University
of Ljubljana
Faculty
of Civil and Geodetic
Engineering

Presentation of the study programme

1st CYCLE PROFESSIONAL BACHELOR DEGREE PROGRAMME

TECHNICAL REAL ESTATE MANAGEMENT (BA)

Valid from study year 2018/2019

1. Information about the study programme

Professional first cycle bachelor degree programme *Technical Real Estate Management* consists of 3 years (6 semesters) and amounts to 180 ECTS points. The study programme does not include any orientations. The study program is carried out as a regular and a part-time study.

2. Basic goals of the programme

The basic goal of the Professional Bachelor Degree Programme Technical Real Estate Management is to train expert with professional quality skills and fundamental theoretical and mostly practical knowledge in the fields of geodesy and real estate management.

Acquired knowledge:
- enables graduate quick and effective involvement in the work at the time of first employment,
- is a basis for independent follow-up of the profession in the context of lifelong learning,
- is an appropriate basis for the study of geodesy and geoinformation at the second cycle,
- enables transition between related study programs,
- ensures European comparability of achieved education.

3. General competences

General competences acquired by the graduate of the Technical Real Estate Management are:
- the ability of defining, understanding in solving applied problems in the fields of geodesy and real estate management,
- the ability to critically assess concrete solutions,
- professional technical, environmental and social responsibility,
- the ability of professional written and oral communication,
- the ability to use selected information technologies in the fields of geodesy and real estate management,
- the ability to connect with other professionals and work in a team with experts from various fields,
- the ability to manage a small geodetic company.

4. Course-related competences

With the programme Technical Real Estate Management, the graduate acquires mainly the following course-related specific competences:
- knows the role and importance of real estate management in sustainability-oriented society with support of geodesy and geoinformation,
- independently solves all types of typical practical tasks in the field of data recording and less complex real estate rearrangements,
- understands and makes professional use of contemporary geodetic technologies and methodologies to the benefit of creating and maintaining data bases,
- records boundaries of private properties and boundaries of other rights on real estate,
- evaluates real estate market values,
- records and maintains data bases for the needs of real estate taxation,
- knows and interprets the meaning, form, quality, sources, acquisition and maintenance of spatial data for the needs of urban and rural spatial planning and definition of land use,
- takes part in the preparations of spatial acts,
- takes part in planning, design and implementation of interventions into space,
- develops geodetic works:
  - in detailed surveying,
  - in the construction of less complex structures,
  - within legal procedures for the needs of real estate recording,

- maintains land information systems,
- understands cartographic presentations of spatial data,
- cooperates with investors, designers and contractors in interventions into space,
- knows the bases of legal and administrative system important for surveyor as well as for managing and recording space.

5.   Conditions for enrolment

To enrol to the professional bachelor degree program Technical Real Estate Management the candidates are required to:

a)   pass school-leaving exam in a four-year secondary school programme;
b)   pass professional matura exam;
c)   pass matura exam.
d)   finish equivalent education abroad.

The number of places is determined in the Call for enrolment into second cycle study programmes of the University of Ljubljana individually for each academic year.

6. Selection criteria when enrolment is restricted

In the event of restricted enrolment, the candidates will be selected according to:
- general success in school-leaving exam or (professional) matura exam   60 %,
- general success in the 3rd and 4th year   40 %.

7.   Criteria for recognising knowledge and skills acquired before enrolment in the programme

Knowledge conforming in contents and scope the contents of the courses in the professional first cycle bachelor degree programme 1 Technical Real Estate Management may be acknowledged. The recognition of knowledge and skills acquired before the enrolment is subject to the decision by the Study Board of the Department of Geodetic Engineering of UL FGG based on student's written application, certificates and other documents that prove successful acquisition of knowledge and the contents of the knowledge, and in accordance with the Rules on procedure and criteria for the recognition of informally acquired knowledge and skills, adopted at the 15th meeting of the Senate of UL, 29.5.2007.

For the acknowledgement of knowledge and skills the following is considered:
- certificates and other documents evidencing finished courses and other forms of education,
- evaluation of products, services, publications and other own works of students,
- evaluation of knowledge acquired by the student with individual education or empirical learning (possibility of performing study obligations without participation at lectures, practicals, seminars),
- adequate work experiences are taken into account.

Shall the Study Board of the Department of Geodetic Engineering, UL FGG, establish that the acquired knowledge can be acknowledged, this is evaluated with the same number of ECTS points as the number of ECTS points of the course.

8. Methods of assessment

The assessment methods are in accordance with the Statute of University of Ljubljana and listed in the Course Syllabi.

9. Conditions for progression through the programme

9.1 Conditions for progression from one year to another

Students are allowed to enrol to the second study year after completing by the end of the academic year all the obligations foreseen by the study plan and achieving 60 credit points according to ECTS. Students are allowed to enrol to the third study year after completing by the end of the academic year all the obligations foreseen by the study plan and achieving at least 54 credit points according to ECTS.

Exceptionally, a student can apply for enrolment in a next study year if he has completed compulsory subjects in accordance with the study program and has reached at least 45 credit points of the current year and has justified reasons. Eligible grounds are determined in accordance with the UL Statute. The exceptional enrolment is decided by the Study Board of the Department of Geodesy, UL FGG.

Faculty of Civil and Geodetic Engineering has been offering tutorship and supervision for its students for several years. From the first year onwards students shall have mentors of each class, while smaller groups of students will also have individual tutors – teachers and students from higher years, who will help them select orientation, elective courses, etc.

Students with above-average study results are allowed to advance at a faster rate. An adequate decree thereof shall be adopted by the Senate of FGG based on a candidate's application and on opinion of the Study Board of FGG. The decree also defines the principles of faster advancement.

9.2 Conditions for repeated enrolment in the same year

Failing to meet all the obligations defined by the study programme for the advancement in the next year, students may enrol in the same year for the second time. They are entitled to the repeated enrolment only once for the duration of the study, provided that they achieve at least 30 credit points according to ECTS.

10. Transfers between study programmes

Transfer between programmes shall mean termination of education in the student's original study programme (first programme) and continuation of education in the first cycle professional study programme of Technical Real Estate Management (second programme), in which a part of the completed study requirements from the first study programme are recognised as completed.

Transfers are possible from the first cycle study programmes, and until their expiration also from the undergraduate study programmes adopted after June 11 2004, where the competences of the finished studies are comparable and according to the acknowledgement criteria at least half of the obligations according to ECTS from the first study programme related to compulsory courses of the second study programme can be acknowledged. Considering the scope of acknowledged obligations from the first study programme in the Republic of Slovenia or abroad student may enrol to the same or higher year in the second study programme. Transferring students shall fulfil the conditions for the enrolment to the second study programme.

Applications of candidates for the transfer to the first cycle professional study programme Technical Real Estate Management and the scope of acknowledged obligations in the study programme will be examined individually by the Study Board of the Department of Geodesy. If in the procedure of acknowledging obligations for the purpose of transfer the candidate is approved at least the amount of credit points and those point that are required for the enrolment to a higher year of the first cycle professional study programme Technical Real Estate Management, the candidate may enrol to the higher year of the first cycle professional study programme Technical Real Estate Management.

11. Conditions for completion of the study

Students finish the study by accomplishing the foreseen obligations totalling 180 credit points according to ECTS, including practical training and diploma thesis.

12. Conditions for completion of individual parts of the programme

The Study is uniform.

13. Qualification, professional or academic title

- diplomirani inženir geodezije (VS)
  (first cycle graduate in geodesy)

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  (first cycle graduate in geodesy)

14. Qualification, professional or academic title (abbreviation)

- dipl. inž. geod. (VS)

15. Classifications

- KLASIUS-SRV: Professional higher education (first cycle Bologna)/professional higher education (first cycle Bologna) (16203)
- ISCED: architecture, urbanism and civil engineering (58)
- KLASIUS-P: Geodesy and cartography (5813)
- Frascati: Technical sciences (2)
- Level SOK: Level SOK 7
- Level EOK: Level EOK 6
- Level EOVK: First cycle

16.Study programme courses, Syllabus

1st YEAR	Contact hours								
	L	S	ST	LV	FW	OW	Σ CH*	Σ SO*	ECTS*
1st semester									
Surveying	60			60			120	240	8
Infrastructural objects	30		30				60	120	4
Engineering mathematics I	45		30				75	150	5
Software in real estate management	30		45				75	150	5
Legislation on real property management	30		30				60	120	4
Statistics with elements of informatics	45		30				75	150	5
Total 1st semester	**240**		**165**	**60**			**465**	**930**	**31**
2nd semester									
Engineering mathematics II	45		30				75	150	5
Cartography and topography	45		45				90	180	6
Development and planning in space	45			60			105	210	7
Terrestrial detail surveying	45			60			105	210	7
Analysis of survey measurements I	30		30				60	120	4
Total 2nd semester	**210**		**105**	**120**			**435**	**870**	**29**
Total 1st and 2nd semester	**450**		**270**	**180**			**900**	**1800**	**60**

2nd YEAR	Contact hours								
	L	S	ST	LV	FW	OW	Σ CH*	Σ SO*	ECTS*
3rd semester									
Analysis of survey measurements II	30		30				60	120	4
Data processing	45			45			90	180	6
Geodesy for building construction	45			45			90	180	6
Economics and organization of surveying work	60		45				105	210	7
Remote sensing and photogrammetry	45			60			105	210	7
Total 3rd semester	**225**		**75**	**150**			**450**	**900**	**30**
4th semester									
Geodetic instruments and methods	45			45			90	180	6
Geographic information systems	45		45				90	180	6
Real property cadastres	60			60			120	240	8
Elective course I (FGG or external)	30		30				60	120	4
Practical training	6					120	54	180	6
Total 4th semester	**186**		**75**	**105**		**120**	**414**	**900**	**30**
Total 3rd and 4th semester	**411**		**150**	**225**		**120**	**864**	**1800**	**60**

L – lectures; S – seminar; SP – seminar practicals; LP – laboratory practicals; FW – field work; OW – other work; CH – contact hours; SO – study obligations

* student workload amounts to 60 ECTS/year, which comes to 1800 hours/year; the hours include contact hours and independent work

3rd YEAR	Contact hours								
	L	**S**	**ST**	**LV**	**FW**	**OW**	**Σ CH**[*]	**Σ SO**[*]	**ECTS**[*]
5th semester									
Building land management and valuation	30	15	30				75	150	5
Methods of spatial analyses in GIS	30	15		30			75	150	5
Satellite supported geodetic survey	45			45			90	180	6
Reference systems in geodesy	45		30				75	150	5
Elective course II (FGG)	30		30				60	120	4
Elective course III (FGG or external)	45		30				75	150	5
Total 5th semester	**225**	**30**	**120**	**75**			**450**	**900**	**30**
6th semester									
Detailed urban planning	45		30				75	150	5
Land management	45			30			75	150	5
Field work						105	105	210	7
Elective course IV (FGG)	45		30				75	150	5
Diploma work						120	120	240	8
Total 6th semester	**135**		**60**	**30**		**225**	**450**	**900**	**30**
Total 5th and 6th semester	**360**	**30**	**180**	**105**		**225**	**900**	**1800**	**60**

ELECTIVE PROFESSIONAL COURSES	Contact hours								
	L	**S**	**ST**	**LV**	**FW**	**OW**	**Σ CH**[*]	**Σ SO**[*]	**ECTS**[*]
Topographic photogrammetry	30			30			60	120	4
Mass valuation of real properties in GIS	30		30				60	120	4
Standards in geodesy and engineering	15	30	15				60	120	4
Measurements higher accuracy	30	15		30			75	150	5
Location-based services	30	15		30			75	150	5
Housing and municipal economics	30		30				60	120	4
Environmental protection and spatial planning	30		30				60	120	4
Applied remote sensing	30		30				60	120	4
Engineering surveying	45			30			75	150	5
Agrarian land operations	45			30			75	150	5
Cartographic reproduction	30			30			60	120	4
Total Elective Courses – profession	**345**	**60**	**135**	**180**			**720**	**1440**	**48**

L – lectures; S – seminar; SP – seminar practicals; LP – laboratory practicals; FW – field work; OW – other work; CH – contact hours; SO – study obligations

* student workload amounts to 60 ECTS/year, which comes to 1800 hours/year; the hours include contact hours and independent work

17.Possibilities of elective courses and mobility

Elective courses are foreseen: one in 4th semester (5 ECTS), two in 5th semester (4 ECTS each) and one in 6th semester (5 ECTS). The study programme proposes 10 elective professional courses (Topographic Photogrammetry, Residential and Municipal Economics, Mass Real Estate Valuation in GIS, Environmental Protection and Environmental Ethics, Standards in Geodesy and Engineering, Applicable Remote Sensing, Geodesy in Engineering, Cadastral Land Development, Locational Services, Surveying of Increased Precision and Sports Education). Among other elective courses from FGG students are recommended to select courses from traffic infrastructure and hydrology. Among external elective courses from other faculties, member of UL, other universities and higher education institutions in Slovenia or abroad especially the contents from the areas of law or real estate legislation, economy or real estate management, administration, communicology, computer science, foreign language, etc., are recommended.

Student may transfer 30 ECTS points of the programme (one study semester, regardless of mandatory and elective units) from any other area of (technical) real estate management, provided there exists an adequate agreement signed with UL FGG.

18. Presentation of individual courses

18.1 Obligatory courses

GEODESY (8 ECTS)
Definition of Geodetic Engineering and Surveyor. Different branches of Geodetic Engineering, tasks, relation to other professions. International organization of Geodetic Engineering, history, technical development. Geodetic Engineering as profession which assures national spatial infrastructure, geodetic engineering from the aspect of users. Measurements, metrology - basic definitions. Numbers as outcomes of measurements, significant figures, accuracy of calculations. Plane and spherical trigonometry: use in surveying. The figure of the Earth, and its approximations. Plane coordinate systems, coordinate conversions. Bearing. Horizontal point positioning: intersection, resection, lateration. Geographic coordinates on the Earth as a sphere. Principal geodetic problems on the sphere. Surveying measurements, introduction to surveying measurement equipment; measurement units, measurement procedures, surveying systems; basics of angle and distance measurements; observation and errors, measures of quality. Basic metrology terms: comparison, calibration of surveying equipment, resolution, sensitivity, precision, accuracy, repeatability.

INFRASTRACTURAL OBJECTS (4 ECTS)
Civil engineering, building structures, legal bases, preparation of land and arrangement of building site, construction time plan, building documents, building profiles, geomechanical bases, earth works and foundation engineering, structural elements, protective structures, installations and other equipment, design and construction of high structures, design and construction of roads and railways, infrastructural buildings and devices, technical infrastructures, technical-technological characteristics of traffic structures and devices, energy, urban, water infrastructure, infrastructure for managing other natural resources and structures in public use, basic materials, building materials and binders, structural solutions, construction contract, project management, cadastre of public technical infrastructure.

ENGINEERING MATHEMATICS I (5 ECTS)
Sets, numbers, mappings. Linear algebra: geometric vectors, systems of linear equations, matrices, determinants, eigenvalues and eigenvectors of matrices. Sequences and series. Limits and continuity of a function of one variable, properties of continuous functions. Derivative of a function of one variable, properties of differentiable functions, local and global extrema.

SOFTWARE IN REAL ESTATE MANAGEMENT (5 ECTS)
Role and importance of information in modern society, sign systems, information systems and applicability, information pollution and information literacy, principles and application of information technology, communication and communication technology, computer software equipment (operation systems, operation

environment, distributed data processing, internet/intranet, web pages, services), computer-aided solving of engineering problems (analysis and modelling of problems, data structures, elaboration and recording of algorithms, standard algorithms), basics of computer programming (program concept, program languages, program types, procedural programming, object-oriented programming, object-oriented programming with selected program language).

LEGISLATION ON REAL PROPERTY MANAGEMENT (4 ECTS)
Public administration, government and law, legal norms, legal acts, legal emptiness, administration and management, supervision, real law, condominium, cadastre and land registry, restrictions of property rights in the public interest, surveying legislation (organization of geodetic and surveying services, surveying enterprises, Administrative Procedure Act, Legislation regulating designation of areas and naming and marking settlements, streets and buildings, land register from surveyors point of view, judicial procedures on disputed boundaries, real estate agencies act and laws or regulations in other areas (spatial planning, environmental protection, building construction, surveying plan, agricultural land, forest land, water land) and the law on the fundamental geodetic measurement.

STATISTICS WITH ELEMENTS OF INFORMATICS (5 ECTS)
Basics of statistics, presentation of data, descriptive statistics (graphic presentations and numerical presentations of spatial and other data), descriptive statistics (percentiles, frequency distribution, data in classes), probability calculus (introduction, event, probability of event), probability variables, moments of probability variables and their functions, probability distributions, sampling (properties of basic statistics, average of sample, variance of sample), evaluation of parameters (point and interval evaluations), assumption testing (basics of the theory of assumption testing, classic examples of testing assumptions, testing conformity, "hi-square" test), bivariant analysis (testing of statistic dependence, testing of linear correlation, linear regression, application of the least square method), variance analysis, all with examples from practice.

ENGINEERING MATHEMATICS II (4 ECTS)
Riemann integral of a function of one variable (primitive function, integration methods, applications), functions of several real variables (partial derivative, gradient, chain rule, total derivative, extrema - local and global), double Riemann integral (definition, properties, computation, applications), ordinary differential equations (solution, initial problem, linear differential equation).

CARTOGRAPHY AND TOPOGRAPHY (6ECTS)
Definition and meaning of cartography and topography, cartographic communication, map and it's attributes, maps' related presentations, history of cartography, development of cartographic technology, mathematical cartography, map projections, linear, angular and areal deformations, Gauss-Krueger projection, system UTM, ETRS/D96, system maps, map design, graphical elements and graphical variables, colours, creation and implementation of map symbols, legend of symbols, cartographic generalization, meaning, methods and procedures, types of spatial data, data editing, topology, topographic and cartographic databases, map sources, quality of map sources, national and European spatial data infrastructure, standardization, national topographical – cartographical system, national maps and topographic databases, map use, map measuring, map interpretation, terrain profile, navigation and orientation, instruments and adds, use of screen maps.

DEVELOPMENT AND PLANNING IN SPACE (7 ECTS)
The course is divided into two thematic parts. The first part provides the fundamentals of spatial planning: the basic terminology in spatial planning, the concepts of land and ownership, history and development, land records (databases and their availability), comprehension of mapping and designs, legislative (normative) framework of spatial planning and inclusion of the public in spatial planning, space as development potential, spatial restrictions, spatial data, comprehension of basic planning tools and elaboration of spatial analyses. In the second part, the students are familiarised with spatial structures, activities and their distribution in space: natural geographical features, man-made features, population (demography), settlement system, traffic and other public infraworks, landscape (green systems), synthesis in spatial planning.

TERRESTRIAL DETAIL SURVEYING (7 ECTS)

National coordinate system, vertical coordinate system, geodetic points, classical terrestrial geodetic measurements, theodolite, horizontal angle observations, methods and errors of measurements of horizontal angles, electronic distancemeters, measurements and errors of distance measurements, distance measurement reductions, heights measurements, trigonometric heighting, influences on trigonometric heighting, geometric levelling, level, methods and errors of geometric levelling, detail surveying, numeric detail surveying (orthogonal, polar, trilateration), determination of instrument station of terrestrial surveying, detail levelling, detail measurement, plan and realization of measurements, geodetic plan - contents, charting, geodetic plan certificate.

ANALYSIS OF SURVEY MEASUREMENTS I (4 ECTS)

Concept of adjustment and of mathematical model, statistic properties of observations and inclusion of observations in the model, linearization of nonlinear problems, method of least squares, precision and accuracy of observations, standard deviation, variance, weight, weight matrix, adjustment according to the least square principle, iterative solving of linearized problems, indirect and direct adjustment according to the least square principle, law of variance covariance propagation, variance covariance propagation in indirect and conditional adjustment.

ANALYSIS OF SURVEY MEASUREMENTS II (4 ECTS)

Recommended precision of survey measurements, general least squares adjustment, statistic analysis of measurements, bivariate normal distribution, error ellipses, absolute and relative error ellipses, preanalysis of survey measurements, gross error detection in survey measurements, redundancy matrix and redundancy number, global model test, data snooping, tau-test, quality assessment of survey measurements.

DATA PROCESSING (6 ECTS)

Overview of course content, terminology and literature. Introduction to programming. Software development methodology. Programming language Python (introduction, mathematical libraries, graphing). Basics of databases, relational technology, characteristics and use of the standard SQL language. Standard data formats (text files, XML, JSON). Advanced application and programming relational databases (PostgreSQL, PostGIS). QGIS and use of the programming language Python to automate processes. Modern information systems, computing environment (high-performance and high-permeable).

GEODESY FOR BUILDINGS CONSTRUCTION (6 ECTS)

Engineering surveying for construction of buildings, use of standards in engineering surveying, geodetic network for setting out and acceptance criteria, measurement accuracy and tolerance – connection between geodetic and construction accuracy, measurements/setting out off horizontal angels and distance, accuracy assessment of setting out horizontal angles and distance, setting out procedures and accuracy assessment, alignment of points on the axis, extension of axis, engineering surveying for design and construction of roads and infrastructural devices, geometry of circular curve and clothoid, setting out curve, setting out height of points, volumes of earthwork, controlling of prefabricated elements, setting out of modular prefabricated building.

ECONOMICS AND ORGANISATION OF SURVEYING WORK (7 ECTS)

Strategic management, forms of business organisation, types of business forms, development of strategies and goals of an organisation, management of human resources, aims of coordination and motivation, negotiations, business behaviour, problem analyses and solutions, optimisation of workflow, information systems for organisation management and control, business economics, analyses of transaction costs, market coordination, economics of information and coordination, business strategy, decision making in risk circumstances, principles of business operations and effectiveness criteria, business reports, system engineering, project management, organisation of activities in geodesy, surveying, geoinformatics and real property management, surveying activities in EU and Slovenia, regulation and control of surveying companies, public surveying services, professional codex.

REMOTE SENSING AND PHOTOGRAMMETRY (7 ECTS)

Introduction to remote sensing and photogrammetry, physical background of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with the atmosphere and surface, remote sensing sensors, physical background of photogrammetry, mathematical background of photogrammetry, digital image processing, digital images, image processing methods, radiometric and geometric operations in the image, image resampling, image compression, image statistical analysis, selected satellites and sensors, satellite data reception, transfer and processing, photointerpretation methods, planning of aerial surveying mission, orientation of a stereopair, photogrammetric equipment, photogrammetric acquisition of vector data, orthophoto (production, quality, use).

GEODETIC INSTRUMENTS AND METHODS (7 ECTS)

Introduction (base detailed measurement) triangulation – principle, theodolites (conditions for proper functioning, quality control), methods of measurement, calculation of the coordinates with adjustment, trilateration – the principle of electronic distancemeters (conditions for proper operation, testing, precision, quality control), measurement of the length and condition of the atmosphere, reduction of measurements, usability – the calculation of the coordinates with adjustment, combined network – TPS systems, calculation of the coordinates with adjustment, trigonometric levelling – principle, methods of calculating the height differences, the precision of height differences, limitations, calculation of the heights with adjustment, precision geometric levelling – digital level, precision levelling staff, determining the quality of the measurements, calculation of the heights with adjustment, establishment, measurement and calculation of classical geodetic networks – types of geodetic networks, methods for establishing and measurement of geodetic networks, project of geodetic network, optimization works, financial evaluation, implementation of the project of the geodetic network – process, content and preparation of the study of the geodetic network, case studies (ideal and professional unacceptable!)

GEOGRAPHIC INFORMATION SYSTEMS (6 ECTS)

Overview of the course content (introduction, purpose, terminology, literature, etc.). System, information system and GIS. Geoinformation and GIS technology, history and development, properties and applications. Modelling of reality, the notion of spatial models, users, data and procedures. Analog and digital spatial data, sources and acquisition techniques, storage models and types of graphical data, location and topology, spatial data and reference systems, relational and object-oriented modelling approach. Spatial data quality, standardized quality model and basic elements of quality. Standardization and types of standards in the geoinformation domain, legal issues, formal, de facto and open industrial standards. Description of some important formal and open source standards for geographical data. SDI and its EU implementation (Inspire). Spatial data production chain, marketing and distribution data, selling strategies and policies. Legal issues and spatial datasets. Cost benefit analysis in the geoinformation. Vector data structure, topology and relational model for vector data organization, storage and transfer formats, attributes, visualization. Raster data structure, storage and transfer formats, compression techniques, attributes, visualization. Mobile GIS and in field data gathering in real time, software support. Overview of spatial data analysis, history and development, applications and basic guidelines, analytical and logical approaches, classification of values and display.

REAL PROPERTY CADASTRES (8 ECTS)

Introduction to land cadastre, the history and development of land cadastre, cadastral legislation regarding periods of their establishment, cadastral boundaries and cadastral plans, surveying and the land cadastre (boundary settlement, boundary adjustment, boundary reconstruction, identification of actual land use, subdivision, land under the building, land consolidation, new cadastral survey, cadastral classification of land, land quality evaluation), cadastre, history of the condominium property, the process of entry to the Surveying and Mapping Authority, inventory of buildings, the creation and management of real estate register with the register of real estate, housing register, cadastre of public infrastructure (PI), system of spatial data, geodetic services at the construction of public infrastructure, management and maintenance of cadastre of public infrastructure, European and other international directives at the recording of real property.

PRACTICAL WORK (6 ECTS)

Making of survey plan, realization of less complex geodetic-technical works at the structures construction, realization of less demanding cadastral and geodetic-technical works, making of cartographic bases and

representations for the spatial planning needs, planning, design and implementation of interventions in the space, realization of geodetic-technical works in the context of processes of real estate registration, maintenance of geographic, cartographic and land information systems, preparation of cartographic representations of spatial data, preparation of spatial planning documentation, coordination of activities among investors, designers and contractors of different activities in space, organization of work in a small surveying and real estate companies.

BUILDING LAND MANAGEMENT AND VALUATION (5 ECTS)
Building land management, building land development, real estate valuation, building land acquisition, economic and financial aspects of building land development, the legal basis of real estate valuation, characteristics of the real estate market, valuation subject, value and valuation approaches, individual real estate valuation, real estate valuation standards, real estate report, mass real estate valuation, data acquisition, valuation models, practical examples.

METHODS OF SPATIAL ANALYSES IN GIS (5 ECTS)
Spatial analyses vs. analyses of spatial data, operators in spatial analyses, classification of spatial analyses, functional classification of spatial analyses, analytical methods, reclassification, overlay, methods to calculate distance and connectivity, contextual methods, methods of spatial interpolations, methods for error assessment and management, methods of statistical spatial analyses in GIS.

SATELLITE SUPPORTED GEODETIC SURVEY (6 ECTS)
Basics about the shape and size of the Earth. Basic parameters and mathematical formulation of the relationship between parameters of the Earth – presented as sphere or ellipsoid of revolution. Radius of curvature of meridian and prime vertical, mean radius of ellipsoidal surface curvature in the specific point. Geodetic and Cartesian coordinates related to ellipsoid of revolution, conversion of coordinates. Meridian arc length on ellipsoid of revolution. Gauss-Krueger projection of meridian zones: both (direct an inverse) tasks: (fi, la <=> y, x). Basic concepts and development of satellite geodesy and global navigation satellite systems (GNSS). Coordinate and time systems essential for satellite geodesy and GNSS. Historical development of GNSS and importance of GNSS in geodesy, surveying and society. Segments of different GNSS systems. GNSS satellite orbits. Satellite signal, types GNSS observations. Types and structure of GNSS receivers. GNSS influences and their modelling or reduction. Position determination based on code and on phase observations for static and kinematic positioning. Calculation of baselines for static surveying, adjustment of GNSS network, quality evaluation of the results. The concept of DGNSS and RTK-GNSS. GNSS active networks and positioning using different concepts: MRS, VRS, FKP, MAX, i-MAX. Mathematical formulation of the relationship of different coordinate data (acquired from GNSS to other coordinate data 2D or 3D); static and kinematic methods, post-processing or real-time positioning strategy. Common usage and practical implementation of GNSS observations in geodetic surveying.

REFENCE SYSTEMS IN GEODESY (5 ECTS)
Coordinates' systems in geodesy, reference systems and reference frames, geodetic datum, celestial and terrestrial coordinate system, continental and national coordinate systems; ellipsoidal geometry, geodetic coordinates on the ellipsoid, coordinate conversion and transformation, Earth's gravitational field, normal gravity field of the Earth, geoid, level ellipsoid; determination of geoid, GNSS-levelling, interpolation of the geoid height from the model, height systems, tide gauge, sea surface topography, levelling networks in Slovenia and Europe, gravimetry, gravity surveys in Slovenia and Europe.

DETAILED URBAN PLANNING (5 ECTS)
Introduction to detailed urban planning, history of urban design, expanding the knowledge on legal regulations in detailed spatial planning, contents of detailed spatial plans, methodological approaches to detailed spatial planning, building typology (with an emphasis on residential buildings), typologies of structures (public, residential, industrial, infrastructure facilities ...), norms and standards (land use, built structures, green spaces, traffic ...), connection with implementation of the plan in the field (land allotment, link to public infraworks).

LAND MANAGEMENT (5 ECTS)

Interdisciplinarity of land management, land policy, review of systems for the structuring of space, spatial database on real property (land use classification systems and their mutual connection, spatial implementation conditions), computer support to land regulations (GIS, distributed information systems, mobile information systems), implementation of regulations connected with the real property law, the law on agriculture, land use control system based on spatial data (planning, obtaining permits and realization), actual use of land, the rights on property and their changes on the realization of implementing spatial planning documents (ownership, easement), a detailed local plan as a basis for land development, management of infrastructure with land information systems a construction and maintenance of buildings.

PRACTICAL WORK (4 ECTS)

Establishment of a coordinate reference frame for the selected site, planning, preparation and realization of the practical survey activities on the basis of terrestrial and GNSS measurements in real estate and engineering survey tasks on the site, evaluation and assessment of obtained results.

DIPLOMA WORK (8 ECTS)

Diploma work under supervision of a selected teacher. The work is publicly presented at the end of the study. It has to include introduction, working hypothesis, overview of resources, materials and methods, results, discussion and conclusion. As a rule, the work deals with practical problems of managing land and real estates, and gives solutions resulting from the study and outcomes of own work.

18.2 Elective courses

TOPOGRAPHIC PHOTOGRAMMETRY (4 ECTS)

Models of central perspective projection (geometrical, optical, physical, technical), depth of field, resolution, distortion, central projection equations of an image, correction of optical distortion and film deformation or sensor imperfection, corrections due to atmosphere refraction and earth curvature, normal case of a stereopair, image enhancement and implementation of simple digital filters, the basics and applications of image matching, digital photogrammetric cameras: terrestrial and aerial, functioning, characteristics, bulk topographic data acquisition: significance of photogrammetry, topology and photogrammetric vector data acquisition for databases and GIS, homogenisation of collected data, data acquisition in practice, examples.

MASS VALUATION OF REAL PROPERTIES IN GIS (4 ECTS)

Real property appraisal theory and general principles (individual and mass appraisal of real properties, urban and rural areas, buildings), organization of mass real property appraisal, market data on real property transactions and analyses of transactions, surveying and other data on objects of appraisal, spatial analyses of real property market and interpolation methods for modelling real property market values in GIS, general procedures of mass appraisal, conceptual model of different mass appraisal models, software solutions and suitable databases for mass appraisal of real properties, calculation of general market value based on different mass appraisal models, indexation, presentation of data and its availability (intra- and internet), legislation, standardization in the field.

STANDARDS IN GEODESY AND ENGINNERING (4 ETS)

International standards (ISO), European standards (CEN), German standards (DIN), Slovenian Institute for standardization (SIST), Slovenian Institute of Quality and Metrology (SIQ), Metrology Institut of the Republik of Slovenia, standardization system in Slovenia (terminology, identification, legal basis), development of standards, calibration and test laboratories (legal identity, accreditation), national legal bases, ISO and DIN standards for geodetic instruments - development, type, purpose, IAG/IUGG standard as a part of conventions, IERS standards, GNSS specifications and standards for instruments, regularization of GNSS spectrum, Industrial standards for exchangeability of data between GNSS and other devices (NMEA 0183 and NMEA 2000), Standards for real-time data data flow (RTCM SC 104), NTRIP protokol for RTCM data streaming over the internet.

MEASUREMENTS HIGHER ACCURACY (5 ECTS)

How to assure optimal measuring conditions, measurement equipment, calibration of measuring instruments, testing of measuring instruments, determination of practical accuracy of measuring instruments by ISO and DIN standard procedures, measurement uncertainty, efficiency of measurement equipment, consideration of atmospheric influences and instrumental errors, geometric and electronic eccentricities of measuring instruments, methods of measurements, organisation and optimisation of measurement, computation, adjustment of measurements and evaluation of the results, rigorous adjustment, mathematical models of evaluation of calibration parameters, testing of hypothesis, evaluation and interpretation of the results, assuring of property measuring equipment.

LOCATION-BASED SERVICES (5 ECTS)

Definition of location-based services (LBS), relationships between LBS and GIS, components of LBS, LBS providers the concept, architecture and functions of the components of LBS, potential and future of LBS. Navigation and orientation in space, mobile communications networks' determination of the position in wireless communication networks, determining the position in the GNSS. Differential GNSS networks to support GNSS navigation the concept of A-GNSS, GNSS navigation on land at sea and in the air, integration of GNSS and GIS. Network analysis: an introduction and basic concepts, examples of computer tools, graphs - general characteristics of graphs, data sources , the complexity of the calculations, the key problems of network analysis, the tree of the shortest connections, Gabriel's network, Steiner's tree, shortest path problems, Dantzig's algorithm , the Dijkstra's algorithm , traveling salesman problem , the method of backtracking, location analysis, key problems, median problems in p, service areas, routing connections, cartographic presentation of positions gained in GNSS, provision and preparation of spatial data for navigation, cartographic representation for the purpose of navigation, multimedia presentation possibilities, location-based services: emergency, location billing, tracking, traffic control, intelligent routing, location-based information services.

HOUSING AND MUNICIPAL ECONOMICS (4 ECTS)

Fundamental concepts in the field of housing and municipal economics, property and other rights to housing, housing in spatial planning, housing market, housing management, costs and housing expenses (rent), municipal economics specificities, costs aspects of performing municipal activities, organizational and management models of performing municipal activities.

ENVIRONMENTAL PROTECTION AND SPATIAL PLANNING (4 ECTS)

Ecology and protection of natural heritage as scientific areas, basic characteristics of ecosystems related to the matter–energy flow, interrelations and interdependence, human interventions in nature, the use of renewable and non-renewable resources and implications for the environment, burdening and environmental pollution and contamination, reduction of biotic diversity, anthropogenic environment and quality of life, degraded environments and remediation options, ethics in environmental protection; in exercises the students gain knowledge and learn to critically examine spatial interventions and possibilities of prevention of adverse effects to the environment, in view of different types of ecosystems at global and local levels, by elaborating their own product.

APPLIED REMOTE SENSING (4 ECTS)

Interpretation of remote sensing imagery (digital image processing, visual interpretation), image pre-processing (elimination of defects in sensors functioning, geometrical corrections and registration, atmospheric corrections, corrections of variations in illumination and topographic normalisation, sensor calibration), image enhancement (human sense of sight and colour spaces, contrast enhancement, pseudo-colour images, filtering), image transformations (arithmetical operations, vegetation index, principal components analysis, Kauth-Thomas transformation, HSI transformation), image classification (spectral space, unsupervised classification, supervised classification, evaluation of classification), examples of remote sensing applications.

ENGEENIRING SURVEYING (5 ECTS)

Trigonometric levelling and precise levelling for engineering surveying, hydrostatic levelling, plumbing (mechanical, optical), setting out steel construction, engineering surveying for mechanical engineering, structural deformation surveying (stabilisation of reference and target points, control geodetic network…), engineering surveying for design and construction of tunnels and bridging objects, laser beans used in engineering surveying.

AGRARIAN LAND OPERATIONS (5 ECTS)

The history of land development, agricultural and forest land, the legal base of land development, agriculture land rearrangements (introduction, exchange of agricultural land, increase the agricultural land, land consolidation and irrigation or other appropriate measures on land), contractual land consolidation (legislation, execution, detailed report of contractual land consolidation, administrative procedure), administrative land consolidation on agricultural land (presentation of the land consolidation (briefly), proposal for the introduction of the land consolidation, conceptual design, detailed study of the existing situation, land valuation report, report of the new distribution of land, a technical report on the progress of land consolidation process, an overview of the technical procedures and organization of land consolidation), development of the agricultural land in the European Community (practices and legislation in Germany and in the Nordic countries).

CARTOGRAPHIC REPRODUCTON (4 ECTS)

Definition and meaning of cartographic reproduction, development of cartographic technology, editing of maps, project of map production, editorial works, editorial plan, technology of map production, map medias, creation of maps on internet, software and hardware for map production, printing.