Meteorology and Climatology

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=3473*

The program of the discipline

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

Atmospheric processes and meteorological phenomena are among the most important environmental factors. Climate change and, as a result, catastrophic changes in the weather characteristics of different territories of our planet lead to huge destruction and human losses. With the constant growth of anthropogenic impact on the atmosphere and an increase in emissions of pollutants, there is an urgent need for quality specialists in this field. Understanding the main processes occurring in the atmosphere, their impact on weather and climatic characteristics is an indispensable component of the future specialist in ecology and environmental protection.

The subject of the discipline "Meteorology and Climatology" *is the processes and phenomena that take place in the Earth's atmosphere and the influence of anthropogenic activity on them.*

The purpose of the discipline " Meteorology and Climatology "

The purpose of studying the discipline is to form in students a full range of knowledge about the physical, electrical and physico-chemical processes taking place in the atmosphere and the influence of these processes on the formation of meteorological phenomena. In accordance with the goal, the preparation of bachelors requires the formation of the following competencies among students:

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

According to the requirements of the program of the discipline " ***Meteorology and Climatology*** *", students, after mastering it,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;*
- *improve 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 " **Meteorology and Climatology** " is based on the principles of integration of various knowledge gained by students in the study of natural and engineering disciplines. The discipline " **Meteorology and Climatology** " provides the disciplines "Technoecology", "Environmental Monitoring", "Human Ecology".*

3. Contents of the course

Section 1. Meteorology

Topic 1.1 Introduction to the course of meteorology and climatology.

Basic concepts andterms of meteorology and climatology. Meteorological elements. Weather and climate. Sections of meteorology. The connection of meteorology and climatology with other sciences. Air circulation in the atmosphere. The importance of meteorology and climatology for the national economy.

Topic 1.2 Composition and structure of the atmosphere.

Composition and main and characteristics of the atmosphere. The composition of the air in the surface layer of the atmosphere. Characteristics of the layers of the atmosphere. Impurities in the air (solid, vapor-gaseous) and their role in the biosphere. The structure of the atmosphere.

Topic 1.3: Solar radiation.

The sun is the source of life on Earth. Solar radiation. The intensity of solar radiation. Radiation and heat balance of the Earth and the atmosphere. Weakening of solar radiation in the atmosphere. Direct and scattered solar radiation. Measurement of solar radiation and effective radiation.

Topic 1.4 Air Temperature.

Air temperature. The processes of heating and cooling the air. The role of the underlying surface in the heating of air. Daily and annual course of air temperature. Adiabatic processes in the atmosphere. Vertical temperature distribution, temperature inversion. Violation of the annual course of temperature, causes and consequences.

Topic 1.5: Water vapor in the atmosphere.

Water vapor in the atmosphere. Values characterizing the humidity of the air. The elasticity of water vapor. Condensation and sublimation of water vapor. Methods and means of measuring and calculating air humidity.

Topic 1.6 Condensation of water vapor.

Causes of water vapor thickening. Condensation nuclei. Clouds. Microstructure of clouds. International Classification of Clouds. Clouds. Cloud families and their genera. Geographical distribution of cloudiness. Cloud formation.

Topic 1.7 Precipitation.

Precipitation. Precipitation classification. Precipitation formation. Characteristics of the precipitation regime. Daily and annual rainfall. Water balance. The water balance of the Earth. Duration and intensity of precipitation. Methods for measuring precipitation.

Topic 1.8 Thermodynamics of the atmosphere.

Adiabatic processes in the atmosphere. Adiabatic changes in the state in the atmosphere. Dry-adiabatic and moisture-adiabatic temperature changes. Pseudoadiabatic process. Potential temperature. Construction of aerological diagrams.

Topic 1.9 Atmospheric pressure. Air density.

Atmospheric pressure. Units of measurement of atmospheric pressure. Change in atmospheric pressure in height. Annual and daily pressure fluctuations. Baric degree. Air density. Methods and means of measuring atmospheric pressure.

Topic 1.10: Air currents in the atmosphere.

Wind. Elements of the wind. The structure of the wind, its speed. Causes of wind. Air currents. Air currents in areas of high and low pressure. Local winds.

Section 2. Climatology

Topic 2.1: Weather and its changes.

Air masses, fronts. Formation of cyclones and anticyclones. Weather in cyclone and anticyclone. Scheme of general circulation of the atmosphere. Trade winds and anti-passats, the weather in them.

Topic 2.2 Weather forecasting.

Weather forecasting. The structure of the weather service. Drawing up synoptic maps. Synoptic analysis and forecast. Long-term weather forecasts. Local signs of weather. Weather and seasonal phenomena in nature.

Topic 2.3 Climate Formation. Microclimate.

Climate formation. Climato-forming factors. Factors of anthropogenic impact on the climate. Microclimate. Methods of his research.

4. Learning Materials and Resources

Basic literature

1. *Netrobchuk I.M. Measurement of meteorological quantities: naoch. posib. - Lutsk: Vezha-druk, 2018. - 128 p.*
2. *Valchuk-Orkusha O.M., Sytnyk O.I. Meteorology with the basics of climatology: textbook. posib. - Uman: VPC "Vizavi", 2018. - 223 p.*
3. *Netrobchuk I.M., Gorbach V.V. Atlas of clouds: a visual aid. - Lutsk: Vezha-Druk, 2019. 70s.*
4. *Kholyavchuk D.I. Regional climatology: a textbook. - Chernivtsi: Yuriy Fedkovych Chernivtsi National University, 2019. - 167 p.*
5. *Semenova I. G. Regional weather forecaster: a textbook. - Odessa: TPP, 2019. - 208 p.*
6. *Radovenchyk Y.V. Methodical instructions for the implementation of the abstract on the discipline "Meteorology and Climatology" for the direction of training: 6.040106 "Ecology, environmental protection and balanced environmental management". – K.: NTUU "KPI", 2013. – 12 p.*
7. *Radovenchyk Y.V. Methodical instructions for conducting practical classes and performing independent work on the discipline "Meteorology and Climatology" for the direction of training: 6.040106 "Ecology, environmental protection and balanced environmental management". – K.: NTUU "KPI", 2013. – 12 p.*

Further reading

8. *Kovalenko Y. L. Meteorology and climatology: lecture notes / Y. L. Kovalenko; Kharkiv. National. un-t city. households them. A. M. Beketova. - H.: KNUMH them. O. M. Beketova, 2018. – 65 p.*
9. *Antonov V.S. Short course of general meteorology. Chernivtsi, "Ruta", 2004, - 335 p.*
10. *Protsenko G.D. Meteorology and climatology. – K.: NPU them. Dragomanova, 2007. – 265 p.*
11. *Kobrin V.M. Meteorology and climatology. - H.: KhAI, 2006. – 355 p.*
12. *Climatology: textbook / [E.P. Shkolnyi, O.O. Vrublevska, L.D. Goncharova, G.P. Katerusha]; per zag. Ed. E. P. Shkolny. – Odesa: Ecology, 2013. – 346 p.*
13. *Voronov G.S., Palamarchuk L.V. Fundamentals of meteorology. PART II. – VPC "Kyiv University", 2004, - 143 p.*
14. *Climate of Ukraine. /Edited by V.M. Lipinsky, V.A. Dyachuk, V.M. Babichenko. – K., Raevsky Publishing House, 2003, - 342 p.*

Information resources on the Internet

15. *Ukrainian Hydrometeorological Center - https://meteo.gov.ua/*
16. *Ministry of Environmental Protection and Natural Resources of Ukraine - https://mepr.gov.ua/*
17. *Central Geophysical Observatory - http://cgo-sreznevskyi.kyiv.ua*
18. *Electronic archive of scientific and educational materials KPI them. Igor Sikorsky - https://ela.kpi.ua/*
19. *Ukrainian Meteorological and Hydrological Society - http://umhs.org.ua/*

Educational content

5. Methods of mastering the discipline (educational component)

Lectures

Lectures are aimed at:

- *providing modern, holistic, interdependent knowledge of the discipline "Meteorology and Climatology ", the level of which is determined by the target setting 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 and phenomena in the atmosphere;*
- *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	*Introduction to the course of meteorology and climatology.* *Basic concepts andterms of meteorology and climatology. Meteorological elements.* Weather and climate. Sections of meteorology. *The connection of meteorology and climatology with other sciences.* ***Literature: 1 [13-19]; 4 [6-11]; 5 [7-9, 263-283].*** *Tasks on IWS. Air circulation in the atmosphere. The value of meteorology and climatology for the national economy.*
2	*The composition and structure of the atmosphere.* *Composition and main* and characteristics of the atmosphere. The composition of air in the *surface layer of the atmosphere. Impurities in the air (solid, vapor-gaseous) and their role in the biosphere. The structure of the atmosphere.* ***Literature: 1 [21-37]; 2 [4-8]; 3 [5-13]; 4 [27-32].*** *Tasks on IWS. Characteristics of the layers of the atmosphere.*

3-4	*Solar radiation.* *The sun is the source of life on Earth. Solar radiation. The intensity of solar radiation. Radiation and heat balance of the Earth and the atmosphere. Weakening of solar radiation in the atmosphere. Direct and scattered solar radiation.* ***Literature 1 [45-68] 2 [11-24] 3 [14-28]: 4 [42-53] 8 [62-71] 10 [10-24] 11 [3-32].*** *Tasks on IWS. Methods and means of measuring solar radiation and effective radiation.*
5-6	*Air temperature.* *Air temperature. The processes of heating and cooling the air. The role of the underlying surface in the heating of air. Daily and annual course of air temperature. Adiabatic processes in the atmosphere. Vertical temperature distribution, temperature inversion.* ***Literature: 1 [121-134]; 2 [27-38]; 4 [134-144]; 5 [93-111]; 12 [55-69].*** *Tasks on IWS. Violation of the annual temperature course. Causes and consequences.*
7-8	*Water vapor in the atmosphere.* *Water vapor in the atmosphere. Values characterizing the humidity of the air. The elasticity of water vapor. Condensation and sublimation of water vapor.* ***Literature: 1 [207-221]; 4 [174-181]; 5 [93-105]; 9 [68-82].*** *Tasks on IWS. Methods and means of measuring and calculating air humidity.*
9	*Condensation of water vapor.* *Causes of water vapor thickening. Condensation nuclei. Clouds. Microstructure of clouds. International Classification of Clouds. Clouds. Cloud families and their genera.* ***Literature: 2 [47-48]; 3 [50-52]; 4 [193-205]; 5 [142-158].*** *Tasks on IWS: Geographical distribution of cloudiness. Cloud formation.*
10-11	*Precipitation.* *Precipitation. Precipitation classification. Precipitation formation. Characteristics of the precipitation regime. Daily and annual rainfall. Water balance. The water balance of the Earth.* ***Literature: 1 [234-251]; 2 [49-56]; 3 [53-60]; 4 [214-225]; 5 [161-180]; 8 [257-273].*** *Tasks on IWS. Duration and intensity of precipitation. Methods for measuring precipitation.*
12	*Thermodynamics of the atmosphere.* *Adiabatic processes in the atmosphere. Adiabatic changes in the state in the atmosphere. Dry-adiabatic and moisture-adiabatic temperature changes. Pseudoadiabatic process. Potential temperature.* ***Literature: 2 [27-38] 4 [46-53]; 5 [87-96].;*** *Tasks on IWS. Construction of aerological diagrams.*
13-14	*Atmospheric pressure. Air density.* *Atmospheric pressure. Units of measurement of atmospheric pressure. Change in atmospheric pressure in height. Annual and daily pressure fluctuations. Baric degree. Air density.* ***Literature: 1 [262-278]; 2 [63-68]; 4 [231-247]; 5 [95-100]; 9 [279-299].*** *Tasks on IWS. Methods and means of measuring atmospheric pressure.*
15	*Air currents in the atmosphere.* *Wind. Elements of the wind. The structure of the wind, its speed. Causes of wind. Air currents.* ***Literature: 1 [300-308]; 2 [78-88]; 4 [364-376]; 5 [203-215].*** *Tasks on IWS. Air currents in areas of high and low pressure. Local winds.*

16	*Weather and its changes.* *Air masses, fronts. Formation of cyclones and anticyclones. Trade winds and anti-passats, the weather in them.* ***Literature: 2 [89-92]; 4 [331-335]; 5 [224-245].*** *Tasks on IWS. Weather in cyclone and anticyclone. Scheme of general circulation of the atmosphere.*
17	*Weather forecasting.* *Weather forecasting. The structure of the weather service. Drawing up synoptic maps. Synoptic analysis and forecast. Long-term weather forecasts.* ***Literature 4 [376-380]; 5 [255-262].*** *Tasks on IWS. Local signs of weather. Weather and seasonal phenomena in nature.*
18	*Klimat* *Climate formation. Climato-forming factors. Factors of anthropogenic impact on the climate.* ***Literatur: 2 [92-106]; 4 [384-395]; 5 [263-291]; 10 [39-97].*** *Tasks on IWS. Microclimate. Methods of his research.*

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 knowledge therefore, 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 meteorology and climatology;*
- *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	***Atmosphere and its properties*** *The atmosphere, its connection with the Sun and the earth's surface. Heat and moisture turnover in the atmosphere. Formation of the gas composition of the atmosphere in the process of evolution of the planet.* ***Literature: 5 [10-13] 8 [59-62] 11 [8-14];;.*** *Tasks on IWS. Ozone layer. The main factors that negatively affect the thickness of the ozone layer. Ozone holes. Anthropogenic and natural air pollution.*
2	***Solar radiation*** *Changes in the intensity of solar radiation, factors leading to its weakening in the atmosphere. Types of solar radiation. Reflected solar radiation. Effective radiation.*

	Literature 9 [23-33]: 10 [25-41] 14 [3-12];;. *Tasks on IWS. Solar constant. Albedo. Counter radiation of the Earth.*
3	***Humidity and temperature of atmospheric air*** *Thermal convection and advection. Types of annual temperature changes. Characteristics of humidity of atmospheric air. The processes of water vapor entering the atmosphere.* ***Literature: 8 [65-72] 10 [52-57, 82-87] 13 [121-132];;.*** *Tasks on IWS. Temperature distribution in the surface air layer. Dew point. The structure of the hygrometer.*
4	***Clouds*** *Condensation products of water vapor in the atmosphere.* *The structure of the clouds, their classification. Characteristics of cloud families. Daily and annual course of cloudiness. Fog.* ***Literature 2 [24-27]: 11 [33-42] 12 [69-74];;.*** *Tasks on IWS. Types of clouds that are not included in the main classification. The role of clouds in the formation of atmospheric phenomena.*
5	***Precipitation, changes in the state of the atmosphere*** *Types of precipitation. Dew, frost, ice. Adiabatic temperature changes. Pseudoadiabatic process. Virtual temperature.* ***Literature: 3 [28-36] 8 [241-246] 13 [133-140];;.*** *Tasks on IWS. Types of precipitation characteristic of the territory of Ukraine. Abnormal levels of precipitation.*
6	***Atmospheric pressure and winds, atmospheric electricity*** *Baric degree and vertical pressure gradient. Electrical phenomena in the atmosphere. Daily and annual course of wind speed. Determination of wind direction and strength.* ***Literature: 2 [92-94] 10 [114-119];.*** *Tasks on IWS. Baric field. Thunderstorms and their types. Types and causes of lightning formation.*
7	***Weather*** *Weather forecasting methods. Types of weather forecasts and their level of reliability. The latest methods of forecasting and modeling the processes of changing the state of the atmosphere.* ***Literature: 1 [314-326] 10 [241-244];.*** *Tasks on the IWS. Hydrometeorological Service of Ukraine. The structure of the meteorological site.*
8	*Modular test work*
9	*Test*

Independent work of the student

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

No s/n	*The name of the topic submitted for independent study*	*Number of hours of* ***IWS***
	Section 1. METEOROLOGY	
1	*Air circulation in the atmosphere. The value of meteorology and climatology for the national economy.* ***Literature: 1 [13-19]; 4 [6-11]; 5 [7-9, 263-283].*** *Ozone layer. The main factors that negatively affect the thickness of the ozone layer. Ozone holes. Anthropogenic and natural air pollution.* ***Literature: 5 [10-13] 8 [59-62] 11 [8-14];;.*** *Characteristics of the layers of the atmosphere.* ***Literature: 1 [21-37]****; 2* ***[4-8]****; 3* ***[5-13]****.* *Methods and means of measuring solar radiation and effective radiation.* ***Literature: 8 [62-101]; 10 [10-59]; 11 [3-21].*** *Solar constant. Albedo. Counter radiation of the Earth.* ***Literature 9 [23-33]: 10 [25-41];.*** *Violation of the annual temperature course. Causes and consequences.* ***Literature: 4 [134-141]; 5 [93-101]; 12 [55-70].*** *Temperature distribution in the surface air layer. Dew point. The structure of the hygrometer.* ***Literature: 8 [65-72] 10 [52-57, 82-87] 13 [121-132];;.*** *Methods and means of measuring and calculating air humidity.* ***Literature: 5 [102-106, 127-134]; 9 [68-87].*** *Geographical distribution of cloudiness. Cloud formation.* ***Literature: 4 [193-214]; 5 [142-158].*** *Types of clouds that are not included in the basic classification. The role of clouds in the formation of atmospheric phenomena.* ***Literature 2 [24-27]: 11 [33-42] 12 [69-74];;.*** *Duration and intensity of precipitation. Methods and means of measuring precipitation.* ***Literature: 2 [49-60]; 5 [160-183]; 8 [257-279].*** *Types of precipitation characteristic of the territory of Ukraine. Abnormal levels of precipitation.*	*21*

	Literature: 3 [28-36] 8 [241-246] 13 [133-140];;. *Construction of aerological diagrams.* ***Literature: 2 [27-38]; 4 [46-54]; 5 [87-95].*** *Baric field. Thunderstorms and their types. Types and causes of lightning formation.* ***Literature: 2 [92-94] 10 [114-119];.*** *Methods and means of measuring atmospheric pressure.* ***Literature: 2 [63-68]; 4 [230-249]; 5 [98-113]; 9 [311-321].*** *Air currents in areas of high and low pressure. Local winds.* ***Literature: 1[300-308]; 4 [364-369]; 5 [203-221].***	
	Section 2. CLIMATOLOGY	
2	*Weather in cyclone and anticyclone. Scheme of general circulation of the atmosphere. Trade winds and anti-passats, the weather in them.* ***Literature: 2 [89-92]; 4 [331-335]; 5 [224-255].*** *Local signs of weather. Weather and seasonal phenomena in nature.* ***Literature: 4 [376-380]; 5 [256-262].*** *Hydrometeorological Service of Ukraine. The structure of the meteorological site.* ***Literature: 1 [314-326] 10 [241-244] 14;;.*** *Microclimate. Methods of his research.* ***Literature: 2 [92-106]; 5 [263-278]; 10 [39-59].***	*9*
3	*Abstract* ***Literature: 6.***	*24*
4	*Modular test work*	*6*
5	*Preparation for the test*	*6*
	Total hours	*66*

Individual tasks

According to the curriculum, the student must perform an individualnot a task in the form of an essay. The execution of the abstract performs several educational functions simultaneously. First, the abstract covers in a more specific form those issues that the teacher discussed briefly; secondly, the student acquires skills in working with scientific literature and the ability to analyze a specific problem; thirdly, defending his scientific work, the author of the abstract learns to defend his point of view in a discussion in which the students themselves take part.

The abstract should be based on the study of sources of basic and auxiliary literature. In addition, it is recommended to use monographs, special articles, textbooks for university students and periodicals as auxiliary literature.

Requirements for the implementation of the abstract are given in [6] literature.

Politics and control

6. 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:*
- *Learn About Weather - https://www.futurelearn.com/courses/learn-about-weather*
- *Backyard Meteorology: The Science of Weather - https://online-learning.harvard.edu/course/backyard-meteorology-science-weather?delta=2*
- *Diploma in Meteorology - https://alison.com/course/diploma-in-meteorology*

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

7. 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*	*ICR*	*Abstract*	*Semester control*
4	*4*	*120*	*36*	*18*	*–*	*66*	*1*	*1*	*test*

The student's rating consists of points that he receives for working in practical classes, writing a modular test paper (2 papers of 45 minutes each) and preparing an essay.

Semester control is test.

Rating (weight) points system and evaluation criteria

1. Work in practical classes.

Weight score – 7. The maximum number of points in all seminars is equal to: 7 points × 5 lessons = 35 points.

Criteria for assessing students' knowledge:

Completeness and signs of response	***points***
full answer (at least 90% of the required information)	*6… 7*
Minor inaccuracies were made in the response	*4… 5*
The answer made significant mistakes, but more than half of the material is presented	*2… 3*
Additions to answers	*1*
Lack of response	*0*

2. Modular test work

*Weight score 20. The maximum number of points for all tests (2 works of 45 minutes each) is equal to 20 points*2= 40 points*

Criteria for evaluating tests

points	*Complete answer*
16… 20	*"excellent", creative disclosure of one of the issues, fluency in the material*
11...15	*"good", incomplete disclosure of one of the questions or a complete answer with minor inaccuracies*
4...10	*"satisfactory", Incomplete disclosure of the issue (at least 60% of the required information) and minor errors*
1… 3	*Unsatisfactory work*
0	*Lack of work.*

3. Abstract on a given topic.

Weight score 25.

Criteria for evaluating an individual student's assignment

points	*Complete answer*
21… 25	*"excellent", creative approach to solving the problem*
15...20	*""good", deep disclosure of the problem, reflected own position*
8...14	*"satisfactory", reasonable disclosure of the problem with certain shortcomings*
1… 7	*"enough", the topic is revealed incompletely*
0	*"unsatisfactory", the topic is not disclosed, the abstract is not credited*

Thus, the rating semester scale from the credit module is:

*R=7*5+2*20+25=100 points*

According to the results of educational work in the first 7 weeks, the "ideal student" should score 30 points. At the first certification (8th week), the student receives "enrolled" if his current rating is at least 18 points.

According to the results of educational work for 13 weeks of study, the "ideal student" should score 90 points. At the second certification (14th week), the student receives "enrolled" if his current rating is at least 35 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.

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 of the credit module.

*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*

8. Additional information on the discipline (educational component)

8.1 An approximate list of questions that are submitted to the MKR

Test paper No1.

Option 1.

1. How does the Sun and the underlying surface affect the state of the atmosphere?
2. What is called direct and scattered radiation, how are they determined?
3. What is called temperature inversion, what are the causes of its occurrence?

Option 2.

1. By what mechanism does heat and moisture exchange occur in the atmosphere?
2. What is called the intensity of solar radiation, what is its value?
3. What values characterize the humidity of the air?

Option 3.

1. What is the composition of the air in the surface layer?
2. What factors affect air circulation?
3. What is called the elasticity of water vapor?

Option 4.

1. What impurities of natural and anthropogenic origin can be in the atmosphere, what role do they play in it?
2. How is the radiation and thermal balance of the Earth and the atmosphere determined?
3. What are the primary products of vapor condensation formed in the atmosphere and under what conditions?

Option 5.

1. What is the structure of the atmosphere?
2. What is called thermal radiation and reflected solar radiation?
3. What are the causes of condensation of water vapor in the atmosphere?

Option 6.

1. Give a description of the layers of the atmosphere

2. What daily and annual course does the air temperature on Earth have?
3. How can air humidity be determined?

Option 7.

1. What is the mechanism by which the atmosphere is heated and cooled?
2. How is the temperature distributed in the surface layer of air and what processes affect this distribution?
3. What role do atmospheric impurities play in condensation processes?

Test paper No2.

Option 1.

1. Provide an international classification of clouds
2. What air currents are observed in areas of high and low pressure
3. What is called atmospheric stratification?

Option 2.

1. What daily and annual course has cloudiness?
2. What local winds do you know? How are they formed?
3. Give a general scheme of air circulation on Earth and explain it?

Option 3.

1. What are the types of precipitation falling out of the clouds and under what conditions are they formed?
2. What tasks can be solved using the baric stage?
3. Under what conditions are cyclones and anticyclones formed, what is the weather in them?

Option 4.

1. How is precipitation formed from the clouds?
2. How are isobars and isobaric surfaces applied to synoptic maps?
3. Give a geographical classification of air masses

Option 5.

1. How are adiabatic graphs built?
2. What is called wind and what elements does it consist of?
3. How does the pressure fluctuate during the day and year, what are the reasons for this fluctuation?

Option 6.

1. What units measure the pressure and density of air, what is the dependence between them?
2. What daily and annual stroke has wind speed. What are the causes of wind
3. What problems can be solved using the Laplace-Babin formula?

Option 7.

1. How does the pressure change in the height of the atmosphere and why?
2. How does the rotation of the Earth affect the direction of the winds on the planet?
3. What are the conditions of stable and unstable equilibrium in the atmosphere?

8.2 Approximate list of topics of abstracts

1. *Features of the structure of the Earth's atmosphere, its connection with the Sun and the earth's surface.*
2. *Features of pseudoadiabatic processes in the Earth's atmosphere.*
3. *Patterns and features of air circulation in the Earth's atmosphere.*
4. *Is solar radiation a source of life, or a threat to it?*
5. *Thermal and radiation radiation of the Sun and earth is a source of development of the biosphere.*
6. *Effective radiation.*
7. *Heating and cooling atmospheric air. The influence of man on these processes.*

8. *Patterns and features of temperature distribution in the Earth's atmosphere.*
9. *Features of adiabatic processes in the atmosphere.*
10. *Causes and consequences of a violation of the annual course of temperature.*
11. *What can the clouds tell a meteorologist?*
12. *The dependence of life on Earth on the humidity of the atmosphere.*
13. *Consequences of condensation and sublimation of water vapor for the earth's surface.*
14. *Precipitation and their types. Are they always good for life on earth?*
15. *The emergence and prediction of typhoons and tornadoes.*
16. *The nature of atmospheric pressure and how a person uses this phenomenon to his advantage.*
17. *Features of pressure changes in the height of the atmosphere.*
18. *Conditions for the formation of wind and directions of its movement.*
19. *The relationship between pressure and wind.*
20. *Features of temperature changes in the height of the atmosphere.*
21. *Stratosphere.*
22. *Functions of the atmosphere in the Earth's biosphere.*
23. *Cyclones and anticyclones.*
24. *How to predict the weather.*
25. *Local signs of weather.*
26. *Features of the climatic zones of the planet.*
27. *The influence of man on the climate of the planet.*
28. *Creating a microclimate in certain parts of the planet.*
29. *Natural disasters.*
30. *The development of weather forecasting methods.*

Credit module work program (syllabus):

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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_)*