Course title:	Exploring the Environment: Advanced Techniques and Tools for Environmental Measurement
Course title in Polish:	Zrozumieć środowisko: Zaawansowane techniki i narzędzia do pomiarów środowiskowych
Course for discipline:	environmental engineering, mining and energetics, agriculture and horticulture, forestry, biology

Semester:	4	**Status of course:**	faculty	**Language:**	english
Academic year:		**Catalog number:**			

Coordinator of course:	Agnieszka Bańkowska-Sobczak
Lecturer od course:	Arkadiusz Przybysz, Robert Popek, Agnieszka Bańkowska-Sobczak, Anna Sieczko, Marta Stachowicz
Executing unit:	Centre for Climate Research
Ordering unit:	Doctoral School SGGW
Assumptions, goals and description of the course:	Environmental management and research require a fundamental understanding and skills in measuring and monitoring the environment. The course aims to familiarize students with the most modern techniques for assessing the quality of (1) soil, (2) water and (3) air. The course will include short field visits, the collection and storage of environmental samples, the selection of measurement techniques adapted to the research purpose, the measurement (in-situ or in laboratory conditions) of collected samples, and the interpretation of results. By completing the course, students will not only acquire practical skills enabling them to work on environmental projects but also gain a deeper understanding of the world around them.
Didactic form, number of hours:	10
Teaching methods:	filed study, laboratory practicum, experiment, discussion, problem solving
Limit of people in the group:	15

Learning outcomes

KNOWLEDGE - the graduate knows and understands:	**SKILLS - the graduate is able to:**	**COMPETENCES - the graduate is ready to:**
To the extent enabling to revise the existing pradigms in the field/discipline - the world achievments, gathering theoretical background as well as general and selected detailed issues	Carry out critical assessment of the scientific research findings and expert activities and their contribution to the knowledge development in the field/discipline	Critically evaluate the achievments in the field/discipline represented
Major general development trends in the field/discipline		Recognise knowledge in solving cognitive and practical problems characteristic for the area of research (field/discipline) and in an interdisciplinary aspect
		Support the ethos of scientific circles and conduct independent research

The method of verification of learning outcomes:	report from experiment
Form of documentation of achieved learning outcomes:	report archiving, EHMS, attendance list
Elements and weights of the final grade:	report 80%, individual activity during classes 20%
Place of the course:	SGGW campus

Basic and supplementary literature

Basic.
1. Radcliffe, David E., and Jirka Šimůnek. Soil Water Measurement: A Practical Handbook. Oxford: Wiley-Blackwell, 2010.
2.Kabata-Pendias, Alina. Trace Elements in Soils and Plants. 4th ed. Boca Raton, FL: CRC Press, 2010.
3. Gaal, Zoltan, ed. Handbook of Soil Analysis. Dordrecht: Springer, 2005.
4. Pansu, Marc, and Jacques Gautheyrou. Handbook of Soil Analysis: Mineralogical, Organic and Inorganic Methods. 2nd ed. Berlin: De Gruyter, 2024.
5. Pope, C. Arden III, i Douglas W. Dockery. Particles of Truth: A Story of Discovery, Controversy, and the Fight for Healthy Air. Cambridge, MA: MIT Press, 2025.
6. Seinfeld, John H., and Spyros N. Pandis. Atmospheric Chemistry and Physics: From Air Pollution to Climate Change. 4th ed. Hoboken, NJ: Wiley, 2024.
Supplementary:
1. Rowell, David L. Soil Science: Methods and Applications. Harlow: Longman, 1994.
2. Alloway, Brian J. Heavy Metals in Soils: Trace Metals and Metalloids in Soils and their Bioavailability. 3rd ed. Dordrecht: Springer, 2013.
3. Viessman, Warren, and Mark J. Hammer. Water Supply and Pollution Control. 8th ed. Boston: Pearson Education, 2008.
4. Samet, Jonathan M., and Spengler, John D., eds. Indoor Air Pollution: A Health Perspective. Baltimore, MD: Johns Hopkins University Press, 1991.
5. Brasseur, Guy P., John J. Orlando, and Geoffrey S. Tyndall, eds. The Changing Atmosphere: Implications for Global Security. Berlin: Springer, 2018.

Comments:	Students of all semesters of Doctoral School are encouraged to join the course.

Estimated number of hours of work of the doctoral student necessary to achieve the assumed learning outcomes:	25

Leraning outcomes reference to the second degree characteristics of the National Qualification Framework (level 8) covering doctoral competences:

Symbol:	**Learning outcomes:**	**8 level NQF**
SD1_KW01	To the extent enabling to revise the existing pradigms in the field/discipline - the world achievments, gathering theoretical background as well as general and selected detailed issues	P8S_WG
SD1_KW02	Major general development trends in the field/discipline	P8S_WG

SD1_KU05	Carry out critical assessment of the scientific research findings and expert activities and their contribution to the knowledge development in the field/discipline	P8S_UW
SD1_KK01	Critically evaluate the achievments in the field/discipline represented	P8S_KK
SD1_KK03	Recognise knowledge in solving cognitive and practical problems characteristic for the area of research (field/discipline) and in an interdisciplinary aspect	P8S_KK
SD1_KK08	Support the ethos of scientific circles and conduct independent research	P8S_KR