Annex No. 5
to Ordinance No.
21/2019

COURSE/MODULE SYLLABUS FOR UNIVERSITY COURSES/PhD STUDIES

1.	Course/module name in Polish and English Trace fossils and their palaeoenvironmental significance/ Skamieniałości śladowe i ich znaczenie dla paleośrodowiska
2.	Discipline Earth and Environmental Science
3.	Language of instruction English
4.	Teaching unit Faculty of Earth Science and Environmental Management, Institute of Geological Sciences
5.	Course/module code USOS
6.	Type of course/module *(mandatory or optional)* optional
7.	Field of studies (major, if applicable) Geology
8.	Level of higher education *(undergraduate (I cycle), Master's (II cycle), 5 year uniform Master's studies)* Master's (II cycle)
9.	Year of studies *(if applicable*) I/II
10.	Semester *(winter or summer)* winter/summer
11.	Form of classes and number of hours Lectures: 26 Teaching methods: Multimedia lecture, presentation.
12.	Name, title/degree of the teacher/instructor Coordinator: Alina Chrząstek, Phd Lecturer: Alina Chrząstek, Phd
13.	Course/module prerequisites, in terms of knowledge, skills, social competences Main knowledge concerning geology.
14.	Course objectives The aim of the lecture is presentation of the main ichnofacies and common trace fossils and their usefulness to reconstruction of the sedimentary conditions and palaeoenvironments.

15.	Course content Lectures: Definition of the trace fossils. Ethological division of the trace fossils into different categories. Main tracemakers of the trace fossils. The historical background of ichnology. Characteristic of the main Seilacherian ichnofacies (continental, shallow-marine and deep-marine). Ichnodiversity of the trace fossils in various ichnofacies. Description of the common ichnotaxa. Informations concerning trace makers of the burrows and their paleoenvironmental requirements. Usefulness of the trace fossils to the palaeoenvironmental reconstructions (bathymetry, energy of water, oxygenation level and salinity, sedimentary rate, character of the substrate). Ichnological analysis. Examples of ichnological analysis from different regions from Poland (Sudety Mountains) and Europe or other countries. Vertebrate traces. The most interesting discoveries of vertebrate traces. Colonization of the continental, brackish, shallow-marine and deep-marine environments by producers of the trace fossils. Phanerozoic history of the trace fossils, changes ichnotaxonomical diversity in time. The application of the invertebrate and vertebrate trace fossils to biostratigraphy – ichnostratigraphy. Definition of the systems boundaries (Neoproterozoic-Cambrian boundary). Changes in the trace fossil assemblages during 5 Mass-Extinction episodes (Latest Ordovician, Late Devonian, End-Permian, End-Triassic, End-Cretaceous Mass Extinctions). Trace fossils in the well cores. Neoichnology.	
16.	Intended learning outcomes	Symbols of learning outcomes for particular fields of studies:
	W_1 Students have knowledge concerning trace fossils. They received also some informations connecting with historical geology and sedimentology.	K2_W01; K2_W08
	W_2 Students know the modern methods of ichnological analysis and are able to recognize the common trace fossils. They can use the trace fossils for reconstructions of continental, shallow- and deep-marine environments.	K2_W03
	W_3 They are able to interpret the sedimentary environment on the basis of trace fossils.	K2_W04
	W_4 They have knowledge concerning geology of Poland (examples of the ichnological analysis from the Sudety Mountains).	K2_W07
	W_5 Students known English ichnological terminology.	K2_W09
	U_1 Students use the modern ichnological models and ichnological literature (in Polish and English) in aim to reconstruct the palaeoenvironment.	K2_U01; K2_U02
	U_2 They can choose correct informations that allow to recognize the trace fossils and establish sedimentary conditions.	K2_U03

	K_1 Students understand the need of systematic study. Due to continuous development of science (ichnology), they understand the necessity to expand their knowledge. K_2 Students are able to establish the sequence of research concerning trace fossil assemblages, in aim to reconstruct the palaeoenvironment. K_3 Students learn to use ichnological literature (always the newest one) to reconstruct the sedimentary conditions.	K2_K01 K2_K03 K2_K06
17.	Required and recommended reading *(sources, studies, manuals, etc.)* Required reading Bromley, R.G. 1996. Trace Fossils. Biology, Taphonomy and Applications, 1–347. Chapman and Hall; London. Bromley, R.G., Buatois, L.A., Mángano, G., Genise, J.F. and Melchor, R.N. 2007. Sediment-Organism Interactions: A Multifaceted Ichnology. SEPM, Special Publication, 88, 393 pp. Buatois, L. and Mángano, M.G. 2011. Ichnology, Organism-Substrate Interactions in Space and Time. Cambridge University Press, 358 pp. Knaust, D. and Bromley, R.G. 2012. Trace fossils as indicators of sedimentary environments, Developments in Sedimentology, 64, 924 pp. McIlroy, D. 2004. The application of ichnology to palaeoenvironmental and stratigraphic analysis. Geological Society, Special Publication, 228, 490 pp. Pemberton, S.G., Spila, M., Pulham, A.J., Saunders, T., MacEachern, J.A., Robbins, D. and Sinclair, I.K. 2001. Ichnology and sedimentology of shallow to marginal marine systems. Ben Nevis & Avalon Reservoirs, Jeanne d'Arc Basin. Geological Association of Canada, Short Course Notes, 15, 343 pp. Seilacher, A., 2007. Trace fossil analysis, 1–226. Springer-Verlag, Berlin-Heilderberg-New York. Recommended reading Curran, H.A. 1985. Biogenic structures: their use in interpreting depositional environments. SEPM, Special Publications, 35, 347 pp. Frey, R.W. and Seilacher, A. 1980. Uniformity in marine invertebrate ichnology. Lethaia, 13, 183–207. Frey, R.W., Howard, J.D. and Pryor, W.A. 1978. Ophiomorpha: its morphologic, taxonomic, and environmental significance. Palaeogeography, Palaeoclimatology, Palaeoecology, 23, 199–229. Frey, R.W., Pemberton, S.G. and Saunders, T.D.A. 1990. Ichnofacies and bathymetry; a passive relationship. Journal of Paleontology, 64, 155–158. Knaust, D., 2017. Atlas of Trace Fossils in Well Core. Appearance, Taxonomy and Interpretation. Springer, 271 pp. Miller, W., III 2007. Trace fossils. Concepts. Problems. Prospects. Elsevier, 611 pp.	
18.	Assessment methods for the intended learning outcomes: - final test (written, above 50% of all points) – K2_W01, K2_W03, K2_W04, K2_W07, K2_W08, K2_W09, K2-U01, K2_U02, K2_U03, K2-K03, K2_K06	
19.	Credit requirements for individual components of the course/module: - monitoring attendance and progress on the course subject matter, - semester paper (individual or group), - writing a class report, - final test (written).	

20.	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: 26	26
	student's own work (including group-work) such as: - being prepared for classes: 5 - reading the suggested literature: 8 - preparing papers/presentations/projects: - writing a class report: - preparing for tests and exam: 12	25
	Total number of hours	51
	Number of ECTS credits	2