SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University of Cluj-Napoca**
1.2 Faculty	**Faculty of Environmental Science and Engineering**
1.3 Department	**Department of Environmental Analysis and Engineering**
1.4 Field of study	**Environmental Engineering**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Environmental Engineering**

2. Information regarding the discipline

2.1 Name of the discipline	Meteorology and climatology						
2.2 Course coordinator			Prof. dr. Adina Croitoru				
2.3 Practical work activities coordinator			Prof. dr. Adina Croitoru				
2.4 Year of study	II	2.5 Semester	III	2.6. Type of evaluation	C	2.7 Type of discipline	DF.DD. Mandatory

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 Practical work	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 Practical work	28
Time allotment:					Hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					15
Preparation for seminars/labs, homework, papers, portfolios and essays					15
Tutorship					5
Evaluations					5
Other activities					10

3.7 Total individual study hours	70
3.8 Total hours per semester	126
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1 Curriculum	• Knowledge acquired by deepening the contents taught within the disciplines *Basics of Environmental Science*, *Environmental Geodynamics*, and *Environmental Geography* facilitates the understanding and accessibility of the proposed topics, and alternatively, the students will strengthen their operational conceptual base by activating and capitalizing on the pre-existing information fund.

4.2 Competencies	• The continuity of the applied valorization of the acquired knowledge allows a gradual reading of the chapters, in close relation to the topic of the previously studied discipline.

5. Conditions (if necessary)

5.1. for the course	• Amphitheater equipped with video projector
5.2. for the seminar /lab activities	• Room equipped with computers; Classic weather station; Suitable area for topographic and microclimatic measurements

6. Specific competencies acquired

Professional competencies	• Understanding the main physical processes and the dynamic phenomena and processes associated with weather at all scales of occurrence. • Develop the skills of analysis and interpretation of meteoro-climatic data and information in order to formulate concrete arguments and approaches; • The use of various ways of written and oral communication in relation to the specifics of the discipline; • Useful skills for the purpose of pertinent interpretation of the information provided by the meteorological centers and the use of data in forecasting the evolution of the weather; • Ability to write a scientific paper in the field; • To learn how to use methods and techniques for field investigation of micro- and topoclimates.
Transversal competencies	• Deepening the methods, techniques and procedures of meteo-climatic research; • Awareness of the global problems of humanity that interact with weather and climate: climate change/fluctuation, degradation of the ozone layer, etc. • Formation of practical skills of interpretation and analysis of meteoro-climatic risk situations; • To develop the skills necessary for multidisciplinary cooperation, communication and building of partnership relationships based on the application of acquired knowledge and the development of transdisciplinary scientific reasoning.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	○ Study and investigation of processes, phenomena, and meteo-climate parameters
7.2 Specific objectives	• Knowledge of the laws governing atmospheric processes and phenomena, as well as their regime and distribution to identify the determining factors of the state and quality of the atmospheric environment;

	• Development of observational and environmental awareness through the interpretation of atmospheric phenomena; • Understanding the laws underlying atmospheric processes and phenomena to adopt the best measures for atmospheric management; • Acquiring the criteria for classifying climates and the elements of differentiation both at the planetary, regional, and local levels; • Application of the concepts discussed in different case studies.

8. Content

8.1 Course	Teaching methods	Remarks
Part I. Meteorology **Introduction to Meteorology** *Keywords:* meteorology, branches of meteorology Definition, object and tasks of meteorology. The branches of meteorology and its connection with other sciences. The relations of meteorology with different human activities. Brief history of the development of meteorology	Lecture, Heuristic Conversation	2 hours
Earth's atmosphere *Keywords:* atmosphere, mass of atmosphere. The origin and shape of the atmosphere. Composition of atmospheric air. Constant and variable components. Atmospheric impurities and air pollution. The mass of the Earth's atmosphere. The vertical structure of the atmosphere.	Lecture, Heuristic Conversation, Brainstorming, Explanation	2 hours
Keywords *:* direct, diffuse, reflected, terrestrial and atmospheric solar radiation. The Sun and Solar Activity. The spectral composition of solar radiation. Direct solar radiation-Solar constant. Diffuse radiation. Total radiation. Reflected radiation-Albedoul. Terrestrial and atmospheric radiation. The radiative-caloric balance at the Earth's surface and in the atmosphere.	Lecture, Heuristic Conversation, Explanation, Interactive Discussions	2 hours
Air temperature *Keywords:* thermal regime, adiabatic processes, atmosphere stability Transport of heat in the atmosphere. The diurnal movement of the air temperature. The annual movement of the air temperature. Vertical temperature distribution in the troposphere. Adiabatic processes in the atmosphere. Potential, equivalent and equivalent-potential temperature. The conditions of vertical stability in the atmosphere. Temperature inversions in the troposphere.	Lecture Explanation	2 hours
Water vapour in the atmosphere *Keywords:* water vapour, evaporation, relative humidity. Water phase system.	Lecture Explanation	2 hours

The origin, mode of diffusion and role of water vapor in the atmosphere. Quantities that define air humidity. Evaporation-Saturation Tension. Evaporation rate-Evaporation under natural conditions. The diurnal and annual course of evaporation. Diurnal and annular variation of vapour tension and relative humidity.		
Condensation of water vapour *Keywords:* condensation, fog and fog, clouds. The conditions of condensation of water vapor in the atmosphere - The role of air cooling. Condensation nuclei. Condensation of water vapor on the earth's surface. Condensation of water vapor in the lower layer of the atmosphere. Fog and fog. Condensation of water vapor in the free atmosphere. Clouds. International classification of clouds. Characterization of the main genera of clouds. Microphysical structure of clouds. The genesis of clouds. Cloudiness. The diurnal and annual course of the cloudiness.	Lecture Explanation, Multimedia presentation – types of clouds	2 hours
Atmospheric precipitation *Keywords:* type of precipitation, precipitation regime. The main forms and types of precipitation. The genesis of precipitation. The diurnal course of precipitation. The annual course of precipitation.	Lecture, Interactive Discussions, Heuristic Conversation, Case Studies	2 hours
Keywords *:* atmospheric pressure, baric field, isobaric General notions. Variation of atmospheric pressure with altitude. The vertical baric gradient and the baric step. Periodic and non-periodic variations of atmospheric pressure. Diurnal and annual variations. The baric field. Baric topography. Isobar.	Lecture, Explanation, Brainstorming	2 hours
Keywords *:* horizontal baric gradient, geostrophic wind, local wind General notions. Horizontal baric gradient. The deflection force of the Earth's rotational motion (Coriolis force). Frictional force. Centrifugal force. The geostrophic wind. Wind in the presence of frictional force. The direction, speed and pressure of the wind. The duration of the movement and the structure of the wind. Diurnal and annual variation in wind speed and direction. The field of atmospheric currents. Thermal air circulation. Local winds.	Lecture, Explanation, Heuristic Conversation	2 hours
Weather and weather. Air masses and atmospheric fronts *Keywords:* weather, air mass, atmospheric front General notions about the weather.	Multimedia Presentation – Atmospheric Fronts, Explanation, Conversation	2 hours

Air masses. Classification of air masses. The main geographical types of air masses and their characteristics. Atmospheric fronts. Genesis and classification. The main types of atmospheric fronts: warm front, cold front and occluded front.		
Cyclonic and anticyclonic activity *Keywords:* cyclone, anticyclone, forecast General considerations on cyclonic activity. The genesis and evolution of the cyclone. The structure of the young cyclone and the weather. Cyclone trajectories in Europe. Anticyclones and their influence on the weather. Trajectories of mobile anticyclones in Europe. The convective phenomenon and the weather.	Lecture, Explanation, Heuristic Conversation	2 hours
Part II. **Climatology** **Introduction** *Keywords:* climate, climatogenetic factors. The notion of climate. Climatic elements and factors. Branches of climatology and their practical importance. **Genetic radiative factors of climate** Keywords: total radiation, radiative balance. The distribution of total radiation to the Earth's surface. The geographical distribution of the radiative-caloric balance at the Earth's surface. **Geographical factors of climate** *Keywords:* geographical factors of climatogenesis. The influence of land and sea on climate. The influence of relief on climate. The influence of vegetation on the climate. The influence of the snow and ice layer on the climate. Anthropogenic influence on climate. **Keywords:** baric field, general circulation of the atmosphere. The fundamental features of the general circulation of the atmosphere. The baric field and planetary current systems in the upper troposphere and stratosphere. Baric field and atmospheric circulation in the lower troposphere and at the earth's surface. The climatogenetic importance of the trade winds and the equatorial zone. Monsoon circulation. The climatic role of ocean currents	Lecture, Heuristic Conversation, Brainstorming, Explanation	2 hours
Climate classification **Keywords:** climate classification. Basic problems of climate classification. Classification of climates according to W. Kuppen. Classification of climates according to Emm. De Martone. Classification of climates according to L.S. Berg. Classification of climates according to B.P. Alisov. **Geographical types of climate** *Keywords:* geographical types of climate.	Lecture, Heuristic Conversation	2 hours

Types of climate in the equatorial zone. Types of climate in subequatorial areas. Types of climate in tropical areas. Types of climate in subtropical areas. Types of climate in temperate zones. The types of climate in the subarctic and subantarctic areas. The types of climate in the northern and southern polar regions.		
Colloquium	Exposition, Heuristic Conversation	2 hours

Bibliography

1. Arghiuş, V.,(2010), Meteorologie şi climatologie, suport de curs pentru uz intern, Biblioteca Facultatii de Stiinta Mediului

2. Ciulache, S.,(2004), Meteorologie şi Climatologie, Editura Universitară Bucureşti

3. Farcas, I. (1990), Structura si dinamica atmosferei, Universitatea „Babes-Bolyai", Cluj-Napoca

4. Oliver, J., (2005), Encyclopedia of World Climatology, Encyclopedia of Earth Sciences Series, Springer, Netherlands

5. Pop, Gh.,(1988), Introducere în meteorologie şi climatologie, ESE, Bucureşti

6. Saha, K., (2008), The Earth's Atmosphere - Its Physics and Dynamics, Springer, Berlin

8.2. Practical work	Teaching methods	Remarks
The structure of the meteorological network in Romania. Organization and Observation in Classical Weather Stations	Lecture, Conversation	2 hours
Measurement of the main meteorological parameters at classical meteorological stations. Measurement of solar radiation. Soil and air temperature measurement	Lecture, the Demonstration Practical exercise	2 hours
Measurement of the main meteorological parameters at classical meteorological stations. Measurement of air humidity and atmospheric precipitation. Measurement of atmospheric pressure, wind on the ground, and in altitude	Lecture, the Demonstration Practical exercise	2 hours
Atmospheric research using radiosonde, weather radar, and weather satellites	Lecture, Demonstration, Practical Exercise	2 hours
Automatic weather stations – DAVIS weather station	Lecture, Demonstration, Practical Exercise	2 hours
Statistical analysis of maximum daily precipitation	Case Study, Practical Exercise	2 hours
Determination of average temperature trends using the MAKESENS method	Case Study, Practical Exercise	2 hours
Field trip - Transylvania Nord Regional Meteorological Center - Cluj Meteorological Station - meteorological observation platform	Observations, measurements, interactive discussions	3 hours
Field trip - Transylvania Nord Regional Meteorological Center - Cluj Meteorological Station - Regional Weather Forecast Center	Observations, interactive	3 hours

	discussions, Practical exercise	
Field trips – micro and topoclimatic determinations in the urban area of Cluj-Napoca with the help of automatic meteorological stations	Practical exercise, measurements	6 hours
Presentation of the results of the field trips. Colloquium	Oral evaluation. Interactive discussions	2 hours

Bibliography

1. Arghiuş, V.,(2013), Meteorologie şi climatologie, caiet de aplicaţii şi lucrări practice – pentru uz intern, Biblioteca Facultatii de Stiinta Mediului

2. Tiscovschi, A., Diaconu, C., (2004), Meteorologie şi hidrologie – lucrări practice, Ed. Universitară Bucureşti

3. Wilks, D., (1995), Statistical Methods in the Atmospheric Sciences, vol. 59, International Geophysics Series, Academic Press, USA

4. http://www.meteoromania.ro/

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations, and representative employers within the field of the program

- The content of the discipline is in line with what is studied in other prestigious universities in the country and abroad, being constantly updated according to the new scientific discoveries and the requirements of the labor market;
- The analysis of the opinions formulated by employers regarding the preferential attributes of the training of specialists resulted in a high degree of appreciation of their professionalism, which confirms that the structure and content of the educational curriculum built for this study program are correct, comprehensive, and efficient.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the final grade
10.4 Course	Acquiring new knowledge	Colloquium	66 %
	Ability to operate with new knowledge		
10.5 Practical work	Ability to understand practical applications	Oral colloquium	33 %
	Active participation and degree of involvement in practical work sessions		

10.6 Minimum Performance Standards

- Definition of atmospheric parameters;
- Knowledge of the basic features of meteorological parameters (observation/measurement mode, genetic factors, variation, etc.);
- Knowledge of the types of climate and their main characteristics;

Date of completion	Signature of the course coordinator	Signature of the seminar coordinator
08.05.2024		

Date of approval	Signature of the head of department
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