Załącznik nr 1

Specific learning outcomes for the field of geodesy and cartography

Learning outcomes for the field of study	**After completion of the second cycle graduate:**	**The reference to the effects of education for the technical sciences**
KNOWLEDGE		
Common effects		
K2A – W01	has expanded and in-depth knowledge of mathematics, consisting of elements of the calculus of complex functions of one complex variable, differential geometry of curves and surfaces, the first and second quadratic forms and geodetic lines, partial differential equations of first and second order function of two independent variables	T2A – W01 T2A – W07
K2A – W02	has the knowledge necessary to understand the social, socio-technical, legal and other non-technical determinants of surveying and other legal and administrative tasks of surveyor and take them into account in professional practice	T2A – W08
K2A – W03	has a basic knowledge about entrepreneurship, knows how the enterprises function in a market economy, knows organizational and legal regulations of conducting business, knows basic methods of the company management	T2A – W08 T2A – W09 T2A – W11
K2A – W04	has general theoretical knowledge of cartographic modeling, analysis and evaluation of the spatial structure of phenomena using database models, knows the parameters describing the spatial relationships of phenomena and methods of its visualization	T2A_W03
K2A – W05	has knowledge of the methods of obtaining, storing and digital image processing, is familiar with the basic methods of digital photogrammetry and remote sensing, has general theoretical knowledge regarding the methods used for the image classification	T2A_W02 T2A_W07
K2A – W06	has detailed knowledge of the custom parameter estimation methods and data processing	T1A_W04
K2A – W07	has structured, theoretically founded general knowledge in the field of geophysical phenomena occurring in geospheres, knows the basic methods and techniques of geodynamic research, has knowledge of selected methods for modeling the gravitational field of the Earth;	T2A – W02 T2A – W03 T1A_W07
K2A – W08	has detailed knowledge of the use of satellite measurement techniques, mainly in the implementation of GNSS in various surveying tasks	T2A_W04 T2A_W06
K2A – W09	is familiar with the methods and rules of geodetic displacement and deformation measurements of buildings, civil engineering structures and their surroundings, knows the basic methods of measurements processing and evaluation of the stability of the reference system, knows rules of geometric (geodesic) interpretation of measurement results	T2A_W04 T2A_W06
K2A – W10	has structured, theoretically founded detailed knowledge in the field of real estate and property market behavior, knows the legal basis and mechanisms of property management	T2A_W04
K2A – W11	has structured, theoretically founded knowledge of the basic issues of property valuation, knows basic approaches, methods and techniques used in solving engineering tasks in the field of real estate valuation	T2A – W03 T1A_W07
K2A – W12	has knowledge of the development trends and the most important new developments in the field of geodesy and cartography and allied disciplines	T1A_W05
K2A – W13	knows the capabilities of the databases, including spatial databases, knows what role they play in the base infrastructure for spatial information, knows the rules of design and development of spatial	T2A_W04 T2A_W05 T2A_W07

	databases and their sharing in the network, knows the basics of creating web applications	
K2A – W14	is familiar with the terminology associated with data mining; knows supervised and unsupervised data mining methods, knows the basic concepts of geostatistics	T2A_W04
K2A – W15	has theoretically founded detailed knowledge related to selected topics in the field of geoinformatics	T2A_W04 T2A_W05 T2A_W07
K2A – W16	has detailed knowledge of selected fields of study and specializations associated with a specialization in geoinformatics	T2A_W02
K2A – W17	has knowledge on the development trends and significant new solutions implemented in a thesis, knows the rules of constructing and writing a thesis and scientific publications,	T2A_W04 T2A_W05
K2A – W18	knows and understands the basic concepts and principles of the protection of industrial property and copyright law and the need for resource management of intellectual property, can use the resource of patent information	T2A – W10
SKILLS		
Common effects		
K2A – U01	solves selected types of the ordinary differential equations of the second order, knows how to get the real and imaginary part, as well as derivatives of some complex functions of one complex variable, determines the coefficients of the first and second forms of squares of the selected area, determines the type of partial differential equations of second order in the case of a function of two independent variables	T2A – U09 T2A – U10
K2A – U02	is able to communicate in English in a professional environment, has in-depth language skills in the technical sciences and disciplines of geodesy and cartography according to the requirements for level B2 + European Framework of Reference for Languages	T2A – U02 T2A – U06
K2A – U03	is able to propose an organizational and legal form of business activity specific to the project, performs basic interpretation and evaluation of the economic situation of the company	T2A – U14
K2A – U04	can perform spatial analysis and evaluate the structure and spatial relations of phenomena taking into account the local and practical needs, can present results of spatial analysis in the form of cartographic models	T2A_U09
K2A – U05	is able to perform advanced digital image processing based on the tools available in software packages used in photogrammetry, remote sensing, geodesy and cartography, can independently implement basic algorithms of digital image processing	T2A_U08 T2A_U18
K2A – U06	is able to use the appropriate custom method of observation data processing, taking into account data specification and specific task	T1A_U16 T1A_U17
K2A – U07	is able to assess the suitability of the methods and tools used in the geodynamic researches and indicate their limitations; is able to determine characteristics of Earth's gravity field and determine their impact on the results of surveying;	T1A_U10 T2A_U18
K2A – U08	is able to apply appropriate methods of satellite measurements, hardware and software for the implementation of geodetic works	T2A_U18
K2A – U09	knows how to apply basic methods of displacement and deformation measurements of buildings and civil engineering structures, knows how to develop their performance and is able to select appropriate methods for specific purposes	T2A_U09 T2A_U10 T2A_U11 T2A_U15
K2A – U10	is able to make a preliminary economic analysis undertaken on real estate investment activities by identifying potential betterment levy, fees for perpetual usufruct, calculation of compensation for expropriation of property, fees for the conversion of perpetual usufruct right into ownership	T1A_U10 T2A – U14
K2A – U11	can obtain information from literature, databases and other properly	T2A_U01

	selected sources, can integrate information obtained in the process of property valuation, can plan and carry experiments and computer simulations of real estate valuations, interpret the results and draw valid conclusions	T2A_U08
K2A – U12	can make a critical analysis of the methods of operation, evaluate the existing technical solutions, organizational and administrative provisions of the visited facilities and institutions, in particular equipment, facilities, systems, processes, services	T1A_U15
K2A – U13	can design the spatial database and apply it in the fulfillment of his objectives; is able to set up a local network, is able to create a simple website, can run the web application and modify its functionality	T2A_U07 T2A_U15 T2A_U17 T2A_U18 T2A_U19
K2A – U14	can choose appropriate supervised and unsupervised methods for data distribution, can use cluster analysis method for grouping objects, can examine the relationships between variables in a multidimensional space based on the regression model, is able to select and use the appropriate method of interpolation and approximation of spatial data	T2A_U09 T2A_U15 T2A_U17
K2A – U15	is able to assess the suitability of methods and tools for the solution of engineering tasks specific for the selected branches of geoinformatics, is able to see limitations of these methods and tools, is able to solve complex engineering tasks specific for geoinformatics, including unusual tasks and tasks containing a research component	T2A_U17 T2A_U18
K2A – U16	can - when formulating and solving engineering tasks - integrate knowledge of the fields of science, scientific disciplines and specialties related to geoinformatics and apply systemic approach taking into account the non-technical aspects	T2A_U10
K2A – U17	can determine the direction of further learning and achieve learning process in the field of the chosen topic of the thesis; is able to obtain information from literature, databases and other properly selected sources, also in English, is able to integrate obtained information to make their interpretation and critical evaluation, can draw conclusions, formulate and fully justify opinions and conclusions with regard to the chosen thesis topic; is able to prepare a study in Polish and a short scientific report in a foreign language presenting the results of their own research; is able to prepare and present in Polish and foreign language oral presentation concerning specific issues related to the selected topic	T2A_U01 T2A_U03 T2A_U04 T2A_U05
K2A – U18	is able to plan and carry out tests and interpret the results, can develop or adapt existing research methods to accomplish the task; is able to suggest improvements of existing technologies, is able to formulate and test hypotheses about the engineering problems and simple research problems	T2A_U08 T2A_U11 T2A_U16
SOCIAL COMPETENCES		
K2A – K01	understands the need and knows the possibilities of lifelong learning, is able to inspire and organize the learning of others	T2A – K01
K2A – K02	is aware of and understands the validity of the non-technical aspects and effects of the activities of master engineer-surveyor, including its impact on the environment, safety and the responsibility for taken decisions	T2A – K02
K2A – K03	is able to interact and work in a group taking different roles	T2A – K03
K2A – K04	can properly identify priorities for the implementation of the tasks specified by himself or others	T2A – K04
K2A – K05	is able to correctly identify and resolve dilemmas associated with the profession of master engineer surveyor	T2A – K05
K2A – K06	is able to think and act in a creative and enterprising way	T2A – K06
K2A – K07	is aware of the social role of technical university graduate, especially understands the need to formulate and transmit to society - including through the mass media - the information and opinions on the	T2A – K07

	achievements of geodesy and other aspects engineer-surveyor work, takes effort to give such information and opinions in a commonly understood manner justifying different points of view	

T - the area of education in technical sciences,
1 - first degree
2 - second degree
A – general academic profile
K - the symbol of the field of study
O1 - subject / module number
W - knowledge
U - skills
K - competence