrosphere;*
- *reflection of the methodological processing of the material (selection of the main provisions, conclusions, recommendations, clear and adequate to their formulations);*
- *use to demonstrate visual materials, combine, if possible, with the demonstration of results and samples;*
- *teaching research materials in a clear and high-quality language in compliance with structural and logical connections, explaining all newly introduced terms and concepts;*
- *accessibility for perception by this audience.*

	Title of the lecture topic and list of main questions (list of didactic means, links to literature and tasks on the IWS)
1	***Fundamentals of hydrology. Water is life.*** *Entry. Water is life. Theories of water formation. Properties of water and ice.* ***Literature 1 :[5-15]; 6 [30-46]; 12 [11-16].*** ***Tasks on the IWS.*** *Abnormal properties of water and ice.*
2	***Water resources.*** *Water resources of the Earth. The water cycle in nature. Types of circles of the water cycle. The role of living organisms in the processes of evaporation and transportation of water.* ***Literature 1 :[7-9]; 6 [6-16]; 12 [16-19].*** ***Tasks on the IWS.*** *Water resources of Ukraine, their distribution throughout the state.*

3	***History of Hydrology.*** *History and development of hydrology as a separate science. The connection of hydrology with other natural sciences. Sections of hydrology. Fundamental concepts of hydrology. Basic laws of movement of natural waters.* ***Literature 1 :[17-23]; 5 [41-56]; 12 [16-22].*** ***Tasks on the IWS.*** *History of formation and development of hydrology in Ukraine.*
4-5	***Hydrology of groundwater.*** *Hydrology of groundwater. Groundwater classification. Characteristics of the main types of groundwater. Underground horizons. Artesian horizons.* *Formation of groundwater and its connection with surface waters. Water balance in underground horizons. Features of the use of groundwater. Environmental problems of aquifers.* ***Literature 1 :[19-24] 12 [125-142]; 8 [106-118].*** ***Tasks on IWS.*** *Basic laws of groundwater movement. Characteristics of groundwater in Ukraine.*
6-7	***Hydrology of rivers.*** *Hydrology of rivers. Basic concepts of river hydrology. Types of rivers and their distribution on Earth. Water balance of the river basin. Fluctuations in river flow. Basic laws of water movement and sediments. The main factors of the change of course. The effect of seasonal temperature changes. The influence of man on river flow. Ecological problems of rivers.* ***Literature 1 :[29-43]; 5 [126-200]; 12 [34-86].*** ***Tasks on the IWS.*** *Calculation of the water balance of the river basin. Daily and annual fluctuations in river flow levels.*
8-9	***Hydrology of lakes.*** *Lakes, their formation and distribution on Earth. Classification of lakes. The main hydrological processes in the lakes. Balance of water masses of the lake. The main types of reservoirs and their distribution. Water, thermal and ice conditions of reservoirs. The impact of lakes and reservoirs on river flow.* ***Literature 1 :[32-42]; 3 [76-92]; 12 [87-108].*** ***Tasks on the IWS.*** *Ecological problems of lakes and reservoirs. The largest lakes of Ukraine.*
10-11	***Hydrology of swamps.*** *Hydrology of the swamp. The origin of the marshes and their types. The structure of the swamps. Stages of development of swamps. Hydrological regime of swamps. The role of swamps in hydrological processes on land. Environmental problems of swamps.* ***Literature 1 :[55-65]; 3 [102-130]; 12 [109-115].*** ***Tasks on the IWS.*** *Anthropogenic impact on the condition of swamps. The use of swamps by man.*
12-13	***Hydrology of glaciers.*** *Hydrology of the glacier. The origin of glaciers and their classification. The structure of glaciers and their development. The balance of ice and water in glaciers. The main processes*

	in glaciers. Conjugation and revitalization. The use of glaciers by man. Ecological problems of glaciers. ***Literature 1:[62-75]; 12 [116-122]; 8 [94-118].*** ***Tasks on the IWS.*** *Reducing the volume of ice cover on the planet.*
14-15	***Hydrology of the seas and oceans.*** *Seas and oceans, their classification. Waters of the oceans and their properties. The structure and relief of the bottom of the oceans. Bottom sediments. Sea ice, its formation and properties. Water circulation in the oceans. Water level in the seas and oceans. Resources of the oceans and their use by mankind. Ecological problems of the seas and oceans.* ***Literature 1 :[69-73]; 2 [6-34]; 12 [143-168]; 8 [410-423].*** ***Tasks on the IWS.*** *Waves, their formation and impact on the biosphere. Tides, their formation and distribution.*
16-17	***Basics of hydrometry*** ***Measurement of the main parameters of water flows.*** *Measurement of water levels. Processing of water-measuring observations. Organization of water measuring posts. Types of water measuring posts. Processing of calculations of water consumption and solid runoff. Measurement of flow rate. Measurements of depths. Measurement of solid runoff. Determination of water consumption and sediments.* ***Literature 1 [:101-112, 74-92***]; 10 [60-72]***; 11 [72-83].*** ***Tasks on the IWS.*** *Schedules for measuring the parameters of the river. Processing of water-measuring observations.*
18	*Final lecture*

Practical classes

In the system of professional training of students in this discipline, practical classes occupy 15% of the classroom load. Being an addition to the lecture course, they lay and form the foundations for the qualification of a bachelor in ecology. The content of these classes and the methods of their conduct should ensure the development of the creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to check knowledgetherefore, this type of work is an important means of operational feedback. Practical classes should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers in the field of environmental protection.

The main objectives of the cycle of practical classes:

- *help students systematize, consolidate and deepen knowledge of a theoretical nature in the field of hydrology;*
- *teach students techniques for solving practical problems, promote the mastery of skills and abilities to perform calculations, graphic and other tasks;*
- *teach them to work with scientific and reference books and schemes;*
- *to form the ability to learn independently, that is, to master the methods, methods and techniques of self-study, self-development and self-control.*

	The title of the topic of the practical lesson and the list of main issues (list of didactic support, links to literature and tasks on the IWS)
1	***Fundamental concepts of hydrometry.*** ***The movement of water.*** *The equation of motion of water. Modes of water movement. The main forces acting in the aquatic environment. Calculation of the water balance of a certain land area.* ***Literature 1 :[28-33]; 3[24-39]; 9[10-21].*** *Tasks on IWS. Reynolds criterion, its significance for different types of water movement.*
2	***Pressure in the aquatic environment.*** *Determination of pressure in the aquatic environment. System units of pressure measurement. Devices for measuring pressure in the aquatic environment, their structure and principle of operation. The equation of continuity. Calculation of the pressure of the water column.* ***Literature 1 :[33-35]; 7[297-311]; 13[67-73].*** *Tasks on IWS. Non-systemic units for determining pressure.*
3-4	***Groundwater.*** *The equation of water movement in underground horizons. The main characteristics of the soil in terms of the ability to pass moisture. The state of water in underground horizons. The equation of water balance of the underground horizon. Darcy's law of filtration.* ***Literature 1 [40-50] 4[316-332] 8[103-117].:;;*** *Tasks on IWS. Filtration coefficient for different types of soil. The effect of the porosity coefficient.*
5	***Calculation of the main parameters of underground flows.*** *The speed of water in underground horizons. Estimated and actual water velocity. Calculations of water consumption and solid runoff. Calculation of the filtration path.* ***Literature 1 :[51-53]; 8[123-131]; 13[84-89].*** *Tasks on IWS. Methods for determining and calculating the rate of water in underground horizons at considerable depths.*
6-7	***Hydrometric measurements of surface waters.*** *Equation of motion of surface waters. Calculation of costs, volume and flow module. The speed of the water in the river. Calculation of ice thickness. Forecasting the increase in ice thickness. Information processing of water-measuring posts. Processing of water-measuring observations.* ***Literature 1 :[55-61, 124-135]; 3 [46-53]; 14[267-283].*** *Tasks on IWS. Devices used at water measuring posts. Hydrometric observation system in Ukraine.*
8	*Modular test work*
9	***TEST***

6. Independent work

Independent work takes 55% of the time to study the discipline, including preparation for the test. The main task of independent work of students is the acquisition of scientific knowledge in the field of hydrology, which are not included in the list of lecture questions, through a personal search for information. In the process of independent work, the student must consider in detail all the main issues of hydrology, work out additional literature.

No s/n	*The name of the topic submitted for independent study*	*Number of hours of IWS*
	Section 1. Fundamentals of Hydrology	
1	*Abnormal properties of water and ice.* ***Literature 10 :[5-15].*** *Water resources of Ukraine, their distribution throughout the state.* ***Literature 14 :[30-46].*** *History of formation and development of hydrology in Ukraine.* ***Literature 14 :[6-24].*** *Basic laws of groundwater movement. Characteristics of underground waters of Ukraine.* ***Literature 11 :[125-142].*** *Calculation of the water balance of the river basin. Daily and annual fluctuations in river flow levels.* ***Literature 5 :[126-139];7 [34-55]; 9 [59-62].*** *Ecological problems of lakes and reservoirs. The largest lakes of Ukraine.* ***Literature 3 :[76-92]; 5 [202-235; 14 [87-108].*** *Anthropogenic impact on the condition of swamps. The use of swamps by man.* ***Literature 12 :[34-44].*** *Reducing the volume of ice cover on the planet.* ***Literature 5 :[82-95]; 12 [116-122]; 8 [94-118].*** *Waves, their formation and impact on the biosphere. Tides, their formation and distribution.* ***Literature 2 [:6-24]; 9 [269-277].***	*34*
	Section 2. Basics of hydrometry	
2	*Schedules for measuring the parameters of the river. Processing of water-measuring observations.* ***Literature 8 [:74-81];10 [87-99].***	*20*
3	*Modular test work*	*6*
4	*Preparation for the test*	*6*
	Total hours	*66*

Politics and control

7. Policy of the discipline (educational component)

Rules for attending classes and behavior in the classroom

Attending classes is a mandatory component of assessment. Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to

interfere with the teacher to conduct classes, not to be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

- *Incentive points can be awarded by the teacher exclusively for performing creative work on the discipline or additional completion of online specialized courses with the receipt of the appropriate certificate:*

- *https://www.classcentral.com/course/udemy-basic-hydrology-26715*
- *https://ru.coursera.org/learn/russian-water-management*
- *https://www.coursera.org/learn/watermanagement*

The sum of additional points may not exceed 15% of the rating scale.

- *Penalty points within the discipline are not provided.*

Deadline and reshuffle policy

In case of debts in the discipline or any force majeure, students should contact the teacher through the available (provided by the teacher) communication channels to solve problematic issues and coordinate the algorithm of actions for testing.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Unacceptable hints and write-offs when writing tests, conducting classes; passing the test for another student; copying materials protected by the copyright system without the permission of the author of the work.
The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code

Academic Conduct and Ethics Policy

Students should be tolerant, respect the opinions of others, formulate objections in the correct form, constructively maintain feedback in the classroom.
The norms of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code

8. Types of control and rating system for evaluating learning outcomes (RSO)

Distribution of study time by type of classes and tasks in the discipline according to the working curriculum:

Semester	*Study time*		*Distribution of study hours*				*Control measures*		
	Credits	*acad. year.*	*Lecture*	*Practical*	*Lab. rob.*	*IWS*	*FCT*	*RR*	*Semester control*
4	*4*	*120*	*36*	*18*	*–*	*66*	*1*	*–*	*test*

The student's rating in the discipline consists of points that he receives for work in practical classes, writing a modular test.

Semester control is credit.

Rating (weight) points system and evaluation criteria

1. *Performing tasks in practical classes.*

The weight score is 10 points.

Criteria for evaluating the implementation of a practical task

Completeness and signs of the task	***Score***
The task is completed in full	*10*
Minor disadvantages	*8… 9*

Late completion of the task	*6… 7*
Late completion of the task and shortcomings in the implementation	*2… 5*
Poor performance of the task	*1*
Failure to complete the task	*0*

2. Modular test work

Weight score 30. The test work consists of three questions. The maximum number of points for each question = 10 points.

Criteria for evaluating tests

Completeness and signs of response	***Score***
Full answer to the question	*10*
Some inaccuracies were made in the response	*9… 8*
This partial answer or significant mistakes have been made in the answers to the question	*7… 5*
This is a fuzzy answer: there are no or mistakes made in formulas, terms and definitions	*4… 3*
Unsatisfactory answers and the presence of significant errors are given	*2… 1*
Control not credited	*0*

Thus, the rating semester scale in the discipline is:

$$R = 7 \cdot 10 + 30 = 100 \text{ points}$$

According to the results of educational work in the first 7 weeks, the "ideal student" should score 40 points. At the first certification (8th week), the student receives "enrolled" if his current rating is at least 20 points.

According to the results of educational work for 13 weeks of study, the "ideal student" must score 90 points. At the second certification (14th week), the student receives "enrolled" if his current rating is at least 40 points.

The maximum amount of points is 100. To get a test from the credit module "automatic" you need to have a rating of at least 60 points.

A necessary condition for admission to the test is a rating that is at least 40% of the rating scale (R), that is, 40 points.

Students who scored a rating of less than 0.6 R during the semester, as well as those who want to increase the overall rating, perform a test paper. In this case, all points received by them during the semester are canceled. Test tasks contain questions that relate to different sections.

To obtain a credit score, the sum of all rating points ***R*** *received during the semester is transferred according to the table:*

Score	***Score***
95... 100	*Perfectly*
85... 94	*very good*
75...84	*well*
65... 74	*Satisfactory*
60...64	*enough*
RD 60<	*Disappointing*
Admission conditions not met	*not allowed*

9. Additional information on the discipline (educational component)

9.1 An approximate list of questions that are submitted to the ICR

1. To define the subject and structure of general hydrology.
2. To give the basic concepts of river hydrology.
3. To characterize the use and consumption of water by mankind.
4. To characterize the types of rivers and their distribution on Earth.
5.Bring the types of ice in the river.
6. To cite the theory of water formation.
7. To bring the water balance of the river basin.
8. To strike a balance of ice and water in glaciers.
9. Characterize the basic properties of water.
10. Give a description of the fluctuation of the flow of the river.
11. To characterize the water resources of the Earth.
12.Explain the basic laws of water movement and sediment in rivers.
13. Explain the water cycle in nature.
14.Explain the effect of seasonal temperature changes on the river regime.
15. To characterize the environmental problems of rivers.
16. To characterize the lakes, their formation and distribution on Earth.
17. To characterize the hydrological regime of swamps.
18.Explain the main hydrological processes in lakes.
19.Bring devices for measuring the speed of water in the river.
20.To characterize the balance of water masses of the lake.
21.Explain the processes of origin of swamps.
22. To characterize the structure of swamps and the stages of their development.
23.Give the main morphometric characteristics of rivers.
24.Determine the flow rate of water and sediments by a graphical method.
25. To characterize the hydrological regime of swamps.
26.To give the types of water movement in the underground horizon and their definition.
27.Explain the role of swamps in hydrological processes on land.
28.To characterize the accumulation of ice in the glacier.
29.To characterize the origin of glaciers and their classification.
30.Give a description of the seas and oceans.
31.Describe the main processes in glaciers.
32. To characterize the chemical composition of the waters of the oceans.
33.Classify groundwater.
34. To cite the stages of development of swamps.
35.Give a description of the seas and oceans.
36. To characterize the state of water in underground horizons.
37. To characterize the waters of the oceans and their properties.
38.Explain the processes of formation of swamps.
39. Describe the structure and relief of the bottom of the oceans.
40. To characterize the effect of temperature fluctuations on the regime of rivers.
41.To characterize the speed of water in underground horizons.
42.Give a description of sea ice, its formation and properties.
43.Describe the process of measuring depths in water bodies.
44.Indicate the main morphometric characteristics of the river.
45. To characterize the hydrological regime of swamps.
46.Explain the fluctuations in the water levels of the oceans.
47.Give the main elements of the cross section of the river.
48. To characterize the bottom sediments of the oceans.
49. Characterize sea ice, its formation and properties.
50. To characterize the processes of accumulation and consumption of ice in the glacier.

Credit module work program (syllabus):

Compiled by assoc., Ph.D. *Radovenchik Y.V.*

Approved *by Ecology and technology of plant polymers department (protocol No 14 from 08.06.2022)*

Approved *by the CEF Methodical Commission (protocol No.10_ of _24.06.2022_)*