IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE

Ecology and technology of plant polymers

Coursework in Hydrosphere Monitoring

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	*1 ECTS credit (30 hours)*
Semester control/ control measures	*Test*
Schedule of classes	*Independent work*
Language of teaching	*Ukrainian*
Information about thecourse instructors / teachers	*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 purpose of the discipline " Coursework in Hydrosphere Monitoring "

The purpose of studying the discipline is to form students' complex of knowledge and skills regarding the methods of measuring, controlling and calculating the main parameters of surface water bodies and groundwater. In accordance with the goal, the preparation of bachelors requires the formation of the following competencies among students:

- *ability to conduct research at the appropriate level;*
- *ability to assess and ensure the quality of work performed;*
- *ability to critically comprehend the basic theories, methods and principles of the natural sciences;*
- *ability to conduct environmental monitoring and assess the current state of the environment.*

After mastering this discipline, students must demonstrate the following programmatic learning outcomes:

- *understand the basic environmental laws, rules and principles of environmental protection and environmental management;*
- *understand the basic concepts, theoretical and practical problems in the field of natural sciences, which are necessary for the analysis and decision-making in the field of ecology, environmental protection and optimal environmental management;*
- *know the conceptual basis for monitoring and rationing anthropogenic load on the environment;*
- *be able to use software, GIS technologies and Internet resources for information support of environmental research;*

- *participate in the development and implementation of projects aimed at optimal management and management of industrial and municipal waste;*
- *be aware of the responsibility for the effectiveness and consequences of the implementation of comprehensive environmental measures;*
- *improve professional level by continuing education and self-education;*
- *be able to choose the best methods and tools for research, data collection and processing.*

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 is based on the principles of integration of various knowledge gained by students in the study of natural and engineering disciplines. The discipline provides disciplines "Modeling and forecasting of the state of the environment", "Design of water use systems", "Technoecology", "Environmental monitoring".

3. Contents of the course

Section 1. Basic concepts of hydrology

Topic 1.1. Hydrology of groundwater.

Basic laws of groundwater movement. Calculation of the main parameters and indicators of groundwater movement.

Topic 1.2. Hydrology of rivers.

Water balance of the river basin. Calculation of characteristic indicators of the river basin. Basic laws of water movement and sediments.

Section 2. Basics of hydrometry

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

Measurement of water levels. Processing the results of water meters. Measurement of flow rate. Measurements of depths. Measurement of solid runoff. Calculation of water consumption and sediments by various methods.

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. Hydromertia: workshop / Textbook / D.S. Kosyak, V.S. Kholodenko, O.I. Galik. - Rivne: NUWGP, 2018. - 254 p.

3. Kurganevich L.P. General hydrology: a textbook / L.P. Kurganevich, V.I. Bilanyuk, Y.M. Andreychuk. – Lviv: Ivan Franko National University of Lviv, 2020. – 336 p.

4. Obodovsky O. G. Ruslovi processes: / textbook / – Kyiv: Kyiv University, 2017. - 495 p.

5. Smirnova V. Gidrologiya. – K.: Kondor, 2018. – 170 p.

6. 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.

7. 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

8. Yushchenko Yu.S. General hydrology: textbook. \u2012 Chernivtsi: Chernivtsi national. un-t, 2017. \u2012 591 p.

9. Myskovets I. Ya., Molchak Y. O. Fundamentals of general hydrology: textbook. posib. - Lutsk: RVV LNTU, 2016. - 306 p.

10. Obodovsky O.G. Hydrologo-ecological assessment of channel processes (on the example of rivers of Ukraine). – Kyiv: "Nika" –Center, 2001. – 274 p.

11. Kurganevich L. Hydrology: educational and methodical manual [for independent work of students] / L. Kurganevich. – Lviv: Ivan Franko National University of Lviv, 2013. – 48 p.

12. Slyvka P. D. Water management calculations: textbook. posib. / P. D. Slyvka, O. P. Budz. - Rivne: NUWGP, 2010. - 78 p.

13. Yatsyk A.V. Water management ecology. - K.: Genesis, 2014. - 384 p.

Information resources on the Internet

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

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

16. Ukrainian Hydrometeorological Center - https://meteo.gov.ua

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

18. Scientific and Technical Library. G.I. Denysenko – https://library.kpi.ua

Educational content

5. Methods of mastering the discipline (educational component)

The course work consists of seven tasks. Practical assimilation of the discipline is achieved both by purposeful selection of the subject of individual lessons, and by the organization of the process of performing course work.

Course work is performed on an individual task and drawn up in the form of an explanatory note. The explanatory note to the term paper contains the following sections.

1. Tasks for the course work.

2. Theoretical part.

3. The results of calculations and their analysis (numerical, graphic, tabular value of the results of calculations).

4. Conclusions on each of the tasks, on the work as a whole.

5. References.

To provide students with methodological literature, methodological instructions for the implementation of course work have been developed [7], recommended by the Academic Council of the CEF.

Schedule of course work

week	*The name of the stage of work*	*IWS Study Time*
1-2	*Getting the topic and objectives of the course work*	*0,5*
3-5	*Selection and study of literature*	*6*
6	*Preparation of the theoretical part (surface or underground water bodies)*	*2*
7	*Calculation of the parameters of the river (underground flow)*	*1*
7	*Calculation of the main parameters of the river basin, determining the actual water rate in the underground horizon*	*1*
8-9	*Filling in the journal of the water meter post*	*6*
10	*Construction of annual schedules for changes in water levels in the river*	*3*
11	*Construction of repeatability curves of water levels*	*2*
12	*Construction of curves of the duration of water levels for a certain period of time*	*2*
13	*Graphical analysis of hydrometric measurements*	*2*
14	*Analytical analysis of hydrometric measurements*	*2*
15	*Drawing conclusions*	*1*
16	*Submission of a term paper for verification*	*0,5*
17-18	*Course work defense*	*1*
ALL		*30*

Politics and control

6. Policy of the discipline (educational component)

This discipline is studied by students independently, through counseling by the teacher. Students are obliged to perform individual assignments in a high-quality and timely manner, submit it for verification and timely submit the term paper to the defense.

Rules for assigning incentive and penalty points
Incentive and penalty points in this 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.
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

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

The rating system for evaluating coursework has two components. The maximum number of points is 100. The first (starting) component characterizes the student's performance of the course work and its result – the quality of the explanatory note. The second component (component of the defense of the course work) characterizes the quality of the student's protection of the course work. The size of the scale of components is 50 points each.

Rating points system

1. Starting component:

- timeliness of the relevant part of the course work – 15... 1 points;

- correctness of application of calculation methods, qualitative and quantitative assessment of the results obtained –15... 8 points;

- justification of recommendations for further measures to protect the environment - 10... 5 points.

- design quality 10... 1 point.

2. Component of the protection of course work:

- degree of proficiency in the material 20... 5 points;

- the degree of justification of the decisions made and the correctness of the conclusions 15... 9 points;

- ability to defend one's opinion 15...5 points.

The sum of the points of the two components is transferred to the credit score according to the table:

points *R*	*University Scale*
95-100	*Perfectly*
85-94	*very good*
75-84	*well*
65-74	*Satisfactory*
60-64	*enough*
Less than 60	*Disappointing*
Course work is not allowed to be defended	*not allowed*

8. Additional information on the discipline (educational component)

The list of options for course work

Task number 1

1. *Characterize the Black Sea.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an equilateral triangle with a side of 5 m at a flow rate of 10 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 230 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Date	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	above the graph level, cm	average per day, cm	Waters		air		
						zamiryan a	Fixed			
1	8 20	2 2	12 14							
2	8 20	2 2	14 16							
3	8 20	2 2	19 20							
4	8 20	2 2	23 23							
5	8 20	2 2	26 28							
6	8 20	2 2	36 39							
7	8 20	2 2	48 56							
8	8 20	2 3	59 2							
9	8 20	3 2	8 12							
10	8 20	3 3	22 28							
Amount						Corrected water temperature, average per decade		1		Registers for piles No2 – 1,2 m No3 – 1,8 m
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.01 – 15.04.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 5 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	0,5	1,2	3,0	1,8	0,9	0
Speed, m/s	0	0,1/20	0,3/5 0,24/8 0,1/12	0,59/3 0,64/7 0,55/8 0,26/10 0,08/15	0,38/5 0,27/6 0,12/8	0,27/14	0
Mutnist, g/m^3							

Task number 2

1. *To characterize the Sea of Azov.*
2. *Calculate the parameters of the underground flow if the aquifer is composed of fine-grained sands, and its cross-sectional area reaches 1632 m^2, the water level at the starting point is 28 m, the final point is 16 m, the distance between the points is 900 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 1,8 m No4 – 2,4 m No5 – 3,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.02 – 15.05.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	2,5	1,2	1,2	1,1	0,9	0
Speed, m/s Mud, g/m^3	0	1,1/2 1,18/3 1,02/7 0,56/8 0,12/12	0,38/4 0,27/5 0,12/9	0,39/4 0,29/6 0,11/10	0,3/5 0,24/6 0,1/11	0,27/8	0

Task number 3

1. *To characterize the swamps of Polissya*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an isosceles triangle with a side of 5 m and a height of 3 m at a flow rate of 8.10 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 8230 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 2,8 m No4 – 3,4 m No5 – 4,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.03 – 15.06.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 13 m):*

No points	1	2	3	4	5
Depth, m	0	2,5	1,2	1,1	0
Speed, m/s Mud, g/m^3	0	1,1/22 1,18/26 1,02/29 0,56/38 0,12/46	0,38/23 0,27/27 0,12/39	0,3/27 0,24/33 0,1/43	0

Task number 4

1. *To characterize the rivers of Transcarpathia.*
2. *Calculate the parameters of the underground flow if the aquifer is composed of medium-grained sands, and its cross-sectional area reaches 632 m^2, water level at the starting point is 18 m, the final point is 3 m, the distance between the points is 90 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 1,8 m No4 – 2,4 m No5 – 3,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.04– 15.07.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 8 m):*

No points	1	2	3	4	5
Depth, m	0	2,5	1,2	1,1	0
Speed, m/s	0	1,1/59	0,38/78	0,3/87	0
Mud, g/m^3		1,18/66 1,02/78 0,56/90 0,12/112	0,27/88 0,12/101	0,24/92 0,1/117	

Task number 5

1. *To characterize the groundwater of the East of Ukraine.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), having a depth of 3 m, a rectangle profile with an aspect ratio of 1:2 at a flow rate of 21.0 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 310 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
1	8 20	2 2	12 14							
2	8 20	2 2	14 16							
3	8 20	2 2	19 20							
4	8 20	2 2	23 23							
5	8 20	2 2	26 28							
6	8 20	2 2	36 39							
7	8 20	2 2	48 56							
8	8 20	2 3	59 2							
9	8 20	3 2	8 12							
10	8 20	3 3	22 28							
Amount						Corrected water temperature, average per decade		1		Registers for piles No2 – 2,3 m No3 – 2,9 m
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.05 – 15.08.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 11 m):*

No points	1	2	3	4	5	6
Depth, m	0	2	2,5	1,2	1,1	0
Speed, m/s	0	0,59/46	1,1/34	0,38/55	0,3/57	0
		0,64/49	1,18/45	0,27/59	0,24/59	
Mud, g/m^3		0,55/55	1,02/53	0,12/68	0,1/67	
		0,26/58	0,56/64			
		0,08/65	0,12/69			

Task number 6

1. *To characterize the rivers of Crimea*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of coarse-grained sands, and its cross-sectional area reaches 3021 m^2, water level at the starting point is 118 m, the final point is 83 m, the distance between the points is 3990 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 2,9 m No4 – 3,5 m No5 – 4,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.06 – 15.09.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 1; 2; 4; 3; 1 m):*

No points	1	2	3	4	5	6
Depth, m	0	2	2,5	1,2	1,1	0
Speed, m/s	0	0,59/8	1,1/11	0,38/18	0,3/19	0
Mud,		0,64/11	1,18/15	0,27/19	0,24/23	
g/m^3		0,55/9	1,02/16	0,12/21	0,1/25	
		0,26/12	0,56/19			
		0,08/15	0,12/22			

Task number 7

1. *To characterize the groundwater of the South of Ukraine.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an isosceles trapezoid with a height and a smaller base of 2 m, a larger base of 4 m at a flow rate of 7.10 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 1230 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 2,9 m No4 – 3,5 m No5 – 4,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.04– 15.07.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 8 m):*

No points	1	2	3	4	5	6	7	8	9	10
Depth, m	0	0,3	1,5	2,8	5,2	4,4	3,1	3,0	2,7	0
Speed, m/s	0	0,2/33	1,1/25	1,56/26	2,38/29	2,12/26	1,99/25	1,98/25	1,58/25	
Mud, g/m^3			1,08/29	1,72/29	2,47/31	2,18/27	2,00/26	2,02/26	1,62/26	
			0,42/31	1,39/29	2,32/33	2,03/29	1,89/31	1,86/30	1,55/29	
				0,82/34	1,31/36	1,02/39	0,89/37	0,85/36	0,65/35	
				0,23/39	0,44/43	0,33/41	0,26/39	0,25/38	0,17/39	

Task number 8

1. *To characterize the groundwater of Kiev.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of fine-grained sands, and its cross-sectional area reaches 6632 m^2, water level at the starting point is 38 m, the final point is 13 m, the distance between the points is 1190 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Date	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 2,5 m No4 – 3,1 m No5 – 3,8 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.08– 15.11.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 12 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	5,2	3,0	2,7	0
Speed, m/s	0	0,2/2	1,1/1	1,56/3	2,38/2	1,98/2	1,58/3	
			1,08/2	1,72/5	2,47/6	2,02/3	1,62/4	
Mud, g/m^3			0,42/4	1,39/7	2,32/7	1,86/5	1,55/6	
				0,82/9	1,31/8	0,85/8	0,65/8	
				0,23/11	0,4/12	0,25/10	0,17/9	

Task number 9

1. *To characterize the groundwater of the North of Ukraine*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a semicircle profile with a radius of 2.6 m at a flow rate of 10 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 301 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 6,9 m No4 – 7,5 m No5 – 8,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.09 – 15.12.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 6; 6; 7; 8; 7; 6 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	0,3	1,5	5,2	3,1	3,0	0
Speed, m/s	0	0,2/44	1,1/49	2,38/42	1,99/48	1,98/47	
Mud,			1,08/53	2,47/43	2,00/49	2,02/49	
g/m^3			0,42/55	2,32/48	1,89/49	1,86/50	
				1,31/49	0,89/51	0,85/52	
				0,44/56	0,26/54	0,25/54	

Task number 10

1. *To characterize the groundwater of the West of Ukraine.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of pebbles, and the cross-sectional area reaches 632 m^2, water level at the starting point is 38 m, the final point is 23 m, the distance between the points is 3190 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 12,9 m No4 – 13,5 m No5 – 14,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.10– 15.01.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	4,4	3,1	2,7	0
Speed, m/s	0	0,2/3	1,1/4	1,56/3	2,12/2	1,99/2	1,58/3	
Mud,			1,08/6	1,72/4	2,18/3	2,00/3	1,62/4	
g/m^3			0,42/8	1,39/6	2,03/6	1,89/5	1,55/5	
				0,82/7	1,02/9	0,89/8	0,65/6	
				0,23/11	0,33/12	0,26/10	0,17/7	

Task number 11

1. *To characterize the Dnieper River*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an equilateral triangle with a side of 3 m at a flow rate of 8 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 2310 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Date	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	above the graph level, cm	average per day, cm	Waters		air		
						zamiryana	Fixed			
1	8 20	2 2	12 14							
2	8 20	2 2	14 16							
3	8 20	2 2	19 20							
4	8 20	2 2	23 23							
5	8 20	2 2	26 28							
6	8 20	2 2	36 39							
7	8 20	2 2	48 56							
8	8 20	2 3	59 2							
9	8 20	3 2	8 12							
10	8 20	3 3	22 28							
Amount						Corrected water temperature, average per decade		1		Registers for piles No2 – 21,2 m No3 – 21,8 m
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.11 – 15.02.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 12 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	0,5	2,2	3,0	1,8	0,9	0
Speed, m/s	0	0,1/44	0,43/41 0,44/42	0,59/39 0,64/41	0,38/39 0,27/40	0,27/41	0
Mud, g/m^3			0,38/45 0,25/48 0,06/50	0,55/44 0,26/46 0,08/53	0,12/41		

Task number 12

1. *To characterize the Dniester River*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of fine-grained sands, and its cross-sectional area reaches 2632 m^2, water level at the starting point is 18 m, the final point is 6 m, the distance between the points is 1900 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 21,8 m No4 – 22,4 m No5 – 23,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 15.12 – 15.02.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 4 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	2,5	1,2	1,2	2,5	0,9	0
Speed, m/s	0	1,1/21	0,38/19	0,39/18	1,1/22	0,27/35	0
Mud,		1,18/22	0,27/25	0,29/24	1,12/21		
g/m^3		1,02/24	0,12/35	0,11/34	1,02/24		
		0,56/29			0,56/28		
		0,12/39			0,12/31		

Task number 13

1. *To characterize the Desna River*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an isosceles triangle with a side of 5 m and a height of 3 m at a flow rate of 15 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 3230 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 –12,8 m No4 – 13,4 m No5 – 14,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.01 – 01.03.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 1.3 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	2,5	3	1,2	1,2	1,1	0
Speed, m/s	0	1,1/56	1,5/43	0,38/41	0,38/40	0,3/39	0
Mud,		1,18/57	1,58/45	0,27/43	0,27/42	0,24/40	
g/m^3		1,02/59	1,32/49	0,12/44	0,12/43	0,1/40	
		0,56/68	0,86/54				
		0,12/80	0,15/76				

Task number 14

1. *Describe the Southern Bug River.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of medium-grained sands, and its cross-sectional area reaches 1632 m^2**,** water level at the starting point is 28 m, the final point is 13 m, the distance between the points is 390 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 –51,8 m No4 – 52,4 m No5 – 53,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.02– 01.05.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 4; 5; 8; 8 m):*

No points	1	2	3	4	5
Depth, m	0	2,5	1,2	1,1	0
Speed, m/s	0	1,1/31	0,3/44	0,38/43	0
Mud,		1,18/33	0,24/46	0,27/46	
g/m^3		1,02/38	0,1/50	0,12/49	
		0,56/49			
		0,12/54			

Task number 15

1. *Describe the Danube River.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an isosceles trapezoid with a height of 6 m, a smaller base of 5 m, a larger base of 8 m at a flow rate of 50 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 2360 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
1	8 20	2 2	12 14							
2	8 20	2 2	14 16							
3	8 20	2 2	19 20							
4	8 20	2 2	23 23							
5	8 20	2 2	26 28							
6	8 20	2 2	36 39							
7	8 20	2 2	48 56							
8	8 20	2 3	59 2							
9	8 20	3 2	8 12							
10	8 20	3 3	22 28							
Amount						Corrected water temperature, average per decade		1		Registers for piles No2 – 112,3 m No3 – 112,9 m
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.03 – 01.06.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3; 3; 5; 4; 11 m):*

No points	1	2	3	4	5	6
Depth, m	0	2	2,5	1,2	1,1	0
Speed, m/s	0	0,59/6	1,1/5	0,38/5	0,3/6	0
Mud,		0,64/6	1,18/5	0,27/6	0,24/7	
g/m^3		0,55/7	1,02/4	0,12/8	0,1/8	
		0,26/8	0,56/6			
		0,08/10	0,12/9			

Task number 16

1. *Describe thePripyat River.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of coarse sands, and the area of its cross section reaches 1023 m^2, water level at the starting point is 98 m, the final point is 83 m, the distance between the points is 990 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 32,9 m No4 – 33,5 m No5 – 34,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.04 – 01.07.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 10; 20; 40; 30; 10 m):*

No points	1	2	3	4	5	6
Depth, m	0	2	2,5	1,2	1,1	0
Speed, m/s	0	0,59/167	1,1/187	0,38/210	0,3/217	0
Mud, g/m^3		0,64/179 0,55/190 0,26/210 0,08/240	1,18/199 1,02/211 0,56/215 0,12/230	0,27/215 0,12/225	0,24/220 0,1/237	

Task number 17

1. *Describe the river Tisza.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a semicircle profile with a radius of 3.5 m at a flow rate of 12 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 530 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 2,9 m No4 – 3,5 m No5 – 4,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.05– 01.08.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	5,2	4,4	2,7	0
Speed, m/s	0	0,2/11	1,1/14	1,56/13	2,38/18	2,12/18	1,58/17	
Mud,			1,08/15	1,72/15	2,47/19	2,18/20	1,62/18	
g/m^3			0,42/17	1,39/19	2,32/23	2,03/21	1,55/18	
				0,82/22	1,31/26	1,02/24	0,65/19	
				0,23/29	0,44/34	0,33/26	0,17/20	

Task number 18

1. *To characterize the river Seversky Donets.*
2. *Calculate the parameters of the underground flow if the aquifer is composed of fine-grained sands, and its cross-sectional area reaches 363.2 m^2, water level at the starting point is 83 m, the final point is 63 m, the distance between the points is 119.0 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Date	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 72,5 m No4 – 73,1 m No5 – 73,8 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.06– 01.09.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 1.2 m):*

No points	1	2	3	4	5	6	7	8	9	10
Depth, m	0	0,3	1,5	2,8	5,2	3,0	2,7	1,2	0,4	0
Speed, m/s	0	0,2/9	1,1/10 1,08/11	1,56/9 1,72/8	2,38/10 2,47/11	1,98/8 2,02/9	1,58/9 1,62/10	1,02/11 0,95/12	0,3/15	
Mud, g/m^3			0,42/12	1,39/9 0,82/11 0,23/12	2,32/13 1,31/15 0,44/19	1,86/11 0,85/13 0,25/17	1,55/12 0,65/13 0,17/15	0,38/15		

Task number 19

1. *Describe the Bug River.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an equilateral triangle with a side of 3.5 m at a flow rate of 16.20 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 2300 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 16,9 m No4 – 17,5 m No5 – 18,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.07 - 01.10.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (distance between verticals – 6; 6; 7; 8; 7; 6; 5; 7 m):*

No points	1	2	3	4	5	6	7	8	9
Depth, m	0	0,3	1,5	5,2	3,1	3,0	1,3	0,2	0
Speed, m/s	0	0,2/23	1,1/24	2,38/23	1,99/23	1,98/24	1,08/25	0,18/36	0
Mud,			1,08/25	2,47/25	2,00/25	2,02/25	1,01/28		
g/m^3			0,42/28	2,32/28	1,89/29	1,86/29	0,35/34		
				1,31/31	0,89/31	0,85/32			
				0,44/35	0,26/33	0,25/36			

Task number 20

1. *Describe the Prut River.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of pebbles, and the cross-sectional area reaches 1518 m^2, water level at the starting point is 74 m, the final point is 33 m, the distance between the points is 1903 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yesta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 212,9 m No4 – 213,5 m No5 – 214,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.08– 01.11.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3; 6; 7; 3; 5; 5; 4 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	4,4	3,1	2,7	0
Speed, m/s	0	0,2/43	1,1/44	1,56/43	2,12/42	1,99/43	1,58/45	
Mud, g/m^3			1,08/45	1,72/46	2,18/43	2,00/45	1,62/46	
			0,42/48	1,39/49	2,03/48	1,89/49	1,55/54	
				0,82/56	1,02/56	0,89/57	0,65/59	
				0,23/61	0,33/71	0,26/66	0,17/66	

Task number 21

1. *To characterize Lake Svityaz.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an isosceles triangle with a side of 3 m and a height of 2 m at a flow rate of 5.3 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 830 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 22,9 m No4 – 23,5 m No5 – 24,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.09 – 01.12.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3; 6; 4; 5; 6; 5; 4 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	4,4	3,1	2,7	0
Speed, m/s	0	0,2/11	1,1/10	1,56/9	2,12/10	1,99/11	1,58/11	0
Mud,			1,08/12	1,72/13	2,18/13	2,00/14	1,62/14	
g/m^3			0,42/18	1,39/17	2,03/16	1,89/18	1,55/19	
				0,82/21	1,02/19	0,89/21	0,65/22	
				0,23/29	0,33/28	0,26/24	0,17/29	

Task number 22

1. *To characterize the Shatsk lakes.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of fine-grained sands, and its cross-sectional area reaches 326 m^2, water level at the starting point is 36 m, the final point is 16 m, the distance between the points is 2900 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 31,8 m No4 – 32,4 m No5 – 33,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.10 – 01.01.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 7 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	1,2	1,2	2,5	2,5	0,9	0
Speed, m/s Mud, g/m^3	0	0,39/6 0,29/7 0,11/9	0,38/7 0,27/8 0,12/10	1,1/6 1,18/7 1,02/8 0,56/11 0,12/15	1,1/6 1,18/7 1,02/8 0,56/11 0,12/15	0,27/7	0

Task number 23

1. *Characterize the Kremenchug reservoir.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), having a depth of 5.2 m, a rectangle profile with an aspect ratio of 1:2 at a flow rate of 61.0 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 3170 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 –42,8 m No4 – 43,4 m No5 – 44,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.11 – 01.02.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 6.3 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	2,5	1,2	1,2	3	1,1	0
Speed, m/s	0	1,1/32	0,38/38	0,38/38	1,5/35	0,3/37	0
Mud,		1,18/33	0,27/41	0,27/41	1,58/39	0,24/39	
g/m^3		1,02/37	0,12/49	0,12/49	1,32/44	0,1/43	
		0,56/43			0,86/49		
		0,12/51			0,15/54		

Task number 24

1. *To characterize the Kakhovka reservoir.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of medium-grained sands, and its cross-sectional area reaches 326 m^2, water level at the starting point is 28 m, the final point is 3 m, the distance between the points is 2190 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 –71,8 m No4 – 72,4 m No5 – 73,1 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.12 – 01.03.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 4; 5; 8; 6; 7; 8 m):*

No points	1	2	3	4	5	6	7
Depth, m	0	1,2	1,1	2,5	1,2	1,1	0
Speed, m/s Mud, g/m^3	0	0,3/51 0,24/53 0,1/55	0,38/54 0,27/55 0,12/57	1,1/53 1,18/54 1,02/58 0,56/61 0,12/65	0,3/52 0,24/56 0,1/59	0,38/55 0,27/56 0,12/58	0

Task number 25

1. *To characterize the Kiev reservoir.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an isosceles trapezoid with a height and a smaller base of 3 m, a larger base of 4 m at a flow rate of 9.10 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 2830 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
1	8 20	2 2	12 14							
2	8 20	2 2	14 16							
3	8 20	2 2	19 20							
4	8 20	2 2	23 23							
5	8 20	2 2	26 28							
6	8 20	2 2	36 39							
7	8 20	2 2	48 56							
8	8 20	2 3	59 2							
9	8 20	3 2	8 12							
10	8 20	3 3	22 28							
Amount						Corrected water temperature, average per decade		1		Registers for piles No2 – 17,3m No3 – 17,9 m
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.01 – 01.06.*
7. *To carry out a graphical and analytical calculation of river parameters with the following measurement results (distance between verticals – 3; 8; 5; 8; 11 m):*

No points	1	2	3	4	5	6
Depth, m	0	2	2,5	1,2	1,1	0
Speed, m/s	0	0,59/4	1,1/6	0,38/5	0,3/3	0
Mud,		0,64/5	1,18/7	0,27/9	0,24/4	
g/m^3		0,55/8	1,02/11	0,12/11	0,1/7	
		0,26/9	0,56/15			
		0,08/9	0,12/16			

Task number 26

1. *To characterize the Kanev reservoir.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of coarse sands, and its cross-sectional area reaches 2031 m^2, water level at the starting point is 118 m, the final point is 83 m, the distance between the points is 399.0 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
11	8 20	3 3	35 42							
12	8 20	3 3	49 53							
13	8 20	3 3	56 59							
14	8 20	4 4	7 12							
15	8 20	4 4	19 26							
16	8 20	4 4	31 37							
17	8 20	4 4	42 49							
18	8 20	4 4	54 59							
19	8 20	4 4	65 68							
20	8 20	4 5	69 2							
Amount						Corrected water temperature, average per decade		2		Registers for piles No3 – 72,9 m No4 – 73,5 m No5 – 74,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.02 – 01.07.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3; 4; 5; 8; 4 m):*

No points	1	2	3	4	5	6
Depth, m	0	2	2,5	1,2	1,1	0
Speed, m/s	0	0,59/15	1,1/18	0,38/16	0,3/18	0
Mud,		0,64/17	1,18/19	0,27/19	0,24/21	
g/m^3		0,55/22	1,02/23	0,12/23	0,1/27	
		0,26/29	0,56/28			
		0,08/35	0,12/37			

Task number 27

1. *To characterize the Dneprodzerzhinsk reservoir.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a semicircle profile with a radius of 6 m at a flow rate of 60 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 501 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 62,9 m No4 – 63,5 m No5 – 64,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.03– 01.08.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 3; 5; 8; 4; 5; 6; 8 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	5,2	4,4	2,7	0
Speed, m/s	0	0,2/7	1,1/6	1,56/10	2,38/11	2,12/10	1,58/14	
Mud,			1,08/9	1,72/11	2,47/14	2,18/13	1,62/19	
g/m^3			0,42/11	1,39/15	2,32/15	2,03/15	1,55/23	
				0,82/18	1,31/18	1,02/19	0,65/26	
				0,23/22	0,44/26	0,33/24	0,17/29	

Task number 28

1. *To characterize the Dnieper reservoir.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of fine-grained sands, and its cross-sectional area reaches 3266 m^2, water level at the starting point is 68 m, the final point is 23 m, the distance between the points is 9190 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Date	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 52,5 m No4 – 53,1 m No5 – 53,8 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.04 – 01.09.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 42 m):*

No points	1	2	3	4	5	6	7	8	9	10
Depth, m	0	0,3	1,5	2,8	5,2	3,0	2,7	1,2	0,4	0
Speed, m/s	0	0,2/81	1,1/80	1,56/82	2,38/80	1,98/82	1,58/81	1,02/84	0,38/82	
Mud,			1,08/81	1,72/84	2,47/83	2,02/84	1,62/85	0,95/87		
g/m^3			0,42/85	1,39/87	2,32/85	1,86/85	1,55/87	0,38/89		
				0,82/89	1,31/90	0,85/89	0,65/89			
				0,23/94	0,44/94	0,25/92	0,17/93			

Task number 29

1. *To characterize the small rivers of Ukraine.*
2. *Calculate the parameters of the river (annual runoff, contour of the water mirror, filtration circuit, hydraulic radius, water velocity), which has a profile of an equilateral triangle with a side of 8 m at a flow rate of 35 m^3/s.*
3. *Calculate the basic parameters of the river basin with its area of 2410 km^2.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 –56,9 m No4 – 57,5 m No5 – 58,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.04 - 01.10.*
7. *To carry out a graphical and analytical calculation of river parameters with the following measurement results (distance between verticals – 2; 2; 3; 4; 2; 3; 2; 3 m):*

No points	1	2	3	4	5	6	7	8	9
Depth, m	0	0,3	1,5	5,2	3,1	3,0	1,3	0,2	0
Speed, m/s	0	0,2/6	1,1/6	2,38/10	1,99/11	1,98/10	1,08/11	0,18/12	0
Mud,			1,08/8	2,47/13	2,00/14	2,02/11	1,01/14		
g/m^3			0,42/12	2,32/16	1,89/15	1,86/14	0,35/16		
				1,31/19	0,89/19	0,85/17			
				0,44/20	0,26/21	0,25/19			

Task number 30

1. *To cite the problems of groundwater consumption in Ukraine.*
2. *Calculate the parameters of the underground flow, if the aquifer is composed of pebbles, and its cross-sectional area reaches 4632 m^2, water level at the starting point is 18 m, the final point is 2 m, the distance between the points is 90 m.*
3. *Determine the actual rate of water in the underground horizon.*
4. *Fill in the journal of observations of the water metering post, using all the symbols for wind, waves, their intensity, precipitation, ice phenomena.*
5. *Build an annual graph of changes in water levels in the river using Table 8.2 in the course of lectures. Compare the accuracy of graphs constructed at a time scale of 10 and 20 days.*

Yes-ta	Time	Water level				Temperature			Wind and waves	Notes
		No swai	bucket-hunok, cm	over riv-nemgra-fika, cm	average per day, cm	Waters		air		
						Zami-ryana	correct ed-lena			
21	8 20	5 5	4 6							
22	8 20	5 5	7 9							
23	8 20	5 5	12 20							
24	8 20	5 5	15 15							
25	8 20	5 5	14 8							
26	8 20	5 4	6 59							
27	8 20	4 4	68 66							
28	8 20	4 4	62 58							
29	8 20	4 4	55 51							
30	8 20	4 4	44 40							
Amount						Corrected water temperature, average per decade		3		Registers for piles No3 – 22,9 m No4 – 23,5 m No5 – 24,2 m.
Intermediate level										
Highest level						Average				
Lowest level						Highest				

6. *Construct repeatability and duration curves for the period 01.07– 01.11.*
7. *To carry out a graphical and analytical calculation of the parameters of the river with the following measurement results (the distance between the verticals is 13; 16; 17; 13; 15; 15; 14 m):*

No points	1	2	3	4	5	6	7	8
Depth, m	0	0,3	1,5	2,8	4,4	3,1	2,7	0
Speed, m/s	0	0,2/76	1,1/75 1,08/76 0,42/77	1,56/76 1,72/78 1,39/80 0,82/81 0,23/83	2,12/75 2,18/76 2,03/79 1,02/81 0,33/83	1,99/76 2,00/77 1,89/79 0,89/81 0,26/84	1,58/78 1,62/79 1,55/82 0,65/84 0,17/86	0

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_)*