Second-cycle studies programme with hours/week in three semesters [15 weeks]

Field of education: Geodesy and Cartography, **specialization** Cadastre and Land Management

No	Course	Sem. I				Sem. II				Sem. III			
	l - lecture, e - exercices, p - project, E - exam	l	e	p	ECTS	l	e	p	ECTS	l	e	p	ECTS
	General courses												
1	Selected Issues of Economy Law	1			1								
2	Human Rights					1			2				
3	Geodetic and Cartographic Law									1	1		2
4	Specialist Foreign Language										2		1
5	Mathematics		2		3								
6	Selected Topics of Mathematics and Numerical Methods /E	1	2		4								
7	Geophysics	1	1		2								
8	Selected Topics of Physical Geodesy and Geodynamics			1	2								
9	Digital Image Processing			2	2								
	Profiled courses												
10	Standards in Geographic Information	1			2								
11	Geodetic Frames in Geodesy			1	2								
12	Space Geodetic Techniques /E	1		2	3								
13	Engineering Surveying /E	1		1	2								
14	Geodetic Service of the Construction Process	1		1	3								
15	Surveying studies for legal purposes	2		2	4								
16	Facultative class 1					2			1				
17	Facultative class 2					1		1	2				
18	Facultative class 3					2			1				
19	Facultative class 4					2			1				
	Specialization courses												
20	Land Consolidation /E					2			3			3	3
21	Geodesy for Local Development Plans							1	2				
22	Technical Background of Real Estate Valuation					2			2				
23	Real Estate Valuation /E					2	1	1	5	2		1	3
24	Cadastre /E					2		3	5				
25	Selected Sections of Law in Real Estate Appraisal					2			3				
26	Economic Basis of Real Estate Valuation					2	1		3				
24	Land Consolidation 2												
27	Diploma Seminar										2		1
28	Diploma Thesis												20
	TOTAL	9	5	10	30	20	2	6	30	3	5	4	30

Courses descriptions

	General courses	
	Selected issues of economy law	1. Basic information on economic law 2. Sources of law, including the economic law 3. Legal entities. an individual and a legal person, methods of their creation and their legal capacity. 4. The principles of representation of legal persons. 5. Basics principles of obligation. Contracts as a source of obligations. The principle of freedom of contracts. Modes of concluding a contract, in particular in the economy. 6. The principles of fulfillment of contractual obligations. Consequences of non-performance or improper performance of the contract. 7. Taking up and running a business. The concept of the entrepreneur. Forms of runnning and requirements for starting a business. 8. Economic freedom and its limitation 9. Registration of running of an individual entrepreneur in the Central Register of Economic Activity, Polish Classification of Economic Activity 10. Company law. Principles of establishing companies. Register of Entrepreneurs of the National Court Register 11. Partnerships and capital companies – main features

	Geodetic and Cartographic Law	Lecture: Tasks of the organs of the geodetic and cartographic service. State geodetic and cartographic repository – management, sharing, fees, licenses. Submission of geodetic and cartographic works. Coordination of utilities network projects. Protection of geodetic controls. Geodetic works in closed areas. Technical standards applicable in surveying. Rules for completing technical reports. Professional qualifications in the field of geodesy and cartography. Exercises: Preparation of a geodetic work application. Preparation of a fee calculation document for materials for the submitted geodetic work, drawing up a license for the above-mentioned geodetic and cartographic materials. Preparation of a technical report for the submitted work and the content of the technical report for a specific assortment of surveying work. Preparation of an application for authentication of geodetic materials resulting from surveying work. Preparation of a notice of completed surveying work. Preparation of an application for coordination of the utilities network project.
	Specialist foreign language	Achieving the B2+ level of knowledge of a foreign language by expanding the specialist vocabulary related to geodesy and cartography and improving other skills that will enable students to communicate freely in a foreign language, prepare effective presentations and write an abstract of a master's thesis, report or texts in a foreign language useful in their professional work.
	Mathematics	Functions of complex variable: function derivative, Cauchy-Riemann equations, holomorfic function. Integration of complex function, Cauchy integral theorem, Cauchy integral formula, Laurent series, residual of the complex function and its application for the computation of integrals. Basic equations of mathematical physics. Partial differential equations of the first and second order and their classification. Differential equations of the string and of the thermal conductivity. Fourier method of the separation of variables. Integration and ultra-tight (deep) integration.
	Selected Topics of Mathematics and Numerical Methods **/E**	The main purpose of the course is to give students theoretical and practical knowledge on the selected methods of random signals analysis. The course will present mathematical background and describe algorithms of empirical data analysis, both in the time and frequency domain. The course will begin with a short introduction to the theory of probability, random variables and their parameters. Next, given is description of the random signals with special attention paid to the properties of stationarity and ergodicity. The basic characteristics of the signals are introduced: mean value and variance, probability density, autocorrelation and power spectral density (PSD) functions, then the joint characteristics: joint probability density, cross correlation and the cross power spectral density (CPSD). The data analysis algorithms will include the classical methods, based on the digital Fourier transform, and the parametric methods focusing on the autoregressive (AR) modeling of time series. The last part of the course is devoted to the application of the linear Kalman filter to the time domain analysis of discrete data. It begins with definition of the linear dynamical system using the state-space formulation, then the filtering equations are derived. The project part of the course includes application of the computer programs for analysis of empirical data.
	Geophysics	The purpose of this course is to give the students a basic knowledge on the folowing subjects: The Earth as a planet. Internal structure of the Earth. Isostasy – postglacial rebound. Plate tectonics: oceanic rifts, subduction zones, orogens, transform boundary. Rheology. Seismology: seismic waves, seismic wave propagation, Richter scale. Earth's magnetic field: parameters, units, constituents, geodynamo hypothesis. Magnetic surveying: magnetic anomalies. Geomagnetic poles, equator and coordinates (calculation of). Paleomagnetism, polarity reversals. Magnetosphere, magnetic storms and solar activity. Hydrological cycle, physical properties (density, optical, acoustic) of oceanic water. Physical oceanography: thermocline, waves, currents, deep-water circulation, oceanic tides. Basic of fluid dynamics. Particular attention is paid to the interactions between geophysics and geodesy. That includes those geophysical theories and models which are used in geodetic practice, as well as the geodetic observations and models which can support geophysical research.
	Selected Topics of Physical Geodesy and Geodynamics	Gravimetric measurements - construction of a gravimeter, preparation for measurement (calibration, adjustment) - calculation exercise: determination of the gravimetric factor from measurements on a calibration basis. Gravimetric measurements - Development of a gravimetric measurement with the calculation of the tidal correction - calculation exercise: preparation of the results of a gravimetric span measurements with relative method.

		Gravimetric measurements - development of measurement results: calculation of the field correction, calculation of reductions and gravimetric anomalies - calculation exercise: preparation of a map of free air anomalies and the full Bouguer anomaly. Tidal deformations - determination of the deformation of the earth's crust caused by tidal phenomena, static and dynamic tidal model - computational exercise: determination of the deformation of the earth's crust in the neu system for a specific point in a given period. Non-tidal deformations - determination of deformations caused by non-tidal phenomena (atmosphere, hydrology or anthropogenic and local factors) - computational exercise: determination of the Earth's crust deformation in the neu system for a specific point. Implementation of the EVRF2007 system - determination of the increments of geopotential number with the use of real gravimetric measurements and geopotential models - accuracy analysis - computational exercise: determining the increments of geopotential features for a selected leveling line, reduction to zero tide. The phenomenon of isostasy and its importance for the implementation of the geodetic network - computational exercise: modeling of the isostatic effect on the basis of the GNSS time series (Fennoscandia). Gravity field of simple geometric solids - elements of geophysical interpretation - computational exercise: modeling of gravity field anomalies resulting from anomalies of subsurface formations. Elements of the gravity field in connecting the natural (related to the plumb line) and geodetic (related to the normal line) coordinate system - computational exercise: reduction of traverse elements from the tacheometric system to the geodetic system related to the GNSS network.
	Digital image processing	1. Registration and development of a digital image 2. Digital image recording formats. 3. Lossy and lossless image compression methods. 4. Basics of image processing in Matlab (Computer Vision System Toolbox TM) 5. Basics of image processing in Python 6. Preprocessing (Matlab) and automatic image vectorization (ArcGIS) 7. Detection and analysis of text on images using the function Optical Character Recognition (OCR) 8. Clustering algorithms and the basics of machine learning for digital image classification. 9. Contextual processing: removing noise from an image through selected low-pass filters and detection characteristic elements of the image through high pass filters 10. Basics of mathematical morphology. 11. Basics of image texture analysis: fractal analysis, GLCM, granulometric analysis.
	Profiled courses	
	Standards in Geographic Information	Lectures: 1. Concepts of standard and norms. Objectives and tasks of standardization. 2. The subject, structure, and organization of standardization in GI. OGC standards, ISO standards. 3. Standards formalism, ISO / TS 19103 specification - UML language and ISO 19109 - rules of application schemas. 4. Selected issues from the ISO 19100 series standards: - describing the position (ISO 19107, ISO 19125-1, ISO 19111 and ISO 19112); - temporal scheme (ISO 19108); - data quality (ISO 19157 and ISO 19158); - cataloging methodology (ISO 19110); - metadata (ISO 19115); - XML language - GML (ISO 19136 and ISO 19139). 5. Rules for the use of standards in specific applications.
	Geodetic Frames in Geodesy	The content of the exercises: 1. Estimation of a station velocity on the basis of position time series - introducing discontinuities - estimation of seasonal terms - detection of outliers 2. Extrapolation of coordinates to the desired epoch 3. Transformation of coordinates between two terrestrial reference systems 4. Estimation of station velocities using plate tectonics models 5. Estimation of plate rotation pole on the basis of GNSS velocity field. Estimation of intraplate velocities.
	Space Geodetic Techniques /E	Geodetic satellites, classification and history. Equations of motions of satellites The role of atmosphere in satellite geodesy GNSS: GPS, GLONASS, Galileo - error sources, classification - atmospheric effects: ionosphere, troposphere. - antenna phase center variations. Multipath. - differences of observation, linear combinations - GNSS data processing in regional networks SLR and DORIS satellite techniques VLBI - space geodetic technique Satelite altimetry and its missions Earth gravity field. CHAMP, GRACE, GOCE missions. Reference frames realized by space geodetic techniques: ITRS/ITRF. Space geodetic techniques services : IGS, EUREF, ILRS, IDS, IVS. GGOS. Applications of space geodetic techniques in geodynamics

	Engineering Surveying /E	Lectures: Geodetic measurements for construction service and operation control of the railways (4 hours), Specialistic techniques of industrial measurements (autocollimation of parallel and convergent light rays, autoreflection (5 hours), Control measurements of rotary kilns (2 hours), Surveying tasks in underground construction and mining (2 hours), Measurement of unstable objects on the example of shipbuilding (1 hour), Measurements of the special objects. Measurements on the closed areas - excluded from local government administration (1 hour). Project exercises: Measurement and development of the reconstruction project on the example of a railway section (5 hours), Development of the tunnel construction measurements service project (4 hours.), Autocollimation measurements: azimuth transfer in the two-level network, direction transfer through the obstacle (6 hours).
	Geodetic Service of the Construction Process	1. The process of preparing a construction investment (maps for design purposes, supplementary measurements, field interview in the field of finding technical equipment for the area. 2. GESUT. 3. Local Development Plan and Decision on development conditions. 4. Plot development plan, preparation for applying for a building permit. 5. Workplaces for realization of various building objects (formal and technical basics). 6. Geodetic elaboration of a construction project. 7. Object location staking. 8. Building and assembly control systems in servicing the construction of an industrial and residential facility. 9. Geodetic measurement techniques used at various stages of construction implementation. 10. Control measurements of assembly elements and structures. 11. As-built acceptance. 12. Regulations and standards for the measurement of premises' area.
	Surveying studies for legal purposes	Lecture: Surveying procedures and documentation prepared for the purposes of administrative and court proceedings and surveying works related to the determination of the course of boundary lines and location of crossing points. Real estate delimitations – surveying procedures and documentation, criteria of determination of the course of boundaries, and types of resolutions of administrative and court proceedings. Real estate divisions – surveying procedures and documentation – administrative proceedings (act on real estate management and special acts concerning regulation of legal statuses of public roads and railway areas; court proceedings and divisions of agricultural and forest real estate. Land consolidation (surveying procedure and documentation). Land consolidation and division (surveying procedure and documentation). Land usucaption. Land easements. Delineations of real estate covered with surface waters. Renewal of boundary marks and designation of boundary marks (surveying procedures and documentation, rules of use of archival materials and accuracy of determination of coordinates of boundary marks). Determination of the course of boundaries of registered plots (surveying procedure and documentation, criteria of the course of boundary lines). Design practice: preparation of selected documents – maps, directories, and registers, and other studies included in technical reports.
	Facultative class 1 - BIM in Construction Site Survey of Building Investments	Lectures: BIM Standards and Initiatives; BIM Guides and Execution Planning; Uses of BIM; Levels of BIM; Impact of BIM; The Evolution to Object-Based Parametric Modeling; Parametric Modeling of Buildings; Creating a model based on a point cloud; BIM Environments, Platforms, and Tools Overview of the Major BIM Design Platforms; BIM for Owners and Facility Managers; Scope of Design Services; BIM Use in Design Processes; BIM for Contractors; Processes to Develop a Contractor Building Information Model; Construction Analysis and Planning; Integration with Cost and Schedule Control and Other Management Functions.
	Facultative class 1 - Measuring systems in surveying engineering	Measuring systems - automation in land surveying, data integration, multisensor approach. Basics of the sensoric. Structural monitoring systems - definition, applications, monitoring vs control measurements, system overview, using different coordinate types, defining limit classes and alarming. Measuring systems in metrology - instrumentation, interoperability, system designing, measurement uncertainty estimation, examples. Principles of robotic instruments - design, working fundamentals, mechanics, modern trends. Fibre optical measuring systems. Standards and procedures - how to apply them in measuring systems?

	Facultative class 2 - UAV Technologies in Situational and Altitude Surveying	1. Introduction to the class. Basic information on unmanned aerial vehicles (2h) 2. Legal provisions regarding the use of UAV aviation law (2h) 3. Review of photogrammetric UAV platforms and RGB, NIR, multispectral, hyperspectral, LIDAR sensors (2h) 4. Planning and development of photogrammetirc missions with the use of UAV (2h) 5. Processing of photogrammetric data obtained from the UAV (2h) 6. Regulations in the field of geodesy and cartography regarding the use of data from UAV platforms (2h) 7. Presentations of exemplary geodetic works using UAV data (2h)
	Facultative class 2 - Generation and Application of 3D Buildings Model	"1. Introduction to 3D building modelling (1h) 2. Approaches and methods of building modelling (3h) a. Solid models of buildings b. Surface models of buildings c. Parametric approach 3. Standards and examples of 3D building modelling (3h) 4. Assessment and quality control of data in 3D city models (3h) a. Assessment of completeness of models b. Assessment of geometric accuracy c. Approaches in analyzing the accuracy of model evaluation 5. 3D spatial data in advanced three-dimensional analyzesa. acquiring 3D models (transforming 2D data to 3D), downloading data from the resourceb. data structure 6. 3D spatial analyzes - tools and applications
	Facultative class 3 - Property Valuation Methodology	Introduction to the issues of real estate appraisal. The value of the property as the basis for the appraisal. Approaches, methods, and techniques of real estate appraisal in Poland, including: - types of approaches, methods, and techniques of real estate appraisal, and rules of their application; - comparative approach, covering: pairwise comparison method, method of correction of average price, method of statistical analysis of the market; - income-oriented approach, covering: investment method, profits method, technique of simple capitalisation, technique of discounting streams of income; - cost-oriented approach, covering: replacement cost method, substitution cost method, detailed technique, technique of elements of integrated circuits, index technique; - mixed approach, covering: residual method, method of land estimation rate, liquidation cost method.
	Facultative class 4 - Applications of Aerial and Satellite Photogrammetry	Lectures: 1. Products of aerial and satellite photogrammetry in agriculture 2. The role of aerial and satellite photogrammetry in the LPIS system (application, standards, examples of documentation of photogrammetric works within LPIS) 3. The use of photogrammetric data in crisis management (discussion of selected flood prevention and counteraction programs) 4. The role of photogrammetry in the modernization of building and land register using photogrammetric method. Assessment of the possibility of using UAVs in the building and land register update 5. Project of the IT System for Country Protection against extraordinary threats (scope of photogrammetric works, examples of order documentation, contractor's reports, photogrammetric data control protocols within ISOK) 6. Effective use of photogrammetric data in hydraulic modelling 7. Application of photogrammetric data and products in security and defense 8. The role of aerial and satellite photogrammetry in creating topographic studies. The use of photogrammetry in BDOT10k production. 9. Aerial and satellite photogrammetry in urban and spatial planning. 10. Measurements of engineering structures with the use of aerial photogrammetry. 11. Discussion of the role of photogrammetric data in the implementation of the CAPAP project (examples of specifications, contractor reports and control protocols of 3D building models) 12. Products of aerial and satellite photogrammetry in forestry and environmental protection 13. Products of aerial and satellite photogrammetry in mining and power engineering 14. The use of aerial and satellite photogrammetry in earth sciences 15. Products of aerial and satellite photogrammetry in archaeology 16. The use of aerial
Specialization courses		

	Land Consolidation /E	Lecture: Characteristics of the ownership and spatial structure of agricultural farms in Poland. Land consolidation as a method of improvement of rural spatial layout. Detailed rules of development of the concept of a land consolidation project considering the modern requirements of rural development. Soil classification, soil agricultural suitability complexes, factors contributing to the difficulty of soil cultivation and real estate value. Formal-legal procedures in the land consolidation process. Effects of consolidation works. Multifunctional rural development – as an element of a rural development project. Land consolidation in EU countries based on selected examples with particular consideration of the issues of ecology and landscape management. Shaping the road network, water meliorations, anti-erosion measures, ecological protection of streams, designation of ecological grounds, shaping the agricultural-forest boundary, and landscape management. Decision on the environmental conditions of land consolidation implementation, and report from the investment's environmental impact assessment. Rules of development of individual models of agricultural farms. Economic analysis of consolidation works by means of the method of calculation of
		Practical classes: Conducting study analyses for the purposes of development of the concept of a land consolidation project for an existing object: Research on land use structure and ownership structure in existing research objects; Preparation of analyses of spatial structures of agricultural farms, including analyses of the area structure of agricultural farms, land fragmentation, and geometry of registered plots; Preparation of individual characteristics of agricultural farms – analysis of land layout for selected agricultural farms. Preparation of project proposals for existing objects in the scope of shaping a functional agricultural transport road network, division into project complexes, and allocation of land for building development and for public purposes. Preparation of surveying documentation related to the necessity of issuing the decision on the environmental conditions of the implementation of consolidation investments; Consideration of design concepts regarding design of buffer belts along water streams and along melioration ditches, design of tree stands and shrubs along rural transportation and technological roads. Implementation in the concepts of consolidation projects of solutions resulting from the provisions of the planning documentation of the commune. Application of the SWOT analysis in the assessment of a land consolidation project. Determination of
	Geodesy for Local Development Plans	Basic information concerning local spatial management plans. Surveying preparation of a fragment of a management plan for a commune. Interpretation of decisions on conditions of building development and land management. Surveying preparation of a development plan for a plot/land – designs of buildings, design of linear objects, designs of the infrastructural network- preparation of documentation for delineating designs in the field.
	Technical Background of Real Estate Valuation	Review of technologies in construction, including among others types of structures in terms of used material, structural and finishing elements of buildings, finish technologies in buildings, internal installations in buildings. Investment process in construction – participants of the investment process (their rights and obligations), stages of the investment process, documentation of the investment process (construction design, building permit, reporting construction of a building object, operating permit, notification on the completion of construction of a building, change in use of a building, demolition of buildings). Operation of real estate, including among others defects of buildings, technical, functional, and environmental wear and tear of buildings, provision of technical infrastructure. Basics of cost estimation – types of cost estimates, role, tasks and functions of cost estimates, regulatory and pricing framework (techniques of regulating human labour, machine operation, and material wear and tear), rules of performing bills of quantities and quantity surveying of works, specifics of cost estimation of construction works. Determination of the replacement value of buildings

	Real Estate Valuation /E	Lecture: Legal status of the property surveyor, including: definition of property surveyor and professional activity in the scope of real estate estimation, granting professional entitlements and recognising qualifications obtained outside of the Republic of Poland, scope of professional activities of a property surveyor, forms of providing professional activity, performing professional activities outside the Republic of Poland, improvement of professional skills by a property surveyor, professional, civil, and legal liability of a property surveyor. Real estate appraisal and enterprise appraisal. Appraisal of property rights and contractual obligations, covering: appraisal of ownership right; appraisal of perpetual usufruct right; appraisal of limited property rights, including: use, easement (land, personal, transmission), pledge, cooperative member's ownership right to premises, mortgage; appraisal of contractual obligations, including: rent, lease, lending, perpetual usufruct, and others.
		Economic effects of passing or amending local plans. Appraisal of urbanised real estate, including: undeveloped urbanised land, land built-up with single-family housing, land built-up with multi-family housing and apartments, land built-up with commercial, service, and industrial objects. Real estate appraisal for special purposes and appraisal of special real estate, including: appraisal of real estate included to investment and as fixed assets as defined in the accountancy act, appraisal of real estate for the purposes of securing receivables, including for the determination of the bank-mortgage value of the real estate, appraisal of real estate allocated or seized for technical infrastructure facilities, appraisal of real estate allocated or seized for public roads, appraisal of real estate for planning purposes, appraisal of real estate for the purposes of determination of betterment levy, appraisal of real estate for the purposes of adjustment of annual fees for perpetual usufruct, determination of the value of real estate for the purposes of an individual investor, determination of the value of damage caused by the construction of underground and on-ground infrastructure, determination of the value of expenditures for real estate, appraisal of real estate remaining outside the territory of the Republic of Poland, appraisal of land located on fossil deposits, appraisal of historical real estate.
		Appraisal of machinery and equipment permanently related to the real estate, including: subject of appraisal – definitions, quantitative and qualitative assessment of machinery and equipment, revision and anticipatory assessment in the assessment of the process of operation of machinery and equipment, methods of assessment of the technical state, ways of determination of technical wear and tear, concept of the cost approach in the appraisal of machinery and equipment, methods of determination of the initial price, ways of determination of the liquidation value, procedure of appraisal by means of the pairwise comparison method, method of statistical analysis of the market and its use in the appraisal of machinery and equipment. Economic model and its elements, including: selection of the analytical form of the model, estimation of parameters by means of the smallest squares method, model verification. Bulk appraisal, including: real estate mass appraisal, representative real estate, valuation maps and tables, determination of cadastral values in the process of real estate mass appraisal, role and tasks of
		Professional organisations of property surveyors, including: definition of a professional organisation, legal basis for the operation of professional organisations, entitlements of professional organisations. Professional standards and professional ethics of a property surveyor, including: definition of professional standards, determination and arrangement of professional standards, legal status and structure of national and international appraisal standards. Modern concept of real estate appraisal, covering: the British, American, and German school. Participants of the process of real estate appraisal. Studies and expert opinions not constituting an estimation report, including: thematic scope and content and form of studies and expert opinions. Consultancy in the real estate market, including: area and scope of activity of a consultant in the real estate market, work methods and tools of a consultant, real estate audit, real estate market as the subject of consultancy, examples of expert opinions, studies, and consultancy.

		Basics of water management, including: waters in the objective and subjective approach, shoreline, encumbrances on real estate adjacent to flowing surface waters, rules of use of waters and water protection, Water Law Act permit. Appraisal of agricultural land, orchards, and ornamental plant plantations, as well as land under waters, covering: appraisal of agricultural real estate and its parts constituting arable land under permanent cultivation, and constituting meadows and pastures; appraisal of orchards, garden allotments, hop, wicker, and Christmas tree plantations; appraisal of greenhouses and cold frames; appraisal of agricultural land occupied by residential and homestead buildings and other agricultural production facilities; appraisal of land under ponds, appraisal of land under ditches fulfilling the function of detailed water melioration infrastructure.
		Basics of forestry, covering: basic concepts concerning forests and tree stands, forest arrangement plan, simplified forest arrangement plan and inventory of the state of the forest, spatial division of forests, land with tree stands and bushes, parks, ornamental and public gardens, basic rules of forest protection, restrictions in forest land turnover, management of forest real estate under management of the State Forests. Appraisal of forest real estate and real estate with trees and bushes, including: appraisal of forest real estate in comparative approach and income approach; appraisal of forest real estate in mixed approach, covering: determination of the value of forest land, determination of the value of trees and tree stands as components of the real estate; appraisal of forest real estate in cost approach; appraisal of real estate with trees and bushes; appraisal of real estate with trees, bushes, or forest real estate located in the urban investment zone, available to the public; appraisal of real estate with trees, bushes, or forest real estate fulfilling protection functions, located in the urban investment zone, available to the public; appraisal of parks, ornamental and public gardens, and protected forests located in the urban investment zone, available to the public. Practical classes: Calculation tasks in the scope of appraisal of property rights and contractual obligations. Calculation task in the scope of econometric modelling. Project: Preparation of an estimation report for premises real estate for the purpose of securing receivables. Preparation of an estimation report for agricultural real estate. Determination of the value of forest real estate – calculation task.
	Cadastre /E	Lecture: Detailed rules of obtaining data on buildings for purposes related to the modernisation of the real estate cadastre – case studies, legislature, determination of compliance of object construction with the land development plan. Classifying land to particular land uses – case studies, interpretation of provisions, legislation, legal effects. Rules of calculation of the useful floor area of premises for purposes related to running a cadastre and for purposes related to real estate management. Polish (PN-70/B-02365, PN-ISO 9836:1997, PN-ISO 9836:2015-12) and foreign industry standards (ANSI/BOMA Z65.1-2010, norm GIF, RISC standards, norm IPMS – Office Buildings). Rules of verification of the surface area of inventoried objects (premises) – detailed analysis. Current procedures of cadastral information flow in Poland – between the cadastre and land and mortgage register systems. Integrated System of Information on Real Estate (ZSIN) – concept of the system, programme of development of ZSIN in Poland. Historical aspect related to the development of the Integrated Cadastral System (ZSK) in Poland (Projects PHARE and implemented Integration Electronic Platform, and programmes MATRA 1, MATRA 2). Cadastral systems in selected EU countries (Holland, Austria, Sweden, Germany – selected lands) – organisational and technical aspects, connection of the component of the physical cadastre with land and mortgage registers, and reference to Polish solutions. 3D cadastre – concept of a three-dimensional cadastre, existing solutions, proposed model solutions, research trends. Norm ISO 19152 – Land Administration Domain Model (LADM) and standard CityGML – their role and use in

		Visualisation of cadastral data, including for the purposes of modern 3D cadastral systems. Design practice: Preparation of documentation of the modernisation of the land and building register, including establishment of a registry data base in programmes Ewmapa and Ewopis, and preparation of documentation in the analogue form covering: List of technical report documents, Technical report particularly including the analysis of records of technical conditions of an object in terms of their compliance with binding legal provisions, reports from analysis of land and mortgage registers, Calculations of the surface area of registered plots and building development surface area, Extract from a cadastral map, Extracts from the land register, Extract from the building register, Extracts from the premises register. Obtaining data for the numerical description of registered plots based on source documentation (field sketches, sketches of plot delineation after consolidation, etc.), and preparation of documentation in the form of a report from the determination of the course of boundaries of registered plots pursuant to the provisions of the Minister of Regional Development and Construction of 29 March 2001 regarding the land and building register, with calculations, a sketch for calculations, notifications of parties on the aforementioned activities, and technical report. Calculation of the useful floor area of premises based on a horizontal projection for cadastral purposes, i.e. in accordance with the act of 21 June 2001 – regarding the protection of tenants' rights, municipal housing reserves, and amendment of the Civil Code.
	Selected Sections of Law in Real Estate Appraisal	Concept of property rights, examples of property rights on real estate, property – concept, protection, and joint ownership, perpetual usufruct, limited property rights, with particular consideration of rights on real estate. General rules of acquiring real estate by foreigners. Obligation contracts regarding real estate use (rent, tenancy, leasing, timesharing). Selected issues in the scope of family and inheritance law, including: matrimonial property regimes, management of spouses' joint property; management of a child's property by parents, spouses' liability for debts, premises of real estate inheritance. Housing economy and law on cooperatives, including: management of housing real estate of the State Treasury and territorial government units, management of premises real estate, management of cooperative housing, governmental programmes of housing support and financing. Personal data protection, including: basic concepts related to personal data protection, personal data protection authorities, rules of processing personal data. Public procurement, including: basic terms in the scope of public procurement, subjective scope of the public procurement act, material exemptions and limitations of the application of the public procurement act, rules of granting public procurements, and procedures of granting public procurements.
	Economic Basis of Real Estate Valuation	1. Basics of economy: – Introduction to economy – Market definition and elements (Demand, Supply, Price, Supply and demand curve, Market equilibrium; Short- and long-term flexibility of supply and demand, State intervention vs. market mechanisms) – Price, value, income, and cost – Decisions of the consumer and producer – Production factors – work, land, and capital 2. Economic basics of the real estate market – Real estate as economic goods (Features and functions of real estate in the market economy, Value vs. price of real estate. Types of value, Factors affecting real estate value) – Real estate market (Definition and classification of the real estate market, Specific features of the real estate market, Functions of the real estate market, Participants of the real estate market, Factors affecting the functioning of the real estate market, Research and analysis of the real estate market, State interventionism in the real estate market, Functioning of real estate markets in Poland and in selected member states of the European Union) 3. Assessment of investment economic efficiency – Definition, classification, and role of investment – Specifics of investment in real estate – Investors in the real estate market – Objectives and rules of investment in the real estate market – Risk of investment in the real estate market

		– Criteria and examples of the assessment of investment economic efficiency 4. Elements of finances and banking – Selected aspects of the financial system (Financial market and its functions, Entities and structure of the financial market, Role and functions of money, Characteristics of basic financial instruments) – Selected aspects of the banking system (Legal basics of the banking system in Poland, purpose and objectives of a bank in the market economy, Bank products, Assessment of creditworthiness of a bank's clients) – Financing investments and real estate (Sources of financing – own and external, Criteria of selection of sources of financing, Organisation of financing of investments and real estate). 5. Basics of financial mathematics – Basics of the time value of money concept – Sources of changes in money value – Future money value (Simple interest, compound interest, Types of interest rates, Calculation examples) – Current money value (Concept of discounting, discount rate, and discount factor, Current value of one-off income, Concept of money flow, Current value of fixed and variable income). 6. Elements of the concept of analysis of statistical datasets (Random variables probability distributions, Descriptive statistics, Confidence intervals for mean and variance, Elements of verification of statistical hypotheses).
	Economic Basis of Real Estate Valuation	Issues related to major cadastre and real estate management that were implemented in the course of the 2nd degree programme and are related to the Master's degree diploma examination. Preparation and scope of the Master thesis. Editing of the Master thesis. Presentation of individual solutions of the thesis and discussion of the presented issues. Reporting skills.
	Diploma Thesis	Methodology of scientific work, guidelines for writing scientific texts and thesis. Putting a scientific thesis, the ability to verify it, selection of appropriate research methods, methods of presenting results. Review of literature sources, selection and analysis of literature related to the topic of the thesis. General overview of issues in the field of geodesy and cartography, including related topics with diploma theses undertaken as part of the Cadastre and Land Management specialization, as well as accompanying issues, in particular in the field of intellectual property and copyright. Preparation and delivery of presentations presenting important stages of the implementation of the diploma thesis.