Annex No. 5

to Ordinance No. 21/2019

**COURSE/MODULE SYLLABUS FOR UNIVERSITY COURSES/PhD STUDIES**

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|  | Course/module name in Polish and English  Applications of Ground Penetrating Radar (GPR)/Metody georadarowe | | |
|  | Discipline  Earth and Environmental Science | | |
|  | Language of instruction  English | | |
|  | Teaching unit  Faculty of Earth Science and Environmental Management, Institute of Geological Sciences, Department of Structural Geology and Tectonics | | |
|  | Course/module code  USOS | | |
|  | Type of course/module *(mandatory or optional)*  optional | | |
|  | Field of studies (major, if applicable)  Geology (spec. Applied Geoscience) | | |
|  | Level of higher education *(undergraduate (I cycle), Master’s (II cycle), 5 year uniform Master’s studies)*  Master’s (II cycle) | | |
|  | Year of studies *(if applicable*)  II | | |
|  | Semester *(winter or summer)*  summer | | |
|  | Form of classes and number of hours  Lectures: 8  Classes: 8  Field classes: 8  Teaching methods  Multimedia lecture, mini-lecture, presentation, discussion, practical exercises, individual work, group work, preparation of reports | | |
|  | Name, title/degree of the teacher/instructor  Coordinator: Dr Artur Sobczyk  Lecturer: Dr Artur Sobczyk  Classes instructor: Dr Artur Sobczyk | | |
|  | Course/module prerequisites, in terms of knowledge, skills, social competences  Knowledge and skills in physics (Electromagnetic), basics of exploration geophysics, sedimentology, geomorphology and geological mapping. | | |
|  | Course objectives  The main aim of the course is to gain understanding of ground penetrating radar (GPR) technique and its application to geological sciences, emphasizing methodological issues. The course consists of three parts:  (1) lectures;  (2) fieldworks;  (3) computer laboratory. | | |
|  | Course content  Lectures:  Ground Penetrating Radar - principles and method presentation. GPR construction, antenna types and research methodology. Introduction to electromagnetic wave propagation laws, with special reference to different geological media. Regulations, norms and radiological data in GPR technique. An overview for the most popular and common used ground penetrating radar equipment. Signal optimization, modulation, processing and filtration. GPR software for data analysis and visualization. Method application: geology, archaeology, geomorphology, sedimentology, civil engineering. Research planning, study realization and results presentation.  Laboratories and fieldworks:  GPR construction, equipment configuration and running. Terrain research methodology. Parameters for data collection. Collecting field data. Data processing techniques and its visualization. Echoes presentation and preparing of research reports. | | |
|  | Intended learning outcomes  P\_W01 Student has knowledge of the ground penetrating radar technique associated with selected aspects of the geological and related sciences (e.g., geophysics, archaeology, civil engineering).  P\_W02 Student knows the general principles for planning GPR research actively using techniques and tools used in geology and transferring them to other fields.  P\_U01 Student can planned and carried out GPR research tasks and prepare final reports and documentation, is able to configure the equipment according to the project duties.  P\_U02 Student can used specialized GPR techniques and software for the description of phenomena and data analysis, as well as collect and interpret empirical data and prepare final reports.  P\_U03 Student has the ability to write scientific reports in the English language.  P\_K01 Student has the ability to work in a team and lead the work team during the GPR survey.  P\_K02 Student has the ability to identify and solve problems and dilemmas associated with the pursuit geologist. | Symbols of learning outcomes for particular fields of studies, *e.g. K\_W01\**, *K\_U05,K\_K03*  K2\_W02, K2\_W03  K2\_W06  K2\_U04  K2\_U05  K2\_U06  K2\_K02  K2\_K07 | |
|  | Required and recommended reading *(sources, studies, manuals, etc.)*  Required reading  Daniels D.J., 2004. Ground Penetrating Radar (2nd edition). The Institution of Electrical Engineers, London, 734 pp.  Neal A., 2004. Ground-penetrating radar and its use in sedimentology: principles, problems and progress. Earth-Science Reviews, 66, 261-330.  Recommended reading  Bristow C.S., Jol H.M. (eds.), 2003. Ground Penetrating Radar in Sediments. Geol. Soc. London Spec. Publ., 211, 335 pp.  Goodman D., Piro S., 2013. GPR remote sensing in archeology, Springer Verlag. Berlin-Heidelberg, 233 pp. | | |
|  | Assessment methods for the intended learning outcomes:  - preparation and implementation of field work project presented in a form of written report. K2\_W02, K2\_W03, K2\_W06, K2\_U04, K2\_U05, K2\_U06, K2\_K02, K2\_K07. | | |
|  | Credit requirements for individual components of the course/module:  Lecture and classes:  - monitoring attendance and progress on the course subject matter,  - preparing and implementing a project (individual), min. 60% required,  - writing a class report. | | |
|  | Total student effort | | |
| form of student activities | | number of hours for the implementation of activities |
| classes (according to the plan of studies) with a teacher/instructor:  - lectures: 8  - classes: 8  - field classes: 8  - exam: 2 | | 26 |
| student's own work (including group-work) such as:  - consultation: 14  - being prepared for classes: 4  - reading the suggested literature: 6  - preparing results from fieldwork: 12  - writing a class report: 14 | | 50 |
| Total number of hours | | 76 |
| Number of ECTS credits | | 3 |