COURSE DESCRIPTION

Applied remote sensing

2026-2027

1. Date despre program

1.1. Higher Education Institution	Babeş-Bolyai University
1.2. Faculty	Faculty Of Environmental Science And Engineering
1.3. Department	Environmental Analysis and Engineering
1.4. Field	Environmental Engineering
1.5. Level of study	MA
1.6. Degree programme / Qualification	Sustainable development and environmental management
1.7. Form of education	Învățământ cu frecvență (Full time)

2. Course-related data

2.1. Denumirea disciplinei	**Applied remote sensing**			Codul disciplinei	NMX4121
2.2. Course coordinator	Lect. dr. ing. Horațiu Ștefănie				
2.3. Seminar coordinator	Lect. dr. Andrei Radovici				
2.4. Year of study	2	2.5. Semester	3	2.6. Type of evaluation	colloquium
2.7 Discipline regime	Optional		2.8. Course type		DS

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	3	of which: 3.2. course	1	3.3. seminar/ laboratory/ project	2
3.4. Total of hours in the curriculum	42	of which: 3.5. course	14	3.6. seminar/ laboratory	28
Time allocation for individual study (IS) and self-taught activities (ST)					**ore**
Learning from textbooks, course materials, bibliography, and notes (IS)					25
Additional research in the library, on subject-specific electronic platforms, and on-site					25
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					28
Tutoring (professional guidance)					2
Other activities:					-
3.7. Total hours of individual study (IS) and self-taught activities (ST)					80
3.8. Examinations					3
3.9. Total hours per semester					125
3.10. Number of credits					**5**

4. Prerequisites (where applicable)

4.1. curriculum-related	
4.2 skills-related	

5. Specific conditions (where applicable)

5.1. course-related	-
5.2. seminar/laboratory-related	

6.1. Competencies resulting from the completion of the degree programme (as referred to in the curriculum) 1

Professional competencies	
Competency code	**Competency**
PC4	Investigate pollution: Identify the cause of pollution incidents, as well as its nature and the extent of the risks, by performing tests on the site of pollution as well as in a laboratory and performing research.
PC5	Interact professionally in research and professional environments: Show consideration to others as well as collegiality. Listen, give and receive feedback and respond perceptively to others, also involving staff supervision and leadership in a professional setting.
PC11	Manage air quality: Monitoring, audit and management of air quality, including remedial measures.
Transversal competencies	
Competency code	**Competency**
TC1	Think analytically: Produce thoughts using logic and reasoning in order to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
TC3	Report on environmental issues: Compile environmental reports and communicate on issues. Inform the public or any interested parties in a given context on relevant recent developments in the environment, forecasts on the future of the environment, and any problems and possible solutions.

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)[2]

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
CP4 CP5 CP7 CP10 CP11 CP12 CT1 CT2 CT3	1. The student/graduate describes the stages of the scientific research process and of carrying out an applied research project in the field of environmental engineering.	1. The student/graduate actively participates in research and professional practice processes, documenting activities and results. The student/graduate applies integrated theoretical and practical knowledge in solving complex environmental problems. The student/graduate formulates research questions, applies appropriate methodologies and draws well-founded conclusions.1.
CP2 CP3 CP6 CP8 CP11 CT1 CT3	2. The student/graduate identifies and describes the processes and effects of global climate change, energy sources and their environmental impact, as well as the principles of sustainable use of energy resources.	2. The student/graduate analyses the impact of climate change on the environment and society. The student/graduate evaluates and compares energy sources from the perspective of sustainability and environmental impact.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. The student/graduate will know the fundamental principles of remote sensing, including the interaction of electromagnetic radiation with the Earth's surface and the atmosphere.
2. They will understand the types of sensors/instruments (passive and active) as well as their fields of application in atmospheric studies.
3. They will know the methods of data acquisition, preprocessing, and interpretation.

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

Specific academic skills
1. The student/graduate will use digital applications and online platforms.
2. The student/graduate will be able to use and analyze data from active atmospheric remote sensing systems, such as LiDAR and cloud radar, to investigate the vertical structure of the atmosphere.
3. The student/graduate will integrate multi-sensor data (LiDAR, radar, radiometers) for the comprehensive characterization of the atmosphere and validation of satellite observations.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks[3]**
1. Remote sensing. Introductory concepts.	lecture, explanation, conversation	
2. Concepts of radiative transfer in the atmosphere.	lecture, explanation, conversation	
3. Atmosphere. Structure, dynamics, gases and particulate matter.	lecture, explanation, conversation	
4. Study of atmospheric aerosols and clouds using active and passive remote sensing techniques.	lecture, explanation, conversation	
5. Passive remote sensing – aerosol. Radiometers and solar photometers.	lecture, explanation, conversation	
6. Active remote sensing – aerosol. Elastic backscatter LIDAR systems.	lecture, explanation, conversation	
7. • Active remote sensing. Multichannel RAMAN LIDAR systems. Applications in aerosol detection and characterization.	lecture, explanation, conversation	
8. Study of clouds using active remote sensing. Cloud radar. Ceilometer.	lecture, explanation, conversation	
9. Study of clouds using passive remote sensing. Microwave radiometer.	lecture, explanation, conversation	
10. Satellite imaging techniques.	lecture, explanation, conversation	
11. Detection and classification of particulate matter at ground level using optical particle counters.	lecture, explanation, conversation	
12. Modeling pollutant dispersion in the atmosphere at small, medium, and macroscale. Integration of remote sensing data.	lecture, explanation, conversation	
13. International environmental monitoring networks based on remote sensing.	lecture, explanation, conversation	
14. The RADO concept. Romanian Atmospheric 3D Research Observatory. Development of an advanced atmospheric research platform.	lecture, explanation, conversation	

Bibliography:

1. Wallace, J.M., Hobbs, P.V., 2006, Atmospheric science: an introductory survey - 2nd edition., ISBN 13: 978-0-12-732951-2
2. Ann M Holloway and Richard P Wayne, Atmospheric Chemistry, RSC Publishing, ISBN: 9781847558077
3. Fizica mediului – atmosfera, D. Ristoiu, Ed. Napoca Star, 2005, 560 pg
4. Sabina Stefan, Doina Nicolae, Mihaela Caian, 2008, Secretele aerosolului atmosferic in lumina laserului, Ars Docendi, Bucuresti

[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

5. Oleg Dubovik, Brent Holben, Thomas F. Eck, Alexander Smirnov, Yoram J. Kaufman, Michael D. King, Didier Tanre, and Ilya Slutsker, Variability of Absorption and Optical Properties of Key Aerosol Types Observed in Worldwide Locations, Journal of the Atmospheric Sciences, 2001, Vol. 59. p. 520

8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
1. Optical-electronic techniques for environmental monitoring.	conversation	
2. Passive remote sensing. Measurements with the CIMEL CE 318 solar photometer.	experiment, conversation, discovery learning	
3. The AERONET platform – presentation.	experiment, conversation, discovery learning	
4. The AERONET platform – analysis and interpretation of directly measured parameters.	experiment, conversation, discovery learning	
5. The AERONET platform – analysis and interpretation of indirectly measured parameters.	experiment, conversation, discovery learning	
6. Active remote sensing. Measurements with the CLOP LIDAR system.	experiment, conversation, discovery learning	
7. Lidar data processing. The SCC model.	experiment, conversation, discovery learning	
8. Active remote sensing of clouds. Measurements with cloud radar and ceilometer.	experiment, conversation, discovery learning	
9. Passive remote sensing of clouds. Measurements with a microwave radiometer.	experiment, conversation, discovery learning	
10. Modeling pollutant dispersion at macroscale. The HYSPLIT model.	experiment, conversation, discovery learning	
11. Models for forecasting dust intrusions: SKIRON, Copernicus Dust Center.	experiment, conversation, discovery learning	
12. Preparation of an individual or group study (project type) using a remote sensing technique. Presentation and discussion of proposed topics.	Teamwork, experiment	
13. Preparation of an individual or group study (project type) using a remote sensing technique. Presentation and discussion of proposed topics.	Teamwork, experiment	
14. Laboratory colloquium.	Individual study presentation	

Bibliography:

1.Draxler, R.R., Rolph, G.D., HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://ready.arl.noaa.gov/HYSPLIT.php), NOAA Air Resources Laboratory, Silver Spring, MD, [accesat în aprilie 2011]

2.Dubovik, O., Holben, B.N., Eck, T.F., Smirnov, A., Kaufman, Y.J., King, M.D., Tanre, D., Slutsker, I., (2002), Variability of absorption and optical properties of key aerosol types observed in worldwide locations, Journal of Atmospheric Science., 59, 590-608

3.Nicolae, D., (2006), Tehnici LIDAR pentru caracterizarea aerosolilor din atmosfera joasă, Teză de doctorat, Universitatea Politehnica Bucureşti,

9. Evaluation

Type of activity	9.1 Evaluation criteria[4]	9.2 Evaluation methods[5]	9.3 Percentage in the final grade
9.4. Course	Accuracy of responses – correct acquisition and understanding of the issues covered in the course	Oral exam: access to the exam is conditional on participation in seminars.	70 %
9.5. Seminar/ laboratory	Project presentation Application of knowledge in practical contexts		30%
9.6 Minimum standard for passing			
Grade 5 at exam			

10. SDG labels (Sustainable Development Goals)[6]

○ Sustainable Development Generic Label

○ ○ ○ ○ ○ ○ ○ ○ ○

○ ○ ○ x ○ ○ ○ ○ ○

No label applies

Date of entry: Signature of course coordinator Signature of seminar coordinator

22.04.2026

Date of approval: Signature of the head of department

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[5] Both final evaluation methods and ongoing evaluation strategies should be established.

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*