

## List of subjects taught during 5-year master's studies

Field of studies: **GEODESY AND CARTOGRAPHY**

Majors: *geodesy and spatial information systems*

Having completed the third year of studies, students choose one of the two lines of specialization:

1 – *geodesy and satellite navigation*,

2 – *applied geodesy*.

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
<b>1<sup>st</sup> year / 1<sup>st</sup> semester</b>						
Foreign language I	09.1-00-A/1	-	30	30	0	FT
Economics	14.3-00-A/2	30	15	45	2	FT
Physical education	16.1-00-A/4	-	30	30	0	Z
Mathematics	11.1-08-B/1	30	30	60	6	E
Descriptive geometry	11.9-08-B/3	15	30	45	4	E
Basics of computer science	11.3-08-B/4	15	45	60	6	FT
Geodesy	07.6-08-C/1	15	30	45	4	FT
Plotting	07.6-08-C/15	-	30	30	2	FT
<b>1<sup>st</sup> year / 2<sup>nd</sup> semester</b>						
Foreign language I	09.1-00-A/1	-	30	30	0	FT
Physical education	16.1-00-A/4	-	30	30	0	FT
Mathematics	11.1-08-B/1	30	30	60	6	E
Physics	13.2-08-B/2	30	15	45	5	FT
Basics of computer science	11.3-08-B/4	15	30	45	4	E
Geodesy	07.6-08-C/1	15	60	75	6	E
Field training in surveying	07.6-08-E/1	-	60	60	4	FT
Electronic measuring techniques	07.6-08-C/9	15	45	60	5	E
Plotting	07.6-08-C/15	-	30	30	2	FT
<b>2<sup>nd</sup> year / 3<sup>rd</sup> semester</b>						
Foreign language I	09.1-00-A/1	-	30	30	0	FT
Physical education	16.1-00-A/4	-	30	30	0	FT
Mathematics	11.1-08-B/1	30	30	60	6	FT
Physics	13.2-08-B/2	30	45	75	7	E
Geodesy	07.6-08-C/1	15	30	45	4	FT
Basics of satellite geodesy	07.6-08-C/5	15	30	45	4	E
Surveying data adjustment and analysis	11.2-08-C/6	30	30	60	6	FT
Basics of Earth science	13.9-08-C/12	15	15	30	3	FT

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
<b>2<sup>nd</sup> year / 4<sup>th</sup> semester</b>						
Foreign language II	09.1-00-A/1	-	30	30	2	FT
Mathematics	11.1-08-B/1	30	30	60	6	E
Geodesy	07.6-08-C/1	15	60	75	6	E
Field training in surveying	07.6-08-E/2	-	60	60	4	FT
Building engineering	06.4-08-C/4	15	15	30	2	FT
Surveying data adjustment and analysis	11.2-08-C/6	15	30	45	4	E
Land information systems	07.9-08-C/11	15	30	45	4	FT
Basics of Earth science	13.9-08-C/12	30	15	45	3	E
Practical training 2 weeks	-	-	-	-	-	FT
<b>3<sup>rd</sup> year / 5<sup>th</sup> semester</b>						
Foreign language II	09.1-00-A/1	-	30	30	2	FT
Humanities	08.9-00-A/3	30	15	45	2	FT
Basics of engineering geodesy	07.6-08-C/3	15	30	45	4	FT
Building engineering	06.4-08-C/4	15	15	30	2	FT
Photogrammetry and remote sensing	07.6-08-C/7	15	45	60	5	FT
Land information systems	07.9-08-C/11	15	30	45	4	E
Human environment protection	07.2-08-C/13	15	30	45	2	FT
Law	10.0-08-C/14	30	15	45	3	FT
<b>3<sup>rd</sup> year / 6<sup>th</sup> semester</b>						
Foreign language II	09.1-00-A/1	-	30	30	2	FT
Basics of engineering geodesy	07.6-08-C/3	15	45	60	6	E
Field training in engineering geodesy	07.6-08-E/3	-	60	60	4	FT
Photogrammetry and remote sensing	07.6-08-C/7	15	45	60	5	E
Field training in photogrammetry	07.6-08-E/4	-	60	60	4	FT
Cartography	07.6-08-C/8	30	15	45	3	FT
Basics of town-and-country planning	02.0-08-C/10	15	15	30	3	FT
Law	10.0-08-C/14	15	15	30	3	E
Real estate cadastre	07.6-08-C/17	15	30	45	4	FT
Practical training	-	-	-	-	-	FT

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
2 weeks						
<b>4<sup>th</sup> year / 7<sup>th</sup> semester</b>						
Geodesy and geodetic astronomy	07.6-08-C/2	30	30	60	5	FT
Cartography	07.6-08-C/8	15	30	45	3	E
Basics of town-and-country planning	02.0-08-C/10	15	30	45	4	FT
Real estate cadastre	07.6-08-C/17	15	30	45	4	FT
(1) Satellite geodesy	07.6-08-D/2	30	30	60	5	FT
(1) Astrodynamics elements of geodesy	07.6-08-D/3	30	15	45	4	E
(1) Theory of satellite measurement elaboration	11.2-08-D/6	15	30	45	4	FT
(1) Advanced programming techniques	11.3-08-D/9	15	45	60	5	E
(2) Engineering geodesy	07.6-08-D/13	15	30	45	3	FT
(2) Structural mechanics	06.6-08-D/16	15	15	30	3	FT
(2) New measuring techniques and methods	07.6-08-D/18	15	30	45	3	FT
<b>4<sup>th</sup> year/ 8<sup>th</sup> semester</b>						
Geodesy and geodetic astronomy	07.6-08-C/2	15	45	60	5	E
Field training in geodesy	07.6-08-E/5	-	30	30	4	FT
Basics of town-and-country planning	02.0-08-C/10	15	15	30	3	E
Real estate administration	07.6-08-C/18	15	15	30	3	FT
(1) Satellite geodesy	07.6-08-D/2	15	30	45	3	E
(1) Satellite navigation	07.6-08-D/5	15	30	45	3	FT
(1) Theory of satellite measurement elaboration	11.2-08-D/6	15	30	45	4	E
(1) Hydrographic surveys	07.6-08-D/8	15	30	45	3	FT
(2) Engineering geodesy	07.6-08-D/13	15	30	45	3	E
(2) Digital maps	07.6-08-D/17	15	30	45	4	FT
(2) New measuring techniques and methods	07.6-08-D/18	15	30	45	3	E
(2) Internet technologies in Spatial Information Systems	11.9-08-D/23	15	30	45	4	FT
(2) Rural area management and surveying	07.6-08-D/24	15	30	45	4	FT

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
Practical training 4 weeks						FT
<b>5<sup>th</sup> year / 9<sup>th</sup> semester</b>						
Collection and distribution of geodetic and cartographic data.	07.6-08-C/16	15	15	30	3	FT
(1) Physical geodesy	07.6-08-D/1	30	30	60	5	E
(1) Methods of satellite positioning	07.6-08-D/4	15	45	60	5	E
(1) Satellite navigation	07.6-08-D/5	30	30	60	5	E
(1) Data teletransmission systems	07.6-08-D/7	15	30	45	3	FT
(1) Seminar	07.6-08-D/11	-	30	30	2	FT
(2) Computing methods in geodesy	11.2-08-D/14	15	30	45	4	FT
(2) Elements of satellite navigation (GPS RTK)	07.6-08-D/15	15	30	45	4	E
(2) Engineering photogrammetry	07.6-08-D/19	15	30	45	4	E
(2) Photogrammetric methods and technologies	07.6-08-D/20	15	30	45	4	E
(2) Digital processing of remote sensing data	07.6-08-D/21	15	30	45	4	FT
(2) Thematic cartography	07.6-08-D/22	15	30	45	4	FT
<b>5<sup>th</sup> year / 10<sup>th</sup> semester</b>						
Real estate valuation	07.6-08-C/19	15	30	45	3	FT
(1) Monographic lectures	07.6-08-D/10	30	-	30	2	FT
(1) Seminar	07.6-08-D/11	-	30	30	2	FT
(1) Field training in satellite geodesy	07.6-08-D/12	-	60	60	4	FT
(2) Seminar	07.6-08-D/25	-	60	60	3	FT
Master's thesis	07.6-08-E/6				30	E

(1) – concerns the line of specialization: geodesy and satellite navigation

(2) – concerns the line of specialization: applied geodesy

**FT** – the basis for assessment (getting credit) is a final test

**E** – the basis for assessment (getting credit) is an exam

*LEVEL A*

**LEVEL A**

<b>Subject:</b> Foreign language I	<b>Code:</b> 09.1-00-A/1	<b>Semester:</b> 1, 2, 3
<b>Form:</b> Classes	<b>Number hours/semester</b> 30 classes	<b>of</b> <b>Number of ECTS credits:</b> 0

**Coordinator(s):** lecturer in a given language.

**Organizational unit:** Foreign Language Study Center.

**Status in the curriculum:** compulsory.

**Description:** Learning of a chosen foreign language by gaining knowledge of its phonetic systems, grammatical structures and vocabulary at an elementary level, and improving language skills at an advanced level.

**Language of instruction:** chosen from among those taught at the University (English, Belarus, French, Spanish, German, Russian, Ukrainian).

**Goals:** to prepare students for both passive and active use of the language at an advanced level.

**References:** *depending on the level of advance.*

**Assessment:** final test.

**Registration required:** yes.

**LEVEL A**

<b>Subject:</b> Foreign language II	<b>Code:</b> 09.1-00-A/1	<b>Semester:</b> 4, 5, 6
<b>Form:</b> Classes	<b>Number hours/semester</b> 30 classes	<b>of Number of ECTS credits:</b> 2+2+2

**Coordinator(s):** lecturer in a given language.

**Organizational unit:** Foreign Language Study Center.

**Status in the curriculum:** compulsory.

**Description:** Learning of a chosen foreign language by gaining knowledge of its phonetic systems, grammatical structures and vocabulary at an elementary level, and improving language skills at an advanced level.

**Language of instruction:** chosen from among those taught at the University (English, Belarus, French, Spanish, German, Russian, Ukrainian).

**Goals:** to prepare students for both passive and active use of the language at an advanced level.

**References:** *depending on the level of advance.*

**Assessment:** final test.

**Registration required:** yes.

## LEVEL A

<b>Subject:</b> Economics	<b>Code:</b> 14.3-00-A/2	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 classes/15 lectures	<b>Number of ECTS credits:</b> 2

**Coordinator(s):** Stefan Strumiłło, PhD.

**Organizational unit:** Department of Economics.

**Status in the curriculum:** compulsory.

**Description:** Management as a decision-making process. Market microanalysis. Customer behavior. Producer behavior. Introduction to macroeconomics and national income account. National budget and fiscal policy. Money and modern banking system. Exchange markets. Inflation. Labor market. Economic development and short-term cyclical fluctuations. Market imperfections and selected economic functions of the State in a free-market economy. International trade.

**Goals:** to discuss the bases of a free-market economy.

**Teaching method:** lectures, auditory classes.

### References:

Begg D., 2001, *Economics*, PWE, Warszawa.

Dębniowski G., R. Hryciuk, *Makroekonomia*.

Dębniowski G., H. Pałach, W. Zakrzewski, *Mikroekonomia*.

Nojszewska E., *Podstawy ekonomii*.

*Elementarne zagadnienia ekonomii*, praca zbiorowa pod red. R. Milewskiego, PWN, Warszawa 1997.

Rekowski M., *Wprowadzenie do mikroekonomii*.

**Assessment:** test with a possibility of repeat.

## LEVEL A

<b>Subject:</b> Basics of philosophy	<b>Code:</b> 08.9-00-A/3	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/15 classes	<b>Number of ECTS credits:</b> 2

**Coordinator(s):** employees of the Institute of Philosophy.

**Organizational unit:** Institute of Philosophy.

**Status in the curriculum:** optional.

**Description:** Acquiring knowledge of the main branches of philosophy, such as: ontology, gnoseology, ethics, philosophic anthropology and axiology. Discussing the specific and complementary character of these branches of philosophy. Students get to know the fundamental problems of philosophy and learn how to solve them.

**Goals:** to present the specific character of philosophical thinking and a synthesizing role of this form of knowledge in the study of reality.

**Teaching method:** lectures, panel discussion in groups, analysis of source materials.

**Teaching aids:** printed series of course lectures, textbooks, source materials.

### References:

- Ajdukiewicz K., 1983, *Zagadnienia i kierunki filozofii. Teoria poznania. Metafizyka*, Warszawa.
- Anzenbacher A., 1987, *Wprowadzenie do filozofii*, Kraków.
- Bocheński J.M., 1986, *Ku filozoficznemu myśleniu. Wprowadzenie do podstawowych pojęć filozoficznych*, Warszawa.
- Dębowski J., Gawor L., Jedynek S., Kosior S., Zdybel J., Zdybel L., 1996, *Mała encyklopedia filozofii. Pojęcia – problemy – kierunki- szkoły*, Bydgoszcz.
- Jadacki J., 1996, *Jak studiować filozofię?*, Warszawa.
- Krapiec M.A., Kamiński S., Zdybicka Z., Jaroszyński P., 1992, *Wprowadzenie do filozofii*, Lublin.
- Podstawy filozofii*, red. S. Opara, Olsztyn 2001.
- Stępień A., 1995, *Wstęp do filozofii*, Lublin.

**Assessment:** test with a possibility of repeat.

**Registration required:** yes.

## LEVEL A

<b>Subject:</b> Ecological aspects of philosophy	<b>Code:</b> 08.9-00-A/3	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/15 classes	<b>Number of ECTS credits:</b> 2

**Coordinator(s):** Zbigniew Hull, Associate Professor, PhD.

**Organizational unit:** Institute of Philosophy.

**Status in the curriculum:** optional.

**Description:** Ecology, environmental protection and philosophy. Anthropopressure and its effects on the biosphere and man (society). Ecological crisis and suggestions how to overcome it. Assumptions and theory of sustainable development. Classical philosophical problems versus ecological aspects of philosophy. Ecological values, ecological ethics and main directions of its development. Anthropocentrism versus biocentrism, concepts and problems of bioethics.

**Goals:** to familiarize students with the basic concepts and problems connected with the ecological aspects of philosophy.

**Teaching method:** discussions, audiovisual aids: slides, transparencies and video tapes.

**Teaching aids:** printed series of course lectures, textbooks, source materials.

### References:

- Brzostek M., Chojnacki J., Kaleta T., 1998, *Ekofilozofia. Wybór tekstów*, Wyd. SGGW, Warszawa.
- Jonas H., 1996, *Zasada odpowiedzialności*, Kraków.
- Lemańska A., 1998, *Filozofia przyrody a nauki przyrodnicze*, Warszawa.
- Papuziński A., (red.), 1999, *Wprowadzenie do filozoficznych problemów ekologii*, Bydgoszcz.
- Piątek Z., 1998, *Etyka ekologiczna*, Kraków.
- Singer P., 1997, *O życiu i śmierci. Upadek etyki tradycyjnej*, Warszawa.
- Skolimowski H., 1994, *Filozofia żyjąca*, Warszawa.
- Tyburski W., 1995, *Etyka i ekologia*, Toruń.
- Waloszcyk K., 1997, *Planeta nie tylko ludzi*, Warszawa.
- Zięba S., 1998, *Natura i człowiek w ekologii humanistycznej*, Lublin.

**Assessment:** test with a possibility of repeat.

**Registration required:** yes.

**LEVEL: A**

<b>Subject:</b> History of philosophy	<b>Code:</b> 08.9-00-A/3	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/15 classes	<b>Number of ECTS credits: 2</b>

**Coordinator(s):** employees of the Institute of Philosophy.

**Organizational unit:** Institute of Philosophy.

**Status in the curriculum:** optional.

**Description:** The Ionic School (spontaneous materialism). Socrates' ethical intellectualism. Platonic idealism and its filiations. Aristotelism and its reception in the next centuries. Ancient atomism. Ancient ethical concepts. Medieval mysticism and Scholasticism. Augustinianism. Tomism. Renaissance humanism and natural philosophy. Ages of social utopias. Pantheism, rationalism, empiricism, positivism. Kant's critical philosophy. Hegel's absolute idealism.

**Goals:** to familiarize students with the basic concepts and trends in the field of history of philosophy.

**Teaching method:** discussions, audiovisual aids: slides, transparencies and video tapes.

**Teaching aids:** printed series of course lectures, textbooks, source materials.

**References:**

- Copleston F., 1998-2000, *Historia filozofii*, T. 1 i 2, Warszawa.  
Diogenes Laertios, 1984, *Żywoty i poglądy słynnych filozofów*, Warszawa.  
Fuller B.A.G., 1964, *Historia filozofii*, T. 1 i 2, Warszawa.  
Gilson E., 1987, *Historia filozofii chrześcijańskiej w wiekach średnich*, Warszawa.  
Hempoliński M., 1989, *Filozofia współczesna. Wprowadzenie do zagadnień i kierunków*, Warszawa.

**Assessment:** test with a possibility of repeat.

**Registration required:** yes.

**LEVEL: A**

<b>Subject:</b> Physical education	<b>Code:</b> 16.1-00-A/4	<b>Semester:</b> 1, 2, 3
<b>Form:</b> Classes	<b>Number of hours/semester</b> 30 classes	<b>Number of ECTS credits:</b> 0

**Coordinator(s):** physical education teachers employed at the Center for Physical Education and Sports.

**Organizational unit:** Center for Physical Education and Sports.

**Status in the curriculum:** compulsory.

**Description:** The aim of physical education is to improve the physical fitness of students by means of frequent and intensive exercises, as well as to make them develop a habit of practicing sport, perceived as a basis of an active lifestyle and self-discipline. It also promotes the idea of co-operation and competition by participation in team games.

**Goals:** to improve the physical fitness of students and make them feel healthier.

**Teaching method:** exercises, demonstration with explanation.

**Assessment:** on the basis of regular attendance and tests.

**Registration required:** yes.

***LEVEL B***

**LEVEL: B**

<b>Subject:</b> Mathematics	<b>Code:</b> 11.1-08-B/1	<b>Semester:</b> 1, 2, 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 30 lectures/30 classes	<b>Number of ECTS credits:</b> 6+6+6+6

**Coordinator(s):** Andrzej Dawidowicz, PhD  
Jarosław Kosiorek, PhD.

**Organizational unit:** Department of Applied Mathematics.

**Status in the curriculum:** compulsory.

**Description:** Complex numbers. Vector algebra. Linear equations and matrices. Differential calculus of functions of one variable. Differential calculus of functions of several variables. Integral calculus of functions of several variables. Series of numbers and functions.

**Goals:** to familiarize students with elements of higher mathematics, to introduce them to the practical use of tables, guidebooks on mathematics, electronic calculators and mathematical computer programs.

**Teaching method:** lectures based on original and copied materials, active participation of students in classes, elements of competition.

**References:**

- Minorski W.P., 1974, *Zbiór zadań z matematyki wyższej*. WNT, Warszawa.
- Stankiewicz W., 1980, *Zadania z matematyki dla wyższych uczelni technicznych*, cz. I i II, PWN, Warszawa.
- Krysicki W., Włodarski L., 1976, *Analiza matematyczna w zadaniach*, T. 1 i 2, PWN, Warszawa.
- Leksiński W., Nabiałek I., Żakowski W., 1992, *Matematyka. Definicje, twierdzenia, przykłady, zadania*, WNT, Warszawa.
- Bers L., 1969, *Calculus*, Holt, Rinehart and Winston, New York, London.
- Fichtelholz G.M., 1994, *Rachunek różniczkowy i całkowy*, T. 1, 2 i 3, PWN, Warszawa.
- Bronsztejn I.N., Siemiendiajew K.A., 1976, *Matematyka, poradnik encyklopedyczny*, PWN, Warszawa.

**Assessment:** classes – test with a possibility of repeat.  
Examinations at the end of semesters 1, 2 and 4.

**LEVEL: B**

<b>Subject:</b> Physics	<b>Code:</b> 13.2-08-B/2	<b>Semester:</b> 2, 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 30 lectures/15 classes – s. 2 30 lectures/45 classes – s. 3	<b>Number of ECTS credits:</b> 5+7

**Coordinator(s):** Mirosław Alchimowicz, PhD.

**Organizational unit:** Department of Physics and Biophysics.

**Status in the curriculum:** compulsory.

**Description:** Mechanics: Kinematics, dynamics, conservation laws, vibrations. Elements of the relativity theory. Gravitation. Kepler's laws. Ciołkowski problem (rocket). Kinetic theory of matter: intermolecular (van der Waals) forces. Phase transitions. Electrodynamics: Electricity. Magnetism. Electromagnetic waves. Optics: Interference, diffraction, polarization, holography, geometric optics, lenses. Quantum mechanics: Electron diffraction, the uncertainty (indeterminacy) principle. Photoeffect, Planck spectrum. Schrödinger equation. Hydrogen atom. Interactions: Nuclear forces. Nuclear reactions. Reactor structure. Interactions between and classification of elementary particles. Symmetry breaking and Great Unification. Cosmology: Hubble's law. Thermal radiation of the Universe. Friedmann equations. Big-bang.

**Goals:** to discuss the basics of physics.

**Preceding subjects:** mathematics.

**Teaching method:** lectures, laboratory classes.

**References:**

Skorko M., *Fizyka*, PWN, Warszawa.

Sawieliew I.W, 2000, *Wykłady z fizyki*, T. 3, PWN, Warszawa.

Bobrowski Cz., 1998, *Fizyka*, WNT, Warszawa.

Drabent R., Machholc Z., Siódmiak J., *Ćwiczenia laboratoryjne z fizyki*, skrypt UWM w Olsztynie

**Assessment:** classes - test with a possibility of repeat.  
Examination at the end of semester 3.

**LEVEL: B**

<b>Subject:</b> Descriptive geometry	<b>Code:</b> 11.9-08-B/3	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Renata Jędryczka, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Elements of projective geometry. Parallel projection on a single plane, perspective projection and their invariants. Projection of fundamental elements (point, straight line, plane) in both types of projection. Adjacent, common and parallel elements. Plane sections; determination of angles and projections of three-dimensional figures. Practical application to projects concerning road work (parallel projection) and photogrammetry (perspective projection). Axonometric projection of three-dimensional figures.

**Goals:** to make parallel and perspective projections of three-dimensional figures, to reconstitute the real shapes and sizes of the figures projected, to develop the power of three-dimensional thinking.

**Preceding subjects:** mathematics.

**Teaching method:** lectures with visual aids: slides and anaglyphs; auditory classes.

**References:**

- Otto F., Otto E., 1975, *Podręcznik geometrii wykreślnej*, PWN, Warszawa.  
Waligórski J., 1961, *Zasady i zastosowania rzutu cechowanego*, WNT, Warszawa.  
Rachwał T., Dwurażna S., 1984, *Ćwiczenia z geometrii wykreślnej*, T. 1, PWN, Warszawa.  
Hutorowicz H., Pręcerek B., 1987, *Zbiór zadań z rzutu środkowego i aksonometrii*, Wyd. ART, Olsztyn.  
Brzosko Z., 1995, *Wykreślna restytucja perspektywy*, WNT, Warszawa.

**Assessment:** classes – drawing up and defense of projects.  
Examination at the end of semester 1.

**LEVEL: B**

<b>Subject:</b> Basics of computer science	<b>Code:</b> 11.3-08-B/4	<b>Semester:</b> 1, 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/45 classes - s. 1 15 lectures/30 classes – s. 2	<b>Number of ECTS credits:</b> 6+4

**Coordinator(s):** Jolanta Bałandynowicz, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** The basics of the structure and use of a PC and a local area network. Operating system. The principles of using typical office programs (word processor, spreadsheet, database) for geodetic (surveying) purposes. The Internet: browsers, data and information retrieval, WWW pages/sites, electronic mail. Basic software used for geodetic purposes: WinKalk and Micromap, C-Geo – analysis of data and figure elements. The basics of structured and object programming in particular versions of BASIC; geodetic software engineering. Macro instructions and applications in the Office package. Artificial intelligence.

**Goals:** to help students acquire skill at solving problems using available software, to teach them programming to a degree allowing them to master their skills.

**Teaching method:** lectures with visual aids: slides, transparencies; computer-aided practical classes.

**References:**

Bałandynowicz J., Czyżewski C., Prątnicka A., 1990, *Podstawy informatyki dla studiujących geodezję*, Wyd. ART, Olsztyn.

Bałandynowicz J., *Przewodnik po podstawach programowania na przykładzie programowania w języku BASIC*.

Tańska H., Zabokrzeczka A., 1999, *Komputer przyjacielem studenta: zbiór ćwiczeń*, Wyd. ART, Olsztyn.

**Assessment:** classes - test with a possibility of repeat.

Examination at the end of semester 2.

*LEVEL C*

**LEVEL: C**

<b>Subject:</b> Surveying	<b>Code:</b> 07.6-08-C/1	<b>Semester:</b> 1, 2, 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lect./30 classes–s. 1, 3 15 lect./60 classes–s. 2, 4	<b>Number of ECTS credits:</b> 4+6+4+6

**Coordinator(s):** Władysław Dąbrowski, Associate Professor, PhD.  
Barbara Gaşowska, PhD.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** Goals of modern geodesy. Types and classification of maps. Large-scale base maps. The fundamentals of plane coordinate computations. Horizontal and vertical control networks. Reference systems. Automation of surveying computations. Spirit and trigonometric leveling. Methods of distance measurement. Methods and errors of angle measurement. Detail surveys. Creation of large-scale maps. Total stations. Geodetic networks. Coordinate transformations. Numerical (digital) maps: 2D, 2D+H and 3D. Numerical (digital) maps with databases. Methods and formats of database supply. Object digital maps in relational databases. Generating terrain profiles.

**Goals:** to help students acquire skill at conducting surveys and making data evaluations.

**Preceding subjects:** plotting, electronic measuring techniques, the basics of computer science.

**Teaching method:** lectures with visual aids: slides, video projections and video films, computer-aided classes with original educational programs and application/service/user programs, conducted at the Digital Map Compilation Laboratory.

**References:**

- Ząbek J., 1998, *Geodezja I*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa.
- Lazarini T., Hermanowski A., Gaździcki J., Dobrzycka M., Laudyn I., 1990, *Geodezja. Geodezyjna osnowa szczegółowa*, PPWK, Warszawa-Wrocław.
- GEO-INFO 2000 dla Windows. Podręcznik użytkownika*, SYSTEM-INFO, Poznań.
- C-GEO w.5. Podręcznik Użytkownika*, Softline, Wrocław.
- Kraak M.J., Ormeling F., 1998, *Kartografia, wizualizacja danych przestrzennych*. PWN, Warszawa.
- Hernandez M.J., 1998, *Bazy danych*, EDU-MOKOM, Warszawa.
- Główny Urząd Geodezji i Kartografii, *Instrukcje techniczne O-1, G-1, G-2, G-3, G-4, G-7i, K-1*.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects. Examination (written and/or oral) at the end of semesters 2 and 4.

**LEVEL: C**

<b>Subject:</b> Geodesy and geodetic astronomy	<b>Code:</b> 07.6-08-C/2	<b>Semester:</b> 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 30 lectures/30 classes – s. 7 15 lectures/45 classes – s. 8	<b>Number of ECTS credits:</b> 5+5

**Coordinator(s):** Krzysztof Świątek, Associate Professor, :PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Geodetic network adjustment on the reference ellipsoid. Selected problems of physical geodesy (normal gravity field, systems of heights, determination of geoid separation from the ellipsoid, reduction of geoid astronomic measurements and ellipsoid geodetic surveys). Spatial coordinate transformation. Spherical astronomy. Geodetic astronomy. Reference horizontal geodetic networks. Precise leveling.

**Goals:** to familiarize students with the theoretical aspect of examination of the shape of the Earth and the Earth's gravitation field, and computations concerning the reference ellipsoid.

**Preceding subjects:** geodesy, physics.

**Teaching method:** lectures with visual aids: slides, transparencies.

**References:**

*Geodezja wyższa i astronomia geodezyjna*, praca zbiorowa pod red. R. Hlibowickiego, PWN, Warszawa 1981.

*Geodezja wyższa i astronomia geodezyjna – zadania i przykłady*, praca zbiorowa pod red. R. Hlibowickiego, PWN, Warszawa 1988.

*Niwelacja precyzyjna: niwelacja geometryczna, trygonometryczna, satelitarna i hydroniwelacja*, praca zbiorowa pod redakcją Włodzimierza Barana, PPWK, 1993.

Szpunar W., 1982, *Podstawy geodezji wyższej*, PPWK.

Czarnecka U., 1996, *Geodezja współczesna w zarysie*, Wiedza i Życie.

Ćwiczenia z geodezji fizycznej i grawimetrii geodezyjnej, wyd. PW.

Opalski W., Cichowicz L., 1980, *Astronomia geodezyjna*, PPWK.

**Assessment:** classes – tests with a possibility of repeat.

Examination (written and oral) at the end of semester 8.

**LEVEL: C**

<b>Subject:</b> Basics of engineering geodesy	<b>Code:</b> 07.6-08-C/3	<b>Semester:</b> 5, 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes – s. 5 15 lectures/45 classes – s. 6	<b>Number of ECTS credits:</b> 4+6

**Coordinator(s):** Alojzy Wasilewski, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Modern measurement techniques: total stations, laser technology, GPS (including GPS RTK). Geodetic networks – layout, accuracy analysis, adjustment. Geodetic surveys in highway engineering, railroad construction and hydro-engineering. Tall structure measurements. Measurements concerning cranes and elevators. Computer-aided geodetic surveying for town and country development plans. Residential and industrial building – geodetic surveys. Inventory of underground and ground facilities. Measurement of displacement of engineering structures and their surroundings.

**Goals:** to familiarize students with innovative measuring and computing techniques applied in the above branches of engineering geodesy.

**Preceding subjects:** mathematics, geodesy, computing methods in geodesy, electronic measuring techniques.

**Teaching method:** lectures, drawing up projects, field training.

**References:**

*Geodezja inżynieryjna*, 1990, Tom I, Praca zbiorowa pod red. Jana Gmyrka, Warszawa, Wrocław, Państwowe Przedsiębiorstwo Wydawnictw Kartograficznych im. E. Romera.

*Geodezja inżynieryjna*, 1993, Tom II, Praca zbiorowa pod red. Ryszarda J. Grabowskiego, Państwowe Przedsiębiorstwo Wydawnictw Kartograficznych im. E. Romera, Warszawa-Wrocław.

*Geodezja inżynieryjna*, 1994, Tom III, Praca zbiorowa pod red. Jana Gocała, Warszawa-Wrocław.

Czaja J., 1983, *Geodezja inżynieryjno-przemysłowa*, część I, II, Kraków.

Janusz W., 1975, *Obsługa geodezyjna budowli i konstrukcji*, Państwowe Przedsiębiorstwo Wydawnictw Kartograficznych im. E. Romera, Warszawa.

*Grala M., Kopiejewski G., Wasilewski A., 1986, Geodezja inżynieryjna, ART, Olsztyn.*

**Assessment:** classes – tests with a possibility of repeat, drawing up and defense of projects. Examination (written and oral) at the end of semester 6.



**LEVEL: C**

<b>Subject:</b> Building engineering	<b>Code:</b> 06.4-08-C/4	<b>Semester:</b> 4, 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 2+2

**Coordinator(s):** Mirosław Grala, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Ground, foundations and building materials. Structural components and systems. Industrial building and civil engineering. Territorial development and technical infrastructure: water-pipe networks, sewerage systems, heat distribution networks, gas grids, communications networks and power networks. Motor roads and railways. Selected engineering and special-purpose structures.

**Goals:** to familiarize students with the basic technologies applied during building erection in civil engineering, industrial engineering, highway engineering and railroad construction, to teach them how to adjust the technique of conduction geodetic surveys to the requirements and conditions of a building site.

**Teaching method:** lectures with visual aids: slides, transparencies; drawing up projects, laboratory classes, field training, classes at the building site.

**References:**

*Elementy inżynierii lądowej dla geodetów*, praca zbiorowa pod redakcją G. Kopiejewskiego, 1992, wyd. ART, Olsztyn.

**Assessment:** classes – tests with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Basics of satellite geodesy	<b>Code:</b> 07.6-08-C/5	<b>Semester:</b> 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory.

**Description:** GPS – the operating principle. Coordinate systems. Determination of satellite coordinates on the basis of satellite ephemerides. Satellite signal structure. Observation data. Absolute and relative methods of position determination. Practical geodetic surveys - GPS. Field observation procedure. Mathematical models of position determination. Observation post-processing. GPS network adjustment and coordinate transformation to local systems. Methods of real-time positioning: DGPS and RTK. Methods of satellite positioning and their accuracy.

**Goals:** to discuss the principles of satellite positioning (GPS) for geodetic and navigation purposes.

**Preceding subjects:** mathematics, physics.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes and field training.

**References:**

- Misra P., Enge P., 2001, *Global Positioning System – Signals, Measurements and Performance*, Ganga-Jamuna Press, Lincoln, MA, USA.  
Leick A., 1996, *GPS Satellite Surveying*, J Wiley & Sons.  
Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.  
Czarnecki K., 1995, *Geodezja Współczesna*, (w:) Wiedza i Życie, Warszawa.

**Assessment:** classes – homework assignments, reports on field training, test with a possibility of repeat..

Examination (written) at the end of semester 3.

## LEVEL C

<b>Subject:</b> Surveying data adjustment and analysis	<b>Code:</b> 11.2-08-C/6	<b>Semester:</b> 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 30 lectures/30 classes – s. 3 15 lectures/30 classes – s. 4	<b>Number of ECTS credits:</b> 6+4

**Coordinator(s):** Professor Lubomir W. Baran, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Basic definitions and theorems concerning the calculus of probability. Selected problems of mathematical statistics; estimation theory and verification of statistical hypotheses from the perspective of their geodetic applications. The application of one of estimation methods – the least square method – to data evaluation in the case of geodetic surveys: leveling, angular and linear measurements. Sequential methods of data evaluation in the case of large geodetic networks.

**Goals:** to familiarize students with the theoretical basis of data evaluation, as well as with selected algorithms of the least square method and their application to the adjustment of leveling and angular-linear networks.

**Preceding subjects:** mathematics, geodesy.

**Teaching method:** lectures with visual aids: slides and transparence; classes - practical problem-solving.

### References:

Baran L.W., 1999, *Teoretyczne podstawy opracowania wyników pomiarów geodezyjnych*, Wydawnictwo Naukowe PWN, Warszawa.

Wiśniewski Z., 2000, *Algebra macierzy i statystyka matematyczna w rachunku wyrównawczym (teoria i zadania)*, Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego, Olsztyn.

Nowak E., *Algorytmy numeryczne w geodezji*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa.

Osada E., 1998, *Analiza, wyrównanie i modelowanie Geo-danych*, Wydawnictwo Akademii Rolniczej we Wrocławiu, Wrocław.

**Assessment:** classes – tests with a possibility of repeat.  
Examination (written and oral ) at the end of semester 4.

**LEVEL: C**

<b>Subject:</b> Photogrammetry and remote sensing	<b>Code:</b> 07.6-08-C/7	<b>Semester:</b> 5, 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/45 classes	<b>Number of ECTS credits:</b> 5+5

**Coordinator(s):** Zygmunt Paszotta, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Terrain image acquisition – photogrammetric cameras. Affine and projective transformations. Basic characteristics of perspective projection. Digital images. Color models. Determination of point spatial coordinates in the ground coordinate system. The basics of aerial triangulation. The use of photogrammetric surveys for digital map generating. Digital terrain model. Method of photomap generating. Methods of aerial photograph interpretation. Digital photogrammetry in spatial information systems. Acquisition, orientation and analytical elaboration of terrestrial photographs. Methods of reconstruction of space structure images. Physical bases of remote sensing. Satellite images: acquisition, geometry and processing. The possibility of using information provided by satellite images.

**Goals:** to familiarize students with the basics of photogrammetry and modern photogrammetric technologies; to help them acquire skill at orthophotomap generating; to familiarize them with the applications of terrestrial photogrammetry and remote sensing.

**Preceding subjects:** mathematics, physics, surveying data adjustment and analysis, geodesy, computer science.

**Teaching method:** lectures with the use of terrestrial and aerial photographs, satellite images, maps, photomaps and computer-processed images; computer-aided classes, with the use of cartographic materials, camera calibration data, control points, etc.

**References:**

- Sitek Z., 1991, *Fotogrametria ogólna i inżynierska*, PPWK, Warszawa – Wrocław.  
Kurczyński Z., Preuss R., 2000, *Podstawy fotogrametrii*, Wyd. PW, Warszawa.  
Sitek Z., 1994, *Wprowadzenie do teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.  
Świątkiewicz A., 1982, *Fotogrametria*, PWN, Warszawa.

**Assessment:** classes – tests with a possibility of repeat, drawing up and defense of projects. Examination (written and/or oral) at the end of semester 6.

**LEVEL: C**

<b>Subject:</b> Cartography	<b>Code:</b> 07.6-08-C/8	<b>Semester:</b> 6, 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 30 lectures/15 classes – s. 6 15 lectures/30 classes – s. 7	<b>Number of ECTS credits:</b> 3+3

**Coordinator(s):** Professor Idzi Gajderowicz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Spherical trigonometry. Coordinate systems of points situated on the sphere. Spheroid geometry. General theory of map projections. Map projection classification. Projection of ellipsoid of revolution on spherical surface. Azimuthal, cylindrical and conical projections of spherical surface. Gauss-Krüger projection. Quasi-stereographic projection. Conformal transformation. Criteria of map classification. General principles of map compilation. Cartographic generalization. Map reproduction. Topographic maps in Poland since 1945. Topographic map compilation. Thematic cartography. Computer-aided cartography.

**Goals:** to introduce students to the theory of map projections, to familiarize them with the basics of the compilation and reproduction of topographic and thematic maps.

**Preceding subjects:** geodesy, mathematics.

**Teaching method:** lectures with visual aids: slides, transparencies; laboratory classes and a visit to a cartographic publishing house.

**References:**

- Gajderowicz I., 1999, *Kartografia matematyczna dla geodetów*, Wyd. ART, Olsztyn.  
Byearman L., 1989, *Redakcja map i reprodukcja kartograficzna*, Wyd. ART, Olsztyn.  
Menno-Jan Kraak, F. Ormeling, 1998, *Kartografia; wizualizacja danych przestrzennych*, Wyd. Nauk. PWN, Warszawa.  
Ratajski L., 1989, *Metodyka kartografii społeczno-gospodarczej*, wyd. II, PPWK, Warszawa – Wrocław.  
Aleksiejewicz Saliszczew K., 1998, *Kartografia ogólna*, Wyd. Nauk. PWN, Warszawa, wyd. II.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects. Examination (written and oral) at the end of semester 7.

**LEVEL: C**

<b>Subject:</b> Electronic measuring techniques	<b>Code:</b> 07.6-08-C/9	<b>Semester:</b> 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/45 classes	<b>Number of ECTS credits:</b> 5

**Coordinator(s):** Andrzej Wanic, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Mechanical-optical systems of engineering and precision leveling instruments and theodolites with various reading/registration systems. Testing and adjustment of optical surveying equipment. Electronic distance measurement (impulse and phase methods). Total stations. Electronic angle-measurement systems (code, impulse, dynamic). Electromagnetic wave propagation in the atmosphere. Lasers. Wall marks.

**Goals:** to familiarize students with the structure and use of measuring instruments (optical and electronic), to prepare them for carrying out surveying tasks with modern surveying equipment.

**Preceding subjects:** geodesy.

**Teaching method:** lectures and classes with visual aids: slides, transparencies and video types.

**References:**

Plątek A., 1991, *Geodezyjne dalmierze elektromagnetyczne i tachymetry elektroniczne. Część I: geodezyjne dalmierze elektromagnetyczne do pomiarów terenowych*, PPWK, Warszawa-Wrocław.

Plątek A., 1992, *Geodezyjne dalmierze elektromagnetyczne i tachymetry elektroniczne. Część II: optyczne dalmierze interferencyjne, teodolity i tachymetry elektroniczne*, PPWK, Warszawa – Wrocław.

Tatarczyk J. 1994, *Wybrane zagadnienia z instrumentoznawstwa geodezyjnego*, AG-H, Kraków.

Tatarczyk. J. 1977, *Nowe konstrukcje geodezyjnych przyrządów kątomierzowych*, AG-H, Kraków.

Wanic A. 1998, *Instrumentoznawstwo geodezyjne. Przewodnik do ćwiczeń, Część I*. Wydanie II, AR-T, Olsztyn.

Wanic A., 1997, *Instrumentoznawstwo geodezyjne. Przewodnik do ćwiczeń. Część II*, AR-T, Olsztyn.

Ząbek J. i in., 1984, *Ćwiczenia z geodezji I*, PWN, Warszawa.

**Assessment:** classes - test + a practical exam in the use of optical and electronic measuring instruments.

Examination at the end of semester 2.

**LEVEL: C**

<b>Subject:</b> Basics of town-and-country planning	<b>Code:</b> 02.0-08-C/10	<b>Semester:</b> 6, 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes – s. 6, 8 15 lectures/30 classes – s. 7	<b>Number of ECTS credits:</b> 3+4+3

**Coordinator(s):** Professor Ryszard Cymerman, PhD.

**Organizational unit:** Department of Land Planning and Management.

**Status in the curriculum:** compulsory.

**Description:** The essence of land management. Regional policy. Legal aspects of planning. Town-and-country planning at various levels of administrative division. Local town-and-country development plans. Urban area management. Rural area management. Development planning.

**Goals:** to familiarize students with the basics of town-and-country planning and spatial order preservation.

**Teaching method:** lectures, classes (including computer-aided design).

**References:**

- Domański R., 1993, *Gospodarka przestrzenna*, PWN Warszawa.
- Kukliński A., 1984, *Gospodarka przestrzenna Polski – Diagnoza i rekonstrukcja*, Ossolineum. *Biuletyny i Studia Komitetu Przestrzennego Zagospodarowania Kraju*.
- Przyrodnicze aspekty zrównoważonego rozwoju*, (w:) Człowiek i Środowisko, (Kwartalnik), Instytut Gospodarki Przestrzennej i Komunalnej, nr 2, 2000 r.
- Kachniarz T., 1990, *Rzeczywistość i problemy przestrzennego zagospodarowania gmin*.
- Wysocka E. (red.), 2000, *System studiów i planów przestrzennych po reformie administracji państwa*.
- Ziobrowski Z., Zastawiak B., Reizer S., 1995, *Zasady zapisu ustaleń planów miejscowych*, Instytut Gospodarki Przestrzennej i Komunalnej, oddział Kraków.

**Assessment:** classes – tests with a possibility of repeat.  
Examination at the end of semester 8.

**LEVEL: C**

<b>Subject:</b> Land information systems	<b>Code:</b> 07.9-08-C/11	<b>Semester:</b> 4, 5,
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Professor Idzi Gajderowicz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Tools for drawing computerized maps (Microstation). Spatial and descriptive data. Organization of spatial information systems. Data model. Acquisition and pre-processing of spatial data. Map digitalization. Scanning and vectorization. Feeding and modification of descriptive data. Display of objects and their attributes. Object selection. Query creation on the basis of attributes. Spatial criteria in queries. Spatial data exchange (export, import). Comparison of the main characteristics of available professional LIS software. GIS/LIS in the Internet.

**Goals:** to familiarize students with basic information tools for drawing computerized maps, and the principles of creating and using spatial information systems.

**Preceding subjects:** geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies, classes – practical application of descriptive and cartographic materials.

**References:**

*Ustawa z dnia 17 maja 1989 r. – Prawo geodezyjne i kartograficzne* (Dz.U.nr 30, poz.163) wraz z przepisami wykonawczymi.

Gaździcki J., 1990, *Systemy informacji przestrzennej*, PPWK, Warszawa.

Gaździcki J., 1995, *Systemy katastralne*, PPWK, Warszawa.

*Instrukcja techniczna K-1 Mapa zasadnicza.*

**Assessment:** classes – data elaboration, reports; tests with a possibility of repeat. Examination at the end of semester 5.

**LEVEL: C**

<b>Subject:</b> Basics of Earth science	<b>Code:</b> 13.9-08-C/12	<b>Semester:</b> 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes – s. 3 30 lectures/15 classes – s. 4	<b>Number of ECTS credits:</b> 3+3

**Coordinator(s):** Professor Janusz Gotkiewicz, PhD.

**Organizational unit:** Department of Pedology and Soil Conservation.

**Status in the curriculum:** compulsory.

**Description:** System of Earth sciences. Earth's structure, composition and history. Introduction to environmental components: atmosphere, hydrosphere, lithosphere, biosphere. The basics of geology, geomorphology and pedology (soil-science).

**Goals:** to familiarize students with the basics of environmental sciences.

**Teaching method:** lectures, classes.

**References:**

- Przedwojski R., 1985, *Gleboznawstwo z podstawami geomorfologii, mineralogii petrografii*, Skrypty ART, Olsztyn.  
Mizerski W., 2000, *Geologia dynamiczna dla geografów*, PWN, Warszawa.  
Uggla H., 1983, *Gleboznawstwo rolnicze*, PWN, Warszawa.  
Dobrzański B., 1993, *Gleboznawstwo*, PWRiL, Warszawa.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects. Examination at the end of semester 4.

**LEVEL: C**

<b>Subject:</b> Human environment protection	<b>Code:</b> 07.2-08-C/13	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 2</b>

**Coordinator(s):** Iwona Marcinkowska, PhD.

**Organizational unit:** Department of Land Planning and Management.

**Status in the curriculum:** compulsory.

**Description:** Basic concepts of environmental protection. Selected problems connected with the protection of water, air, fauna and flora, noise control, waste control and disposal, radiation protection. Farmland protection: threats to farmland, release of cropland and forest land for other purposes, release charge. Rural landscape assessment. Devastated land reclamation: wasteland and its effects on the condition of agricultural production, the reclamation process, directions and costs of land reclamation, documentation (specifications, cost estimate) of land reclamation projects, results of land reclamation. Ecological development of rural areas.

**Goals:** to discuss the basics of environmental protection, and environmental aspects of planning in the field of geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies; classes – project drawing.

**References:**

- Bartkowski T., 1979, *Kształtowanie i ochrona środowiska*, PWN Warszawa.
- Cymerman R., Hopfer A., 1980, *Ochrona środowiska w planowaniu i urządzaniu terenów wiejskich*, PWN, Warszawa.
- Cymerman R., 1991, *Geodezyjne problemy rekultywacji gruntów*, Wydawnictwo ART Olsztyn.
- Cymerman R., Falkowski J., Hopfer A., 1992, *Krajobrazy wiejskie*, Wydawnictwo ART Olsztyn.
- Ekorozwój obszarów wiejskich*, Zeszyty Problemowe Postępów Nauk Rolniczych PAN, Zeszyt 401, 1992, PWN Warszawa.
- Cymerman R., Bajerowski T., Pośniak K., 1989, 1991, *Ćwiczenia z ochrony środowiska w geodezji rolnej*, skrypt ART., Olsztyn.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: C**

<b>Subject:</b> Law	<b>Code:</b> 10.0-08-C/14	<b>Semester:</b> 5, 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/15 classes – s. 5 15 lectures/15 classes – s. 6	<b>Number of ECTS credits:</b> 3+3

**Coordinator(s):** Professor Stanisław Surowiec, PhD.  
Romuald Waśniewski, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.  
Faculty of Law and Administration.

**Status in the curriculum:** compulsory.

**Description:** Property rights and limited rights in property, real easement and personal servitude. Types of real estate. Land and mortgage registers. The principles of entering proprietary rights into land and mortgage registers. Trade in real estates (State-owned and private). Directions of ownership transformations in State-owned agricultural real properties (holdings): communalization, taking over by the State Treasury Agency for Agricultural Property, association of capital and franchisement of state-owned legal persons. Rights and duties of chartered surveyors, work performed in closed areas. Organizational forms of non-state contractors. Geodetic data used for keeping and updating of land and building registers. Setting lines of demarcation between real estates – geodetic files and legal documents.

**Goals:** to familiarize students with property rights and legal problems connected with state-owned real estates, and the tasks and organization of the State Surveying Service.

**Preceding subjects:** geodesy, land information systems.

**Teaching method:** lectures with visual aids: slides, transparencies, classes in small groups.

**References:**

- Ewidencja gruntów*, praca zbiorowa, 1987, PWN Warszawa.  
*Ustawa z dnia 17 maja 1989 r. – Prawo geodezyjne i kartograficzne* (Dz. U. 30, poz. 163).  
*Rozporządzenie Ministra Rozwoju Regionalnego i Budownictwa z dnia 29 marca 2001 r. w sprawie ewidencji gruntów i budynków* (Dz. U. 38, poz. 454).  
Waśniewski R., 1995, *Prawo – przewodnik do ćwiczeń*, ART Olsztyn.  
Rudnicki S., Szachułowicz J., 2000, *Nieruchomości*, Wyd. Prawnicze PWN Warszawa.  
Ignatowicz J., 1997, *Prawo rzeczowe*, PWN, Warszawa.

**Assessment:** classes – oral examination and a test with a possibility of repeat.  
Examination at the end of semester 6.

**LEVEL: C**

<b>Subject:</b> Plotting	<b>Code:</b> 07.6-08-C/15	<b>Semester:</b> 1, 2
<b>Form:</b> Classes	<b>Number of hours/semester:</b> 30 classes	<b>Number of ECTS credits:</b> 2+2

**Coordinator(s):** Elżbieta Lewandowicz, PhD.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** The basics of plotting: map scale, conventional signs, cartographic lettering, map frames. Lettering in topographic maps, field sketches. Digital drawing. The basics of AutoCad. Graphic objects, plotting aids, drawing pads, footnotes. Contour drawing. Base maps: vector, object or contour base map. Map objects. Designing terrain object symbols. Map editing in geodetic and non-geodetic applications. Plotting devices.

**Goals:** to help students master skill at traditional and computer-aided plotting, to familiarize them with the geodetic standards of the K series.

**Teaching method:** lectures with audiovisual aids: slides, transparencies, video projections; the use of the latest AutoCad versions, geodetic applications and original educational programs; classes conducted at the Digital Map Compilation Laboratory.

**References:**

- Autodesk 1999: AutoCAD 2000. Podręcznik użytkownika.*  
Bem S., 1996, *Rysunek map*, PPWK, Warszawa.  
Dąbrowska D., Wenta J., *Godła mapy; komputerowy program edukacyjny.*  
*Instrukcja obsługi programu C-geo dla Windows. Softline.*  
*Instrukcja obsługi programu Mikromapa. Coder.*  
*Wybrane branżowe instrukcje i wytyczne techniczne.*

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: C**

<b>Subject:</b> Collection and distribution of geodetic and cartographic data.	<b>Code:</b> 07.6-08-C/16	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3

**Coordinator(s):** Władysław Dąbrowski, Associate Professor, PhD.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** Geodetic and cartographic documentation kept at the central, provincial, district and communal levels - genesis, collecting, making available. Centers for Geodetic and Cartographic Documentation - central, provincial, municipal (district) and communal – legal bases of organization, equipment, hardware/software. Computer network at the Center. Digital tools and systems for data acquisition, processing and distribution. Access to data. Data protection and archives. Models of work organization at the Center – example of selected computerized Centers in Poland.

**Goals:** to teach students how to co-operate with Centers for Geodetic and Cartographic Documentation at all levels of public administration.

**Preceding subjects:** geodesy, land information systems, real estate cadastre, the basics of computer science.

**Teaching method:** lectures with visual aids: slides, transparencies, video projections; classes conducted at the Digital Map Compilation Laboratory or at a computerized Center for Geodetic and Cartographic Documentation.

**References:**

*Przepisy prawne w zakresie geodezji i kartografii.*

*Przepisy prawne w zakresie organizacji i funkcjonowania z informatyzowanych ODGiK.*

**Assessment:** test or an oral examination with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Real estate cadastre	<b>Code:</b> 07.6-08-C/17	<b>Semester:</b> 6, 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Professor Stanisław Surowiec, PhD.  
Kazimierz Zwirowicz, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory.

**Description:** Land and building registers and territorial development and technical infrastructure registers as sources of information about real estates. Purposes, scope and structure of registration and record keeping. Record sets and files. System keeping and updating (modernization). Land and building registers versus land and mortgage registers. The rules of gathering information on various types of real estates.

**Goals:** to familiarize students with sources of information about real estates, the creation and keeping of systems of information on land, buildings and apartments/quarters, and their owners/tenants.

**Preceding subjects:** geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies, classes in small groups.

**References:**

*Ewidencja gruntów*, praca zbiorowa, 1987, PWN Warszawa.

*Ustawa z dnia 17 maja 1989 r. – Prawo geodezyjne i kartograficzne* (Dz. U. 30, poz. 163).

*Ewidencja gruntów, budynków i sieci uzbrojenia terenu*, praca zbiorowa pod red. A. Hopfera, 2000, wydawnictwo UWM, Olsztyn.

Gaździcki J., 1990, *Systemy informacji przestrzennej*, PPWK, Warszawa.

Gaździcki J., 1990, *Systemy katastralne*, PPWK, Warszawa.

*Rozporządzenie Ministra Rozwoju Regionalnego i Budownictwa z dnia 29 marca 2001 r. w sprawie ewidencji gruntów i budynków* (Dz. U. 38, poz. 454).

**Assessment:** classes – oral examination and a test with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Real estate administration	<b>Code:</b> 07.6-08-C/18	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3

**Coordinator(s):** Radosław Wiśniewski, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** The basics of real estate administration in urban areas. Procedures of administrating real estates owned by the State Treasury and local government units. Forms and legal bases of trade in real estates. Administration of real estate reserves. Tendering procedure and sale without inviting tenders in the case of real estates owned by the State Treasury and local government units. Long-term usufruct of real property. Expropriation of real estates and restitution of real estates expropriated before. Consolidation and division, partition of real property. Adjacent fees. Right of pre-emption, right of priority.

**Goals:** to familiarize students with the legal and economic bases of real estate administration in urban areas.

**Preceding subjects:** law, economics.

**Teaching method:** lectures with visual aids: slides, transparencies; classes, including seminars and making an inventory.

**References:**

- Bieniek G i inni, 2000, *Komentarz do ustawy o gospodarce nieruchomościami*, ZCO, Zielona Góra.  
Kuryj J., R. Wiśniewski, R. Żróbek (red.), 2000, *Gospodarka nieruchomościami*, Wyd. UWM, Olsztyn.  
Ignatowicz J., 1997, *Prawo rzeczowe*, PWN Warszawa.

**Assessment:** tests with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Real estate valuation	<b>Code:</b> 07.6-08-C/19	<b>Semester:</b> 10
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 3

**Coordinator(s):** Professor Sabina Żróbek, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** Real estate valuation in light of legal acts, purposes of real estate valuation, types of value determined by property appraisers, classification of valuation methods, the principles of real estate valuation – general procedures, appraisal reports, specific character of the real estate market, rules of granting a license to property appraisers, professional standards, ethics and responsibility of property appraisers, the position of property appraisers in relation to other occupations in the field of real estates – brokers, managers, surveyors, etc.

**Goals:** to familiarize students with the profession of property appraiser, and the basics of real estate valuation.

**Preceding subjects:** real estate administration.

**Teaching method:** lectures with audiovisual aids.

**References:**

*Ustawa z dnia 21 sierpnia 1997 roku o gospodarce nieruchomości* (Dz.U. Nr 115/97 z późniejszymi zmianami).

Cymerman R., A. Hopfer, 1997, *System szacowania nieruchomości*, wyd. ZCO, Zielona Góra.

Żróbek S., M. Belej, 2000, *Podejście porównawcze w szacowaniu nieruchomości*, wyd. Educaterra, Olsztyn.

*Szacowanie nieruchomości podejściem dochodowym*, wyd. TWIGGER, Warszawa 2001.

Hopfer A., H. Jędrzejewski, R. Żróbek, S. Żróbek, 1996, *Wycena nieruchomości i przedsiębiorstw, Tom I, Szacowanie nieruchomości*, wyd. TWIGGER, Warszawa.

Hopfer A., i inni, 1999, *Szacowanie nieruchomości niezurbanizowanych*, wyd. TWIGGER, Warszawa.

Standardy Zawodowe Rzeczoznawców Majątkowych, wyd. PFSRM, Warszawa, 2000.

**Assessment:** classes – tests with a possibility of repeat.

***LEVEL D***

**LEVEL: D**

<b>Subject:</b> Physical geodesy	<b>Code:</b> 07.6-08-D/1	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Jan Kryński, Associate Professor, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** Concept of the figure (shape) of the Earth. Earth's gravity field (Earth's gravitational potential and acceleration of gravity, Laplace equation in space polar coordinates and its solution, equipotential surfaces and vertical lines). Geodetic coordinate systems (natural coordinates, systems of heights, sea level and geoid; ellipsoid reference systems; normal gravity field; geodetic reference systems). Gravimetric methods of geoid determination (gravimetric anomaly, vertical deflection, boundary value problem and its solution, Stokes formula and Vening-Meinesz formula; gravity reduction). Astronomic-geodetic methods (astronomical coordinates versus geodetic coordinates; astronomic leveling; geoid in the GPS and direct leveling). Systems of heights (dynamic heights, Poincare-Prey reduction, orthometric heights, normal heights, comparative analyses of height systems, systems of heights in Poland).

**Goals:** to familiarize students with the physical aspects of geodesy.

**Preceding subjects:** mathematics, physics, geodesy and geodetic astronomy.

**Teaching method:** lectures with visual aids: slides, transparencies; classes, including practice and field training.

**References:**

- Czarnecki K., 1995, *Geodezja współczesna*, Wiedza i Życie, Warszawa.  
*Geodezja Wyższa i Astronomia Geodezyjna*, praca zbiorowa, PWN, Warszawa-Wrocław, 1981.  
*Niwelacja Precyzyjna*, praca zbiorowa, PPWK, Warszawa-Wrocław, 1993.  
*Ćwiczenia z Geodezji Wyższej*, praca zbiorowa, PWN, Warszawa, 1974.  
*Geodezja Wyższa i Astronomia Geodezyjna. Zadania i Przykłady*, praca zbiorowa, PWN, Wrocław, 1988.

**Assessment:** classes - homework assignments, reports on field training, test with a possibility of repeat..

Examination (written and oral) at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Satellite geodesy	<b>Code:</b> 07.6-08-D/2	<b>Semester:</b> 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/30 classes - s. 7 15 lectures/30 classes – s. 8	<b>Number of ECTS credits:</b> 5+3

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** The use of satellite systems in geodesy and navigation. Innovative observation technologies. GPS – the operating principle. Reference systems. Satellite orbits. Determination of satellite coordinates on the basis of satellite ephemerides. Satellite signal structure. Observation data. Practical geodetic surveys - GPS. Field observation procedure. Coordinate transformations. Mathematical models of satellite position determination. Observation post-processing. GPS network adjustment and coordinate transformation to local systems. Methods of real-time positioning: DGPS and RTK. Methods of satellite positioning and their accuracy. The future of GPS.

**Goals:** to discuss the principles of satellite positioning (GPS) for geodetic and navigation purposes.

**Preceding subjects:** geodesy and geodetic astronomy.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes and field training.

**References:**

Misra P., Enge P., 2001, *Global Positioning System – Signals, Measurements and Performance*, Ganga-Jamuna Press, Lincoln, MA, USA.

Leick A., 1996, *GPS Satellite Surveying*, J Wiley & Sons.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.

Czarnecki K., 1995, *Geodezja Współczesna*, Wiedza i Życie, Warszawa.

**Assessment:** classes – homework assignments, reports on field training, test with a possibility of repeat.

Examination (written) at the end of semester 8.

**LEVEL: D**

<b>Subject:</b> Astrodynamic elements of geodesy	<b>Code:</b> 07.6-08-D/3	<b>Semester:</b> 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/15 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Andrzej Drożyner, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** the course consists of five main parts:

Astronomic bases of coordinate systems and time (elementary rotation; systems of coordinates and their transformations by elementary rotations; motions of the celestial, ecliptic and terrestrial poles; precession and nutation; sidereal, solar, dynamic, atomic, proper and coordinate time.

Elements of the potential theory (Newtonian potential; potential of a body; Laplace equation and Poisson equation; ellipsoidal and spherical harmonics; sampling functions and mascons; terrestrial magnetic field).

Two-body problem (mathematical model of motion in satellite geodesy; area, energy and Laplace integrals; determination of the parameters of Keplerian orbits).

Perturbations in the motion of Earth artificial satellites (osculating orbit; Newton-Langrange equation; Lagrange and Poisson brackets; geopotential gradient; the Sun, the Moon, planets; Earth's and oceanic tides; atmosphere; radiation pressure; relativistic effects; variation equations for partial derivatives; models of motion of satellite navigation systems).

Planetary geodesy (coordinate systems and gravitational fields of selected planets).

**Goals:** to familiarize students with the methods applied in astronomy, celestial mechanics, astrodynamics and geophysics that may be useful in geodesy and satellite navigation.

**Preceding subjects:** mathematics, physics, geodesy and geodetic astronomy.

**Teaching method:** lectures; classes.

**References:**

The list of reference books is provided at the beginning of the course.

**Assessment:** classes – test with a possibility of repeat.  
Examination at the end of semester 7.

**LEVEL: D**

<b>Subject:</b> Methods of satellite positioning	<b>Code:</b> 07.6-08-D/4	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/45 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Mieczysław Bakuła, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** Basic methods of satellite positioning. GPS observations by the following methods: static, fast static, rapid static, kinematic, DGPS-real-time, DGPS-post-processing, RTK-real-time, RTK-post-processing. Positioning and navigation of a moving object. Monitoring of vehicle traffic. Creation and updating, by the DGPS method, of digital maps and descriptive databases for the purposes of Geographical Information Systems. Creation and updating, by the RTK method, of large-scale digital maps for the purposes of Land information systems. Determination of coordinates (3D) of control points and other terrain points by the RTK method. Marking out (positioning), by the RTK method, of points with known coordinates. Support in control of machinery and robots.

**Goals:** to discuss methods of satellite positioning (GPS) for geodetic and navigation purposes.

**Preceding subjects:** geodesy, geodetic astronomy, satellite geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes and field training.

**References:**

Misra P., Enge P., 2001, *Global Positioning System – Signals, Measurements and Performance*, Ganga-Jamuna Press, Lincoln, MA, USA.

Leick A., 1996, *GPS Satellite Surveying*, J Wiley & Sons.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.

Czarnecki K., 1995, *Geodezja Współczesna*, Wiedza i Życie, Warszawa.

**Assessment:** classes – homework assignments, reports on field training, test with a possibility of repeat..

Examination (written) at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Satellite navigation	<b>Code:</b> 07.6-08-D/5	<b>Semester:</b> 8, 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes – s. 8 30 lectures/30 classes – s. 9	<b>Number of ECTS credits:</b> 3+5

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** The principles of satellite positioning and navigation. Basic parameters of the navigation system. Object dynamics. Mathematical description of object dynamics. Kalman filtering. Mathematical description of the navigation process. Terrestrial navigation. Sea navigation. Aerial navigation. Integration of satellite navigation techniques with deck systems.

**Goals:** to help students gain knowledge enabling them to use satellite navigation in different branches of science and technology.

**Preceding subjects:** geodesy, geodetic astronomy, satellite geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes and field training.

**References:**

Leick A., 1996, *GPS Satellite Surveying*, J Wiley & Sons.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.

Chatfield A.B., 1997, *Fundamentals of High Accuracy Inertial Navigation*, AIAA, Reston, Virginia, USA.

**Assessment:** classes – homework assignments, reports on field training, test with a possibility of repeat.

Examination (written) at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Theory of satellite measurement elaboration	<b>Code:</b> 11.2-08-D/6	<b>Semester:</b> 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Professor Lubomir W. Baran, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** Probabilistic bases of elaboration of satellite observation results. Methods of estimation of random variable parameters. Characteristics of measuring errors in laser, altimetric and interferometric satellite surveys. Observation errors in the GPS and methods of their elimination by the creation of observables. Estimation of vector coordinates determined with the GPS. Adjustment of satellite geodetic networks by the least square method. Adjustment of satellite geodetic networks by sequential methods. Advanced algorithms of elaboration of GPS observation results (Bernese, GYPSY, GAMIT). Elaboration of satellite measurement results by non-standard methods.

**Goals:** to familiarize students with methods of elaboration of satellite measurements applied in geodesy and geodynamics.

**Preceding subjects:** mathematics, physics, computer science, surveying data adjustment and analysis, geodesy, geodetic astronomy, satellite geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies; classes.

**References:**

Baran L.W., 1999, *Teoretyczne podstawy opracowania wyników pomiarów geodezyjnych*, PWN, Warszawa.

Teunissen P.J.G., A. Kleusberg, 1998, *GPS for Geodesy*, Springer-Verlag.

Leick A., 1996, *GPS Satellite Surveying*, J Wiley & Sons.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.

Czarnecki K., 1995, *Geodezja Współczesna*, Wiedza i Życie, Warszawa.

**Assessment:** classes – homework assignments, test with a possibility of repeat. Examination (written and oral) at the end of semester 8.

**LEVEL: D**

<b>Subject:</b> Data teletransmission systems	<b>Code:</b> 06.2-08-D/7	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 3

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** Signal generating. Signal propagation in material media. Signal processing. Signal reception. Signal modulation. Signal coding, Gold codes, PRN codes. Methods of signal catching in the noise. Digital signal transmission. GSM, UTSM and other techniques.

**Goals:** to help students gain practical knowledge of data transmission.

**Preceding subjects:** mathematics, physics, computer science.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes and field training.

**References:**

Wesołowski K., 1999, *Systemy radiokomunikacji ruchowej*, Wyd. Komunikacji i Łączności, Warszawa.

Czajkowski J., 1995, *Cyfrowe systemy transmisji w radiokomunikacji morskiej*, PWP „Skryba”, Gdańsk.

Hołubowicz W., P. Płóciennik, A. Różański, 1997, *Systemy łączności bezprzewodowej*, Poznań.

Hołubowicz W., P. Płóciennik, 1995, *GSM cyfrowy system telefonii komórkowej*, Wyd. EFP, Poznań.

**Assessment:** classes - – homework assignments, test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Hydrographic surveys	<b>Code:</b> 07.6-08-D/8	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 3</b>

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** Theories of bathymetric surveying of streams, lakes and inland water bodies. Sonic depth finders – the operating principle. Integration of the GPS with the depth measurement system. Measuring profile projects. Vessel navigation. Data evaluation and drawing a bathymetric map.

**Goals:** to help students gain practical knowledge of hydrographic surveys.

**Preceding subjects:** geodesy.

**Teaching method:** practical classes and field training. Data handling.

**References:**

*Hydrography for the surveyor and engineer*, Lieutenant-Commander A. E. Ingham  
Simrad EA 501P Instruction Manual, *Kongsberg Simrad*

**Assessment:** classes – reports on field training, test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Advanced programming techniques	<b>Code:</b> 11.3-08-D/9	<b>Semester:</b> 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/45 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** Programming in Pascal, Delphi, C. Algorithms of processing of vector graphic data. Relational databases. Query language for relational databases SQL. Programming in Microstation 95 (interpreter MDL).

**Goals:** to familiarize students with programming for geodetic purposes.

**Preceding subjects:** the basics of computer science.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes at a computerized laboratory.

**References:**

Available professional literature on programming.

**Assessment:** classes – reports.

Examination at the end of semester 7.

**LEVEL: D**

<b>Subject:</b> Field training in satellite geodesy	<b>Code:</b> 07.6-08-D/12	<b>Semester:</b> 10
<b>Form:</b> Field training	<b>Number of hours/semester</b> 60 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Mieczysław Bakuła, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory in the line of specialization: geodesy and satellite navigation.

**Description:** GPS observations by the following methods: static, rapid static, kinematic, DGPS-real-time, DGPS-post-processing, RTK-real-time, RTK-post-processing. GPS observation post-processing. Creation and updating, by the RTK method, of large-scale digital maps for the purposes of Land information systems. Determination of coordinates (3D) of control points by the RTK method. Marking out (positioning), by the RTK method, of points with known coordinates.

**Goals:** to brush up students' knowledge in the field of satellite geodesy.

**Preceding subjects:** satellite geodesy, methods of satellite positioning, data teletransmission systems.

**Teaching method:** practical classes and field training. Data handling.

**References:**

Leick A., 1996, *GPS Satellite Surveying*, J Wiley & Sons.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.

**Assessment:** reports on field training.

**LEVEL: D**

<b>Subject:</b> Engineering geodesy	<b>Code:</b> 07.6-08-D/13	<b>Semester:</b> 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 3+3

**Coordinator(s):** Waldemar Kamiński, PhD.  
Alojzy Wasilewski, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Modern methods of network establishing and data evaluation. The basics of accuracy analysis in geodetic surveys, taking into consideration environmental conditions. Measurement of displacement and deformation in engineering structures and their surroundings. Methods of determining the shape of engineering structures (cooling towers, coatings). Geodetic surveys in hydro-engineering, highway engineering (multi-level and one-level crossings, highway construction, bridge and tunnel building). Geodetic surveys in hydro- and harbor engineering. Railway track monitoring. Assessment of building technical condition for purposes of valuation and appraisal.

Geodetic accuracy analysis of construction projects and designs for buildings. On-site measurement of displacement and deformation in engineering structures and their surroundings. Data evaluation. Geometric interpretation of measurement results.

**Goals:** to familiarize students with innovative techniques of engineering surveys.

**Preceding subjects:** the basics of engineering geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies; computer-aided presentations.

**References:**

Przewłocki S., 2000, *Geodezja inżynieryjno- drogowa*, Wydawnictwo Naukowe PWN, Warszawa.

Bryś H., S. Przewłocki, 1998, *Geodezyjne metody pomiarów przemieszczeń budowli*, Wydawnictwo Naukowe PWN, Warszawa.

Kwiatek J. i in., 1998, *Ochrona obiektów budowlanych na terenach górniczych*, Wydawnictwo Głównego Instytutu Górnictwa, Katowice.

Praca zbiorowa, 1993, *Niwelacja precyzyjna, Niwelacja geometryczna, trygonometryczna, satelitarna i hydroniwelacja*, PPWK, Warszawa- Wrocław.

Czaja J., 1993, *Wybrane zagadnienia z geodezji inżynieryjnej*, Wydawnictwo AGH, Kraków.

**Assessment:** classes – test with a possibility of repeat.  
Examination at the end of semester 8.

**LEVEL: D**

<b>Subject:</b> Computing methods in geodesy	<b>Code:</b> 11.2-08-D/14	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 4</b>

**Coordinator(s):** Professor Zbigniew Wiśniewski, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** General matrix algebra, including first of all general inverses and their application to solving systems of equations. Basic problems of mathematical optimization (optimality conditions and elements of non-linear programming). Adjustment methods, including free adjustment (taking into account general matrix algebra), adjustment with the use of measuring error models (systematic and deterministic errors), gross error-free adjustment. Procedures of estimation and filtration with the use of dynamic models of geodetic observations, including elements of deformation analysis.

**Goals:** to familiarize students with new methods of data evaluation and analysis (concerning first of all results of measurement). The understanding of these methods and the ability to put them to practice helps students describe the problems of modern geodesy, interpret the results properly and solve significant scientific problems. This course prepares them for further development during doctoral studies.

**Preceding subjects:** mathematics, geodesy, surveying data adjustment and analysis.

**Teaching method:** classical and computer-aided.

**References:**

The list of reference books is provided at the beginning of the course.

**Assessment:** classes: computational work; test with a possibility of repeat.  
Examination at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Elements of satellite navigation (GPS RTK)	<b>Code:</b> 07.6-08-D/15	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Zofia Rzepecka, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Lectures concern the following problems: theoretical bases of real-time positioning, including DGPS and RTK, a review of correction transmission methods, a review of enumerative algorithms for precise satellite navigation, the application of precise satellite navigation to engineering geodesy.

Classes concern the following problems: radio aids in correction transmission, practical application of computer programs assisting RTK, practical real-time positioning (RTK), "post-processing" data evaluation, practical application of precise satellite navigation to engineering geodesy (vehicle monitoring).

**Goals:** to familiarize students with innovative satellite techniques applied to engineering surveys.

**Teaching method:** lectures with visual aids: slides, transparencies; computer-aided presentations; field/on-site measurement, computations, accuracy estimation, compute-aided work.

**References:**

Czarnecki K., 1994, *Geodezja współczesna w zarysie*, Wydawnictwo Wiedza i Życie, Warszawa.

Lamparski J., 1997, *System Navstar GPS*, Wydawnictwo Naukowe WSO im. gen. J. Bema, Toruń.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins., 1992, *Global Positioning System, theory and practice*, Springer-Verlay, Wien, New York.

Wasilewski A., Z. Rzepecka, 1999, *Opracowanie metodyki wykorzystania zestawu GPS RTK do pomiarów położenia linii podstawowej morza Bałtyckiego*, Olsztyn (praca nie opublikowana).

**Assessment:** classes: tests with a possibility of repeat.  
Examination at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Structural mechanics	<b>Code:</b> 06.6-08-D/16	<b>Semester:</b> 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3

**Coordinator(s):** Alojzy Wasilewski, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** The following engineering problems are discussed during the course:

- ground as a site of building foundation (types of foundation, including spread foundation and pile foundation),
- ground as building material (earth dams, road surface, ground condition improvement),
- earth pressure as the main pressure on steening in the case of foundation trenches and underground structures (retaining walls),
- geotechnologic ground problems (vibrations, earthquakes, frost penetration, local settlement),
- strength, rigidity and stability of building structures; analysis of building structure work.

**Goals:** to familiarize students with the basics of soil mechanics and structural mechanics for surveyors.

**Preceding subjects:** building engineering.

**Teaching method:** lectures with visual aids: slides, transparencies, computer-aided presentations.

**References:**

Chmielewski T., 1996, *Mechanika budowli: metoda przemieszczeń, metoda Crossa, metoda elementów skończonych*, Wydawnictwa Naukowo-Techniczne, Warszawa.

Dyląg Z., 1993, *Mechanika budowli*, Politechnika Białostocka, Białystok.

Kempiński J., 1992, *Mechanika budowli*, Wydawnictwo Akademii Rolniczej, Wrocław.

Flaga A., 1998, *Mechanika budowli, Ujęcie systemowe: charakterystyki wielkości geometrycznych, mechanicznych i fizycznych pomocne w obliczeniach statycznych, wytrzymałościowych i termicznych budowli*, Wydawnictwo Politechniki Lubelskiej, Lublin.

**Assessment:** classes – test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Digital maps for engineering purposes	<b>Code:</b> 07.6-08-D/17	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Krzysztof Bojarowski, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Digital map compilation for the purposes of planning, design and geodetic service. Localization of particular objects of a project on a digital map. Geodetic surveys for the purposes of project drawing. Computer-aided drawing up of documents necessary for project laying out on the ground (CAD). Map revision by adding the results of inventory field surveying. The use of digital maps for engineering structure monitoring.

**Goals:** to familiarize students with the theory and practice of using digital maps for the purposes of planning, design and geodetic service.

**Preceding subjects:** engineering geodesy, spatial information systems.

**Teaching method:** lectures with visual aids: slides, transparencies; classes – drawing up projects concerning selected investment stages (computer techniques, CAD).

**References:**

Gałda M., E. Kujawski, S. Przewłocki, 1994, *Geodezja i miernictwo budowlane*, PPWK, Warszawa.

Gaździcki J., 1980, *Systemy informacji przestrzennej*, PPWK, Warszawa-Wrocław.

Janusz W., 1975, *Obsługa geodezyjna budowli i konstrukcji*, PPWK, Warszawa.

**Assessment:** test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: D**

<b>Subject:</b> New measuring techniques and methods	<b>Code:</b> 07.6-08-D/18	<b>Semester:</b> 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 3+3

**Coordinator(s):** Alojzy Wasilewski, Associate Professor, PhD.  
Zofia Rzepecka, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** The following problems are discussed during the course: techniques, instruments and methods of measurement of deformation and displacement of engineering structures; computer-aided measuring systems; a review of satellite positioning methods, measuring techniques - GPS, data evaluation, the application of satellite technologies to engineering geodesy.

**Goals:** to familiarize students with modern technologies in engineering surveys and measurement.

**Preceding subjects:** the basics of engineering geodesy, the basics of satellite geodesy.

**Teaching method:** lectures; classes - field/on-site measurement, computations, accuracy estimation, practical application of the GPS for measuring the displacement of engineering structures and their surroundings.

**References:**

Czarnecki K., 1994, *Geodezja współczesna w zarysie*, Wydawnictwo Wiedza i Życie, Warszawa.

Lamparski J., 1997, *System Navstar GPS*, Wydawnictwo Naukowe WSO im. gen. J. Bema, Toruń.

Hofmann-Wellenhof B., H. Lichtenegger and J. Collins., 1992, *Global Positioning System, theory and practice*, Springer-Verlay, Wien, New York.

Wasilewski A., Z. Rzepecka, 1999, *Opracowanie metodyki wykorzystania zestawu GPS RTK do pomiarów położenia linii podstawowej morza Bałtyckiego*. Olsztyn (praca nie opublikowana)

**Assessment:** classes – tests with a possibility of repeat.  
Examination at the end of semester 8.

**LEVEL: D**

<b>Subject:</b> Engineering photogrammetry	<b>Code:</b> 07.6-08-D/19	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Piotr Sawicki, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Close-range photogrammetric systems – optical, digital, thermovision. Close-range photography. Methods of calibration of optical and optical-electronic systems. Analytic-numerical methods. Theory of errors. Calculations concerning terrestrial photograph nets – terrestrial triangulation. CAD/GIS applications based on terrestrial and aerial photographs. Photogrammetry in engineering work and projects. Methods of measurement of deformation and displacement in 2D and 3D space. Architectural photogrammetry. The use of terrestrial and aerial photogrammetry for engineering, metrological and special purposes.

**Goals:** to discuss the methods of collecting geometric and semantic information on objects by means of registration, interpretation and point coordinate determination in photographs and digital images; to discuss photogrammetric methods of numerical/digital solutions in engineering applications.

**Preceding subjects:** surveying data adjustment and analysis, computer science, geodesy, photogrammetry and remote sensing, engineering geodesy.

**Teaching method:** lectures with audiovisual aids: slides, transparencies and video tapes.; classes – study of computer-aided measuring methods applied in engineering photogrammetry.

**References:**

Sitek Z., 1991, *Fotogrametria ogólna i inżynierska*, PPWK, Warszawa – Wrocław.  
Kraus K., 1997, *Photogrammetry*, Bonn, Ferd. Duemmlers, cop.  
Regensburger K., *Photogrammetrie - Anwendungen in Wissenschaft und Technik*.  
*Archiwum Międzynarodowego Towarzystwa Fotogrametrii i Teledetekcji – Komisja V*

**Assessment:** classes – tests with a possibility of repeat, reports.  
Examination at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Photogrammetric methods and technologies	<b>Code:</b> 07.6-08-D/20	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Aleksander Żarnowski, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Digital photograph processing and topographic feature modeling. Accuracy of photogrammetric surveys. Organization of photogrammetric data keeping in databases. Digital map compilation and revision by photogrammetric methods. Digital aerotriangulation on photogrammetric workstations. Automatic and manual DTM generating by photogrammetric methods. Digital orthophotomap compilation. Interpretation of aerial photographs. The use of digital photogrammetric methods and technologies for the purposes of modernization of land registers and keeping building registers.

**Goals:** to familiarize students with photogrammetric methods and technologies applied during the compilation of topographic, thematic and digital orthophotomaps, and digital terrain models.

**Preceding subjects:** mathematics, descriptive geometry, the basics of computer science, surveying data adjustment and analysis, geodesy, photogrammetry and remote sensing, cartography, land information systems.

**Teaching method:** lectures with visual aids: slides, transparencies and presentations; classes – a practical study of photogrammetric measuring methods, using digital stations and photogrammetric instruments.

**References:**

- Sitek Z., 1991, *Fotogrametria ogólna i inżynieryjna*, PPWK, Warszawa-Wrocław.  
Kurczyński Z., R. Preuss, 2000, *Podstawy fotogrametrii*, Wyd. PW, Warszawa.  
Sitek Z., 1994, *Zarys teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.  
Kraus K., 1997, *Photogrammetry*, Ferd. Duemmlers, Bonn.

**Assessment:** reports;  
Examination (written or oral) at the end of semester 9.

**LEVEL: D**

<b>Subject:</b> Digital processing of remote sensing data	<b>Code:</b> 07.6-08-D/21	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Marek Mróz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Energetic photometry. Radiation of real bodies – emissivity and albedo. Spectral characteristics of selected objects (soil, plants, water) in the visible, near and middle infrared bands. The formation of a digital, multispectral satellite image. Digital processing of satellite images. Image visualization. Image statistics, histograms, improvement of the image visual quality – global and local transformations (contrast modifications, high- and low-pass filtering). Methods of histogram matching. Geometric correction of digital satellite images. Multispectral image processing. Microwave active remote sensing. Radar images. Multi-source data processing.

**Goals:** to familiarize students with methods of digital data processing in remote sensing, used for drawing satellite image maps and thematic maps of land cover/land use.

**Preceding subjects:** mathematics, physics, surveying data adjustment and analysis, photogrammetry and remote sensing.

**Teaching method:** lectures with audiovisual aids and multimedia technologies; classes – practical application of selected methods of image processing.

**References:**

Ciołkosz A., A. Kęsik, 1989, *Teledetekcja satelitarna*, PWN, Warszawa.

Sitek Z., 1997, *Zarys teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.

Sitek Z., 1994., *Wprowadzenie do teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.

**Assessment:** classes – tests with a possibility of repeat, drawing up and defense of projects.

**LEVEL: D**

<b>Subject:</b> Thematic cartography	<b>Code:</b> 07.6-08-D/22	<b>Semester:</b> 9
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Idzi Gajderowicz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** Elements of cartographic science. Map features and classification. Thematic map compilation. Cartographical communication. Elements of semiotics. Thematic cartography methodology. The principles of choosing a method of cartographic presentation depending on the kind of data. Maps as research tools. Cartographic visualization. Theoretical problems in modern cartography. Computer techniques in thematic map compilation. The Internet as a medium for cartographic presentations. Thematic map review.

**Goals:** to discuss both theoretical and practical aspects of presenting different kinds of information in the form of cartographic communication; to show them the importance of methodological correctness and esthetics of cartographic presentation.

**Preceding subjects:** cartography, land information systems.

**Teaching method:** lectures with audiovisual aids and map presentation; classes based on thematic map analysis and individual computer-aided project drawing.

**References:**

Menno-Jan Kraak, Ferjan Ormeling, 1998, *Kartografia; wizualizacja danych przestrzennych*, Wyd. Naukowe PWN, Warszawa.

Ratajski L., 1989, *Metodyka kartografii społeczno-gospodarczej*, PPWK im. E. Romera, Warszawa - Wrocław, wyd. II.

Robinson A., R. Sale, J. Morrison, 1998, *Podstawy kartografii*, PWN, Warszawa.

Aleksiejewicz Saliszczew K., 1998, *Kartografia ogólna*, Wyd. Naukowe PWN, Warszawa, wyd. II.

**Assessment:** classes – two tests with a possibility of repeat; presentation of projects drawn up during classes.

**LEVEL: D**

<b>Subject:</b> Internet technologies in Spatial Information Systems	<b>Code:</b> 11.9-08-D/23	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Zygmunt Paszotta, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** The Internet and Intranet (LAN/WAN): technologies, concepts, structures, security, handling. Data transfer in local area networks (LAN) and wide area networks (WAN). The basics of the following languages: HTML, JAVA, JAVA SCRIPT, PHP, CGI, ASP. Databases: MySQL, PARADOX, dBASE – the basics of technology and application. Client-server technologies, e-commerce. Object programming (DELPHI/KYLIX). Internet-based solutions proposed by the companies INTERGRAPH and Bentley Family. Geoinformation technologies in Internet applications.

**Goals:** to familiarize students with the possibilities of using computer networks in spatial information systems.

**Preceding subjects:** mathematics, computer science, spatial information systems

**Teaching method:** lectures with computer-aided presentations; classes – work with computer stations and servers, using computer networks, programming based on Borland and INTERGRAPH software.

**References:**

Patrick Naughton, *JAVA podręcznik programowania*; Paul Dubobis, *MySQL*; Rafe Colburn, *CGI*, Gliwice: Helion, cop. 1998; Bob Rankin, *Linux - same konkrety*, Warszawa, ZNI „Mikom”, 1997; Tim Evans *HTML w 10 minut*; Andrzej Sopala, *Pisanie programów internetowych, środowisko UNIX, środowisko Windows, język Java*, Wydawnictwo MIKOM, 2000; *Podręcznik teleinformatyka, praca zbiorowa*  
Jan Bielecki, *JAVA 3, programowanie współbieżne, obiektowe i zdarzeniowe w Windows 95/98/NT*; Jan Bielecki, *Java od podstaw*; Suleiman, Lalani, *Java biblioteka programisty*; Paul J.Perry, *Java, tworzenie apletów*; *SQL dla każdego* Jan L. Harirington; Paul Beyon-Davies, *Systemy baz danych*; Piotr Wróblewski, *Algorytmy struktury danych i techniki programowania*, Gliwice: Helion, cop. 1997.

**Assessment:** classes – test with a possibility of repeat, reports on projects.

**LEVEL: D**

<b>Subject:</b> Rural area management and surveying	<b>Code:</b> 07.6-08-D/24	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Stanisław Surowiec, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory in the line of specialization: applied geodesy.

**Description:** The essence and scope of rural area management and surveying. General and detailed plans of land parcel location and distribution. Conventional and computerized methods of boundary setting, area determination, project drawing and realization. The influence of farm spatial structure on the rational use of land and land management effectiveness.

**Goals:** to discuss the importance of farm spatial structure and plans of its reorganization for rational land management and optimum use of land.

**Preceding subjects:** geodesy, real estate cadastre.

**Teaching method:** lectures with visual aids: slides, transparencies; computer-aided presentations; classes in small groups, computer-aided land parcel distribution and project drawing.

**References:**

- Hopfer A., M. Urban, 1984, *Geodezyjne urządzenie terenów rolnych*, PWN, Warszawa.  
Tkocz J. 1998, *Organizacja przestrzenna wsi w Polsce*, Wyd. UŚ, Katowice.  
Cymerman R., A. Hopfer, A. Nowak, 1982, *Ocena i waloryzacja gruntów wiejskich*, PWRiL, Warszawa.  
Szeliga K., 1986, *Podstawy projektowania w geodezji rolnej*, Wyd. PW, Warszawa.  
Banat J., W. Przegon, A. Sanek, J. Schilbach, 1989, *Metody geodezyjnego projektowania działek w urządzeniu obszarów wiejskich, Przewodnik do ćwiczeń*, Skrypt AR, Kraków.

**Assessment:** classes – test with a possibility of repeat, reports on projects.

***LEVEL E***

**LEVEL: E**

<b>Subject:</b> Field training in surveying after semester 2	<b>Code:</b> 07.6-08-E/1	<b>Semester:</b> After semester 2
<b>Form:</b> Field training	<b>Number of hours/semester</b> 60 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Adam Łyszkowicz.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** Creation of urban maps on the scale of 1: 500. Establishing primary and secondary control. Detail surveys by the orthogonal and polar method. Elevation measurements. Simple computations, plotting survey maps. Drawing up technical reports. Profile and cross section leveling. Locations of stakes along the line. Profile and cross section plotting.

**Goals:** to help student acquire skill at surveying, doing the necessary calculations and creating urban maps using graphic programs; classes are conducted at the Digital Map Compilation Laboratory.

**Preceding subjects:** plotting.

**Teaching method:** practical land surveying, the use of graphics software and spreadsheets for map preparation at the Digital Map Compilation Laboratory.

**Assessment:** drawing up technical reports. Oral examination.

**LEVEL: E**

<b>Subject:</b> Field training in surveying after semester 4	<b>Code:</b> 07.6-08-E/2	<b>Semester:</b> After semester 4
<b>Form:</b> Field training	<b>Number of hours/semester</b> 60 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Władysław Dąbrowski, Associate Professor, PhD.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** creation of relational-object databases of 2D and 3D digital maps on the basis of field surveying with total stations (establishment of horizontal and vertical control networks, surveys/measurement, transmissions, coding, calculations, data input into the system, map compilation, input of additional descriptive data into object records, database updating, generating 2D maps with different scales and contents, map and database specifications, contour modeling, cross sections, 3D map printing on the scale of 1:500).

Database updating of 2D digital maps (2D digital map plotting on the scale of 1:500, field surveying, creation and input of batch files, map object updating, map history, printing of a revised map on the scale of 1:500).

Transfer of coordinates of an inaccessible point determined by the GPS to a system of re-established points of the A-B type.

Determination of the height of an inaccessible point by short- and long-distance trigonometric leveling.

Drawing up technical reports on topics 1-4.

**Goals:** to help students acquire skill at field surveying and doing geodetic calculations necessary for creating relational-object databases of large-scale digital maps; classes are conducted at the Digital Map Compilation Laboratory.

**Preceding subjects:** plotting, surveying, electronic measuring techniques.

**Teaching method:** practical land surveying, the use of graphics software and spreadsheets for the creation of relational-object databases of large-scale digital maps at the Digital Map Compilation Laboratory.

**Assessment:** drawing up technical reports. Oral examination.

**LEVEL: E**

<b>Subject:</b> Field training in engineering geodesy	<b>Code:</b> 07.6-08-E/3	<b>Semester:</b> After semester 6
<b>Form:</b> Field training	<b>Number of hours/semester</b> 60 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Alojzy Wasilewski, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** geodetic network establishment by conventional methods (theodolite, leveling instrument, electronic distance meter) and by the GPS . Data evaluation, as-built documentation. Terrain geodetic surveys, inventory field surveying by the GPS RTK.

**Goals:** to familiarize students with innovative techniques applied to engineering surveys.

**Preceding subjects:** engineering geodesy.

**Teaching method:** practical land surveying.

**Assessment:** drawing up geodetic as-built documentation.

**LEVEL: E**

<b>Subject:</b> Field training in photogrammetry	<b>Code:</b> 07.6-08-E/4	<b>Semester:</b> After semester 6
<b>Form:</b> Field training	<b>Number of hours/semester</b> 60 classes	<b>Number of ECTS credits: 4</b>

**Coordinator(s):** Piotr Sawicki, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Spatial triangulation of aerial photographs. Digital map compilation by stereo digitization. Stereophotogrammetry in architectural inventory. Measurement of deformation of engineering structures by single-image analytical photogrammetry.

**Goals:** carrying out practical tasks with given technical specifications by the photogrammetric method.

**Preceding subjects:** mathematics, physics, surveying data adjustment and analysis, geodesy, computer science.

**Teaching method:** a practical study of computer-aided measuring and photogrammetric methods.

**References:**

- Sitek Z., 1992, *Fotogrametria ogólna i inżynierska*, PPWK, Warszawa – Wrocław.  
Kurczyński Z., R. Preuss, 2000, *Podstawy fotogrametrii*, Wyd. PW, Warszawa.  
Sitek Z., 1994, *Wprowadzenie do teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.  
Sitek Z., 1997, *Zarys teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.

**Assessment:** drawing up and defense of projects.

**LEVEL: E**

<b>Subject:</b> Field classes in geodesy	<b>Code:</b> 07.6-08-E/5	<b>Semester:</b> After semester 8
<b>Form:</b> Classes	<b>Number of hours/semester</b> 30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Krzysztof Świątek, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** high-precision leveling: determination of height differences by direct leveling, data evaluation and point height determination.  
Gravity measurement of high-precision leveling spans with gravimeters and data evaluation.  
Technical reports on the above topics.

**Goals:** to help students acquire skill at high-precision leveling and familiarize them with gravity measurement techniques.

**Preceding subjects:** geodesy, physics, mathematics.

**Teaching method:** practical land surveying.

**Assessment:** drawing up technical reports. Oral examination.

## 6.5. List of subjects taught during 4-year professional engineering studies

Field of studies: **GEODESY AND CARTOGRAPHY**

Majors: *geodesy and real estate valuation*

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
<b>1<sup>st</sup> year / 1<sup>st</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	FT
Economics	14.3-00-A/2	15	15	30	3.5	FT
Physical education	16.1-00-A/4	-	30	30	0	FT
Mathematics	11.1-08-B/1	30	30	60	7	E
Physics	13.2-08-B/2	15	30	45	5	FT
Computer science	11.3-08-B/6	15	30	45	5	FT
Geodesy	07.6-08-C/1	15	30	45	5	FT
Plotting	07.6-08-D/1	-	30	30	2	FT
<b>1<sup>st</sup> year / 2<sup>nd</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	FT
Physical education	16.1-00-A/4	-	30	30	0	FT
Mathematics	11.1-08-B/1	30	15	45	6	FT
Physics	13.2-08-B/2	15	30	45	5	E
Computer science	11.3-08-B/6	15	30	45	5	E
Geodesy	07.6-08-C/1	15	30	45	5	E
Electronic measuring techniques	07.6-08-C/9	15	30	45	5	FT
Plotting	07.6-08-D/1	-	30	30	2	FT
Field training in surveying	07.6-08-C/18	-	60	60	4.5	FT
<b>2<sup>nd</sup> year / 3<sup>rd</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	FT
Law	10.0-08-A/4	15	15	30	3	FT
Physical education	16.1-00-A/4	-	30	30	0	FT
Mathematics	11.1-08-B/1	30	15	45	5	E
Descriptive geometry and computer graphics	11.9-08-B/5	15	30	45	4	FT
Geodesy	07.6-08-C/1	15	30	45	4	FT
Computing methods in geodesy	11.2-08-C/16	15	30	45	4	FT
Basics of Earth science	13.9-08-C/12	15	30	45	4	FT
<b>2<sup>nd</sup> year / 4<sup>th</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	FT
Law	10.0-08-A/4	15	15	30	3	E
Geodesy	07.6-08-C/1	15	30	45	4	E
Computing methods in geodesy	11.2-08-C/16	15	30	45	4	E
Cartography	07.6-08-C/8	30	30	60	5	FT

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
Basics of town-and-country planning	02.0-08-C/10	30	30	60	5	E
Land information systems	07.9-08-C/11	15	30	45	4	FT
Theory and principles of real estate valuation	07.6-08-D/7	15	30	45	4	FT
Basics of agriculture and land management	01.0-08-D/10	15	15	30	3	FT
Field training in surveying	07.6-08-C/19	-	60	60	4.5	FT
<b>3<sup>rd</sup> year / 5<sup>th</sup> semester</b>						
Engineering geodesy	07.6-08-C/3	15	30	45	4	FT
Geodesy and geodetic astronomy	07.6-08-C/2	15	30	45	4	FT
Building engineering and costing	06.4-08-C/15	15	30	45	4	FT
Photogrammetry and remote sensing	07.6-08-C/7	15	30	45	4	FT
Land information systems	07.9-08-C/11	15	30	45	4	E
Real estate administration	07.6-08-C/17	30	30	60	5	E
Banking and finance	04.3-08-D/12	15	15	30	1	FT
<b>3<sup>rd</sup> year / 6<sup>th</sup> semester</b>						
Engineering geodesy	07.6-08-C/3	15	30	45	4	E
Geodesy and geodetic astronomy	07.6-08-C/2	15	30	45	4	E
Photogrammetry and remote sensing	07.6-08-C/7	15	45	60	5	E
Real estate cadastre	07.6-08-D/2	15	30	45	4	E
Digital maps	07.6-08-D/6	15	45	60	5	FT
Technique and technology of real estate valuation	07.6-08-D/8	15	30	45	4	FT
Field training in engineering geodesy	07.6-08-C/20	-	60	60	4	FT
Field training in photogrammetry	07.6-08-C/22	-	30	30	2	FT
Field training in cadastral surveys	07.6-08-D/15	-	30	30	2	FT
<b>4<sup>th</sup> year / 7<sup>th</sup> semester</b>						
Satellite geodesy	07.6-08-C/5	15	30	45	5	E
Rural area management	07.6-08-D/3	15	30	45	5	FT
Processing of remote sensing data	07.6-08-D/5	15	30	45	5	FT

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
Technique and technology of real estate valuation	07.6-08-D/8	15	30	45	5	E
Basics of forestry and forest management	01.6-08-D/11	15	15	30	3,5	FT
<b>4<sup>th</sup> year / 8<sup>th</sup> semester</b>						
Humanities	08.-00-A/3	15	15	30	3,5	FT
Environmental protection	07.2-08-C/13	15	15	30	4	FT
Rural area management	07.6-08-D/3	15	30	45	5	E
Technique and technology of real estate valuation	07.6-08-D/8	15	30	45	5	FT
Real estate management	04.9-08-D/9	15	15	30	4	FT
Basics of econometrics	14.3-08-D/13	15	30	45	5	FT
Seminar	07.6-08-E/1	-	60	60	5	FT
Field training in geodesy	07.6-08-C/21	-	30	30	2.5	FT
Field training in real estate valuation	07.6-08-D/15	-	30	30	2	FT

*FT – the basis for assessment (getting credit) is a final test*

*E – the basis for assessment (getting credit) is an exam*

***LEVEL A***

**LEVEL: A**

<b>Subject:</b> Foreign language	<b>Code:</b> 09.1-00-A/1	<b>Semester:</b> 1, 2, 3,4
<b>Form:</b> Classes	<b>Number of hours/semester</b> 30 classes	<b>Number of ECTS credits: 0</b>

**Coordinator(s):** lecturer in a given language.

**Organizational unit:** Foreign Language Study Center.

**Status in the curriculum:** compulsory.

**Description:** Learning of a chosen foreign language by gaining knowledge of its phonetic systems, grammatical structures and vocabulary at an elementary level, and improving language skills at an advanced level.

**Language of instruction:** chosen from among those taught at the University (English, Belarus, French, Spanish, German, Russian, Ukrainian).

**Goals:** to prepare students for both passive and active use of the language at an advanced level.

**References:** *depending on the level of advance.*

**Assessment:** final test.

**Registration required:** yes.

**LEVEL: A**

<b>Subject:</b> Economics	<b>Code:</b> 14.3-00-A/2	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 3.5

**Coordinator(s):** Stefan Strumiłło, PhD.

**Organizational unit:** Department of Economics.

**Status in the curriculum:** compulsory.

**Description:** Management as a decision-making process. Market microanalysis. Customer behavior. Producer behavior. Introduction to macroeconomics and national income account. National budget and fiscal policy. Money and modern banking system. Exchange markets. Inflation. Labor market. Economic development and short-term cyclical fluctuations. Market imperfections and selected economic functions of the State in a free-market economy. International trade.

**Goals:** to discuss the bases of a free-market economy.

**Teaching method:** lectures, auditory classes.

**References:**

Begg D., 2001, *Ekonomia*, PWE, Warszawa.

Dębniewski G., R. Hryciuk, *Makroekonomia*.

Dębniewski G., H. Pałach, W. Zakrzewski, *Mikroekonomia*.

Nojszewska E., *Podstawy ekonomii*.

*Elementarne zagadnienia ekonomii*, praca zbiorowa pod red. R. Milewskiego, PWN, Warszawa 1997.

Rekowski M., *Wprowadzenie do mikroekonomii*.

**Assessment:** test with a possibility of repeat.

**LEVEL: A**

<b>Subject:</b> Basic of philosophy	<b>Code:</b> 08.9-00-A/3	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3.5

**Coordinator(s):** employees of the Institute of Philosophy.

**Organizational unit:** Institute of Philosophy.

**Status in the curriculum:** optional.

**Description:** Acquiring knowledge of the main branches of philosophy, such as: ontology, gnoseology, ethics, philosophic anthropology and axiology. Discussing the specific and complementary character of these branches of philosophy. Students get to know the fundamental problems of philosophy and learn how to solve them.

**Goals:** to present the specific character of philosophical thinking and a synthesizing role of this form of knowledge in the study of reality.

**Teaching method:** lectures, panel discussion in groups, analysis of source materials.

**Teaching aids:** printed series of course lectures, textbooks, source materials.

**References:**

- Ajdukiewicz K., 1983, *Zagadnienia i kierunki filozofii. Teoria poznania. Metafizyka*, Warszawa.
- Anzenbacher A., 1987, *Wprowadzenie do filozofii*, Kraków.
- Bocheński J.M., 1986, *Ku filozoficznemu myśleniu. Wprowadzenie do podstawowych pojęć filozoficznych*, Warszawa.
- Dębowski J., Gawor L., Jedynek S., Kosior S., Zdybel J., Zdybel L., 1996, *Mała encyklopedia filozofii. Pojęcia – problemy – kierunki- szkoły*, Bydgoszcz.
- Jadacki J., 1996, *Jak studiować filozofię?*, Warszawa.
- Krapiec M.A., Kamiński S., Zdybicka Z., Jaroszyński P., 1992, *Wprowadzenie do filozofii*, Lublin.
- Podstawy filozofii*, red. S. Opara, Olsztyn 2001.
- Stępień A., 1995, *Wstęp do filozofii*, Lublin.

**Assessment:** test with a possibility of repeat.

**Registration required:** yes.

**LEVEL: A**

<b>Subject:</b> Ecological aspects of philosophy	<b>Code:</b> 08.9-00-A/3	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3.5

**Coordinator(s):** Zbigniew Hull, Associate professor, PhD.

**Organizational unit:** Institute of Philosophy.

**Status in the curriculum:** optional.

**Description:** Ecology, environmental protection and philosophy. Anthropopressure and its effects on the biosphere and man (society). Ecological crisis and suggestions how to overcome it. Assumptions and theory of sustainable development. Classical philosophical problems versus ecological aspects of philosophy. Ecological values, ecological ethics and main directions of its development. Anthropocentrism versus biocentrism, concepts and problems of bioethics.

**Goals:** to familiarize students with the basic concepts and problems connected with the ecological aspects of philosophy.

**Teaching method:** discussions, audiovisual aids: slides, transparencies and video tapes.

**Teaching aids:** printed series of course lectures, textbooks, source materials.

**References:**

- Brzostek M., Chojnacki J., Kaleta T., 1998, *Ekofilozofia. Wybór tekstów*, Wyd. SGGW, Warszawa.
- Jonas H., 1996, *Zasada odpowiedzialności*, Kraków.
- Lemańska A., 1998, *Filozofia przyrody a nauki przyrodnicze*, Warszawa.
- Papuziński A., (red.), 1999, *Wprowadzenie do filozoficznych problemów ekologii*, Bydgoszcz.
- Piątek Z., 1998, *Etyka ekologiczna*, Kraków.
- Singer P., 1997, *O życiu i śmierci. Upadek etyki tradycyjnej*, Warszawa.
- Skolimowski H., 1994, *Filozofia żyjąca*, Warszawa.
- Tyburski W., 1995, *Etyka i ekologia*, Toruń.
- Waloszcyk K., 1997, *Planeta nie tylko ludzi*, Warszawa.
- Zięba S., 1998, *Natura i człowiek w ekologii humanistycznej*, Lublin.

**Assessment:** test with a possibility of repeat.

**Registration required:** yes.

**LEVEL: A**

<b>Subject:</b> History of philosophy	<b>Code:</b> 08.9-00-A/3	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3,5

**Coordinator(s):** employees of the Institute of Philosophy.

**Organizational unit:** Institute of Philosophy.

**Status in the curriculum:** optional.

**Description:** The Ionic School (spontaneous materialism). Socrates' ethical intellectualism. Platonic idealism and its filiations. Aristotelism and its reception in the next centuries. Ancient atomism. Ancient ethical concepts. Medieval mysticism and Scholasticism. Augustinianism. Tomism. Renaissance humanism and natural philosophy. Ages of social utopias. Pantheism, rationalism, empiricism, positivism. Kant's critical philosophy. Hegel's absolute idealism.

**Goals:** to familiarize students with the basic concepts and trends in the field of history of philosophy.

**Teaching method:** discussions, audiovisual aids: slides, transparencies and video tapes.

**Teaching aids:** printed series of course lectures, textbooks, source materials.

**References:**

- Copleston F., 1998-2000, *Historia filozofii*, T. 1 i 2, Warszawa.  
Diogenes Laertios, 1984, *Żywoty i poglądy słynnych filozofów*, Warszawa.  
Fuller B.A.G., 1964, *Historia filozofii*, T. 1 i 2, Warszawa.  
Gilson E., 1987, *Historia filozofii chrześcijańskiej w wiekach średnich*, Warszawa.  
Hempoliński M., 1989, *Filozofia współczesna. Wprowadzenie do zagadnień i kierunków*, Warszawa.

**Assessment:** test with a possibility of repeat.

**Registration required:** yes.

**LEVEL: A**

<b>Subject:</b> Law	<b>Code:</b> 10.0-08-A/4	<b>Semester:</b> 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15w. / 15ćw.	<b>Number of ECTS credits:</b> 3 + 3

**Coordinator(s):** Romuald Waśniewski, PhD.

**Organizational unit:** Faculty of Law and Administration.

**Status in the curriculum:** compulsory.

**Description:** Land and mortgage registers. The principles of entering proprietary rights into land and mortgage registers. Trade in real estates (State-owned and private). Directions of ownership transformations in State-owned agricultural real properties (holdings): communalization, taking over by the State Treasury Agency for Agricultural Property, association of capital and affranchisement of state-owned legal persons.

**Goals:** to familiarize students with rights in property, geodetic and cartographic regulations.

**References:**

- Ignatowicz J., 1997, *Prawo rzeczowe*, PWN, Warszawa.  
*Ustawa z dnia 17 maja 1989 r. – Prawo geodezyjne i kartograficzne* (Dz. U. 30, poz. 163).  
*Rozporządzenie Ministra Rozwoju Regionalnego i Budownictwa z dnia 29 marca 2001 r. w sprawie ewidencji gruntów i budynków* (Dz. U. 38, poz. 454).  
Waśniewski R., 1995, *Prawo – przewodnik do ćwiczeń*, ART Olsztyn.  
Rudnicki S., Szachulowicz J., 2000, *Nieruchomości*, Wyd. Prawnicze PWN Warszawa.

**Assessment:** examination at the end of semester 4.

*LEVEL: A*

<b>Subject:</b> Physical education	<b>Code:</b> 16.1-00-A/4	<b>Semester:</b> 1, 2, 3
<b>Form:</b> Classes	<b>Number of hours/semester</b> 30 classes	<b>Number of ECTS credits:</b> 0

**Coordinator(s):** physical education teachers employed at the Center for Physical Education and Sports.

**Organizational unit:** Center for Physical Education and Sports.

**Status in the curriculum:** compulsory.

**Description:** The aim of physical education is to improve the physical fitness of students by means of frequent and intensive exercises, as well as to make them develop a habit of practicing sport, perceived as a basis of an active lifestyle and self-discipline. It also promotes the idea of co-operation and competition by participation in team games.

**Goals:** to improve the physical fitness of students and make them feel healthier.

**Teaching method:** exercises, demonstration with explanation.

**Assessment:** on the basis of regular attendance and tests.

**Registration required:** yes.

**LEVEL**

**B**

**LEVEL: B**

<b>Subject:</b> Mathematics	<b>Code:</b> 11.1-08-B/1	<b>Semester:</b> 1, 2, 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/30 classes– s.1 30 lectures/15 classes – s. 2, 3	<b>Number of ECTS credits:</b> 7+6+5

**Coordinator(s):** Zofia Fiedorowicz, PhD.

**Organizational unit:** Department of Applied Mathematics.

**Status in the curriculum:** compulsory.

**Description:** Higher algebra. Complex number algebra. Matrix algebra. Systems of linear equations. Analytic geometry (vector algebra, plane and straight line in  $\mathbb{R}^3$ , quadric surface, systems of polar, cylindrical and spherical coordinates). Analysis of functions of one variable and several variables, application to error estimation. Integrals and Multiple integrals and their applications. Linear and quadratic ordinary differential equations.

**Goals:** to provide theoretical bases for learning major subjects.

**Teaching method:** lectures and auditory classes.

**References:**

- Leitner R., Zacharski J., 1995, *Zarys Matematyki Wyższej*, WNT, Warszawa.  
 Leitner R., Matuszewski W., Rojek Z., 1994, *Zadania z Matematyki Wyższej*, WNT, Warszawa.  
 Stankiewicz W., 1990, *Zadania z Matematyki Wyższej dla Wyższych Uczelni Technicznych*, PWN, Warszawa.  
 Gewert M., Skoczylas Z., 1999, *Algebra Liniowa 1, Analiza Matematyczna 1 i 2*, Oficyna Wydawnicza G i S., Wrocław.

**Assessment:** classes – tests with a possibility of repeat.  
 Examination (written oral) at the end of semesters 1 and 3.

**LEVEL: B**

<b>Subject:</b> Physics	<b>Code:</b> 13.2-08-B/2	<b>Semester:</b> 1, 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5+5

**Coordinator(s):** Mirosław Alchimowicz, PhD.

**Organizational unit:** Department of Physics and Biophysics.

**Status in the curriculum:** compulsory.

**Description:** Mechanics: Kinematics, dynamics, conservation laws, vibrations. Elements of the relativity theory. Gravitation. Kepler's laws. Ciołkowski problem (rocket). Kinetic theory of matter: intermolecular (van der Waals) forces. Phase transitions. Electrodynamics: Electricity. Magnetism. Electromagnetic waves. Optics: Interference, diffraction, polarization, holography, geometric optics, lenses. Quantum mechanics: Electron diffraction, the uncertainty (indeterminacy) principle. Photoeffect, Planck spectrum. Schrödinger equation. Hydrogen atom. Interactions: Nuclear forces. Nuclear reactions. Reactor structure. Interactions between and classification of elementary particles. Symmetry breaking and Great Unification. Cosmology: Hubble's law. Thermal radiation of the Universe. Friedmann equations. Big-bang.

**Goals:** to discuss the basics of physics.

**Preceding subjects:** mathematics

**Teaching method:** lectures, laboratory classes.

**References:**

Sawieliew I.W, 2000, *Wykłady z fizyki*, T. 3, PWN, Warszawa.

**Bobrowski Cz., 1998, *Fizyka*, WNT, Warszawa.**

Fichtenholz G.M., 1999, *Rachunek różniczkowy i całkowy*, PWN, Warszawa.

**Assessment:** classes - test with a possibility of repeat.

Examination at the end of semester 2.

**LEVEL: B**

<b>Subject:</b> Descriptive geometry computer graphics	<b>Code:</b> 11.9-08-B/5	<b>Semester:</b> 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 4</b>

**Coordinator(s):** Renata Jędrzycka, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Basic theorems of elementary geometry – a review. Definitions and invariants of parallel and central projection. Projection of fundamental elements (point, straight line, plane) in both types of projection. Adjacent, common and parallel elements. Plane sections; determination of real sizes of plane figures. Highway construction scheme (parallel projection). Length and angle distortion in photographs (central projection). Axonometric projection of three-dimensional figures.

**Goals:** to make parallel and central projections of three-dimensional figures, to reconstitute the real shapes and sizes of the figures projected, to develop the power of three-dimensional thinking.

**Preceding subjects:** mathematics.

**Teaching method:** lectures with visual aids: slides and anaglyphs; auditory classes.

**References:**

- Otto F., Otto E., 1975, *Podręcznik geometrii wykreślnej*, PWN, Warszawa.  
Waligórski J., 1961, *Zasady i zastosowania rzutu cechowanego*, WNT, Warszawa.  
Rachwał T., Dwurażna S., 1984, *Ćwiczenia z geometrii wykreślnej*, T. 1, PWN, Warszawa.  
Hutorowicz H., Przęczek B., 1987, *Zbiór zadań z rzutu środkowego i aksonometrii*, Wyd. ART., Olsztyn.  
Brzosko Z., 1995, *Wykreślna restytucja perspektywy*, WNT, Warszawa.

**Assessment:** classes – drawing up and defense of projects.

**LEVEL: B**

<b>Subject:</b> Computer science	<b>Code:</b> 11.3-08-B/6	<b>Semester:</b> 1, 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5+5

**Coordinator(s):** Alina Prątnicka, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Basic information about computers. A review and comparison of programming languages. Programming in selected languages. Practical application of software packages for the purposes of geodetic surveying. The basics of land information systems. Digital maps: methods of information gathering, features, a review of systems for creating and keeping digital maps. Computer networks.

**Goals:** to prepare students for using computer techniques and new measuring techniques.

**Teaching method:** computer-aided lectures with visual aids: slides, transparencies; computer-aided classes.

**References :**

*Dowolne podręczniki z zakresu obsługi komputerów i programowania w wybranych językach programowania, czasopisma fachowe.*

Sikorski W., 1994, *Przewodnik po IBM czyli od DOSa przez Windows do aplikacji*, NIKOM, Warszawa.

Sikorski W., 1989, *Wprowadzenie do użytkowania mikyearomputerów*, WNT, Warszawa.

Perry G., 1993, *Qbasic Kurs na zderzenie*, INERSOFLAND , Warszawa.

Wiśniewski L., 1992, *Quick Basic*, Lynx – SFT, Warszawa.

Szczepkowicz J., 1990, *Turbo Pascal 5.0 z przykładami konstrukcji oprogramowania podstawowego*. WNT, Warszawa.

Myrda G., 1997, *GiS czyli mapa w komputerze* , Helion , Warszawa.

**Assessment:** classes – test with a possibility of repeat.

Examination (written and oral) at the end of semester 2.

**LEVEL**

**C**

**LEVEL: C**

<b>Subject:</b> Geodesy	<b>Code:</b> 07.6-08-C/1	<b>Semester:</b> 1, 2, 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5+5+4+4

**Coordinator(s):** Krzysztof Świątek, Associate Professor, PhD.  
Waldemar Kamiński, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Goals and tasks of the surveying service in Poland; systems of coordinates and reference surfaces applied in geodesy and surveying; characteristics of the geodetic control network in Poland; establishment of horizontal and vertical control networks; traverse adjustment; methods of terrain detail surveying; area leveling; compilation of planimetric and contour maps. Technologies of detail networks. Topographic surveying by the method of polar coordinates, with total stations. Determination of point height by indirect leveling.

**Goals:** to familiarize students with surveying methods employed to compile planimetric and contour maps.

**Teaching method:** lectures with visual aids: slides, transparencies.

**References:**

Odlanicki-Poczobutt M., 1996, *Geodezja: podręcznik dla studiów inżyniersko-budowlanych*, PPWK, Warszawa.

Ząbek J., Z. Adamczewski, St. Kwiatkowski, 1984, *Ćwiczenia z geodezji I, t. I i II*, PWN, Warszawa.

Lazzarini T., A. Hermanowski, J. Gaździcki, M. Dobrzycka, I. Laudyn, 1990, *Geodezja. Geodezyjna osnowa szczegółowa*, PPWK, Warszawa-Wrocław.

Skórczyński A., 1995, *Niwelacja trygonometryczna w pomiarach szczegółowych*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa.

Skórczyński A., 1995, *Lokalna triangulacja i trilateracja*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa.

**Assessment:** classes – homework assignments, tests with a possibility of repeat, practical operation of surveying instruments.

Examination (written and oral) at the end of semesters 2 and 4.

**LEVEL: C**

<b>Subject:</b> Engineering geodesy	<b>Code:</b> 07.6-08-C/3	<b>Semester:</b> 5, 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Gabriel Kopiejewski, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Geodetic surveys for the purposes of drawing up investment projects. Geodetic surveys at successive stages of investment. Constructional measurements and structure assembly check. Displacement and deformation measurements. Check measurements and quantity surveys of investments. Geodetic inventory documentation, territorial development and technical infrastructure registers.

**Goals:** to discuss and apply in practice geodetic surveying at successive investment stages.

**Preceding subjects:** geodesy, computing methods in geodesy, electronic measuring techniques.

**Teaching method:** lectures, drawing up projects, field training.

**References:**

Praca zbiorowa pod red. Jana Gmyrka, 1990, *Geodezja inżynierska, Tom I*, Warszawa.

Praca zbiorowa pod red. Jana Gocęła, 1993, *Geodezja inżynierska, Tom II*, Warszawa.

Praca zbiorowa pod red. Ryszarda J. Grabowskiego, 1994, *Geodezja inżynierska, Tom III*, Warszawa.

**Assessment:** classes – drawing up projects (semester 5); conducting group field surveys and data elaboration, test at the end of the semester.

Examination (written and oral) at the end of semester 6.

**LEVEL: C**

<b>Subject:</b> Geodesy and geodetic astronomy	<b>Code:</b> 07.6-08-C/2	<b>Semester:</b> 5, 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Jan Kryński, Associate Professor, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory.

**Description:** Introduction to geodesy. Precise leveling. Systems of heights. Determination of geodetic coordinates on the ellipsoid. Gravity reduction. Geodetic survey reduction on the ellipsoid. Ellipsoid projection on the plane. Conversion of geodetic coordinates into orthogonal (rectangular) coordinates in the Gauss-Krüger projection, projective reductions. Systems of state coordinates. Primary (fundamental, basic) horizontal and vertical geodetic control networks. Modernization of geodetic networks in Poland.

GPS – the operating principle. Reference systems. Coordinate transformations. GPS network adjustment and coordinate transformation to local systems. The use of satellite techniques in geodesy and navigation. The future of GPS.

**Goals:** to discuss the basic problems of geodesy, to familiarize students with geodetic tools for the acquisition, compilation and use of spatial data.

**Preceding subjects:** mathematics, physics.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes including field training.

**References:**

Czarnecki K., 1995, *Geodezja współczesna*, Wiedza i Życie, Warszawa.

Praca zbiorowa, 1993, *Niwelacja Precyzyjna*, PPWK, Warszawa-Wrocław.

Praca zbiorowa, 1974, *Ćwiczenia z Geodezji Wyższej*, PWN, Warszawa.

Praca zbiorowa, 1988, *Geodezja Wyższa i Astronomia Geodezyjna. Zadania i Przykłady*, PWN, Wrocław.

A. Leick, 1996, *GPS Satellite Surveying*, J Wiley & Sons.

B. Hofmann-Wellenhof, H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.

**Assessment:** classes - homework assignments and reports on field training. Examination (oral) at the end of semester 6.

**LEVEL: C**

<b>Subject:</b> Building engineering and costing	<b>Code:</b> 06.4-08-C/15	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Janusz Tadeusz Barski, PhD.

**Organizational unit:** Department of Technology, Organization and Economics of Building Engineering.

**Status in the curriculum:** compulsory.

**Description:** Division of building engineering: functional, constructional and technological aspects. Traditional building engineering, structural components. Industrial building, building systems. Technology development. Definitions and types of cost estimate (calculation). Building expenses (including the costs of building materials, labor, transportation, etc.). Calculation of price components. Supplements for execution of work under substandard conditions. Tasks to be performed by parties while making cost estimates. Individual calculation of building expenses, Catalogues of Building Expenses. Measurements versus quantity surveys. Making cost estimates by the detailed method. Computer assistance.

**Goals:** to familiarize students with the basic principles of costing.

**References:**

1. Pawłowski P., *Budownictwo ogólne*.
2. Żenczykowski W., *Budownictwo ogólne*.
3. Praca zbiorowa, *Poradnik majstra budowy*.
4. Praca zbiorowa, *Środowiskowe zasady kosztorysowania*.
5. Rozporządzenia Ministra Spraw Wewnętrznych i Budownictwa z 1999 w sprawie zasad sporządzania kosztorysów inwestorskich.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: C**

<b>Subject:</b> Computing methods in geodesy	<b>Code:</b> 11.2-08-C/16	<b>Semester:</b> 3, 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Professor Zbigniew Wiśniewski, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** The basics of matrix algebra. Methods of inverse matrix calculation. Elements of the matrix theory. General inverse matrixes. Methods of solving systems of equations. Introduction to statistical inference. Random variables (probability density function, cumulative distribution function, descriptive parameters, moments, covariance matrix, covariance matrix propagation, typical distributions of random variables). Elements of the estimation theory. Classical methods of point estimation. Range estimation. Elements of the theory of measuring errors – hypotheses and models. Introduction to the theory of observation adjustment. The basics of adjustment by the least square method. Covariance matrix model. Weight matrix. Co-factor matrix. Coefficient of variance. The principles of adjustment by the parametric method. Accuracy estimation after adjustment. The principles of adjustment by the correlate method. Adjustment of dependent observations. Methods of sequential adjustment. Practical problems accompanying the process of observation adjustment (most common computing methods, programs and systems).

**Goals:** to familiarize students with the theory and practice of observation adjustment.

**Preceding subjects:** geodesy, mathematics.

**Teaching method:** lectures with visual aids: slides, transparencies.

**References:**

Wiśniewski Z., 2000, *Algebra macierzy i statystyka matematyczna w rachunku wyrównawczym (teoria i zadania)*, Wydawnictwo UWM, Olsztyn.

Baran L. W., 1999, *Teoretyczne podstawy opracowania wyników pomiarów geodezyjnych*, Wydawnictwo Naukowe PWN.

Czaja J., 1996, *Modele statystyczne w informacji o terenie*, Wydawnictwo AG-H, Kraków.

*Inne podręczniki z zakresu wyrównania obserwacji geodezyjnych oraz czasopisma naukowe: Geodezja i Kartografia, Journal of Geodesy*

**Assessment:** classes - tests, three computational tasks, reports on the tasks.

Examination (written and oral) at the end of semester 4.

**LEVEL: C**

<b>Subject:</b> Photogrammetry and remote sensing	<b>Code:</b> 07.6-08-C/7	<b>Semester:</b> 5, 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes – s. 5 15 lectures/45 classes – s. 6	<b>Number of ECTS credits:</b> 4+5

**Coordinator(s):** Piotr Sawicki, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Electromagnetic radiation. Optical and optical-electronic systems of photogrammetric image registration. The principles of arranging and taking aerial and terrestrial metric photographs. Analogue and digital metric photographs – spectral range of registration, geometric and radiometric properties. Digital image pre-processing. The basics of metric photograph measurement. Analytical bases of photogrammetry. Methods of solving and adjustment of spatial (aerial) triangulation. Analytical and digital plotting instruments – structure, operation and methods of photograph measurement. Digital map compilation by stereo digitization. Digital map revision (updating) by photogrammetric methods. Generating Digital Terrain Models and Digital Elevation Models by photogrammetric methods. The theory of orthophotography. The creation of orthophotographs. The compilation of digital orthophotomaps. Elements of aerial and satellite remote sensing. Interpretation of aerial photographs. Satellite remote sensing systems. Photogrammetry and remote sensing in the GIS.

**Goals:** to discuss the methods and technologies of gathering geometric and semantic information about physical structures on the basis registration, interpretation and measurement of digital photographs and images.

**Preceding subjects:** mathematics, physics, computing methods in geodesy, geodesy, computer science.

**Teaching method:** lectures with audiovisual aids: slides, transparencies and video tapes; classes – practical application of computer-aided photogrammetric measuring methods.

**References:**

- Sitek Z., 1991, *Fotogrametria ogólna i inżynierska*, PPWK, Warszawa – Wrocław.  
 Kurczyński Z., R. Preuss, 2000, *Podstawy fotogrametrii*, Wyd. PW, Warszawa.  
 Sitek Z., 1994, *Wprowadzenie do teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.  
 Sitek Z., 1997, *Zarys teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.  
 Kraus K., 1997, *Photogrammetry*, Duemmler Verlag, Bonn.

**Assessment:** 2 tests, drawing up technical reports on particular classes.

Examination (written and/or oral) at the end of semester 6.

**LEVEL: C**

<b>Subject:</b> Cartography	<b>Code:</b> 07.6-08-C/8	<b>Semester:</b> 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 30 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Professor Idzi Gajderowicz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Spherical trigonometry. Coordinate systems of points situated on the sphere. Spheroid geometry. General theory of map projections. Map projection classification. Projection of the ellipsoid on spherical surface. Azimuthal, cylindrical and conical projections of spherical surface. Gauss-Krüger projection. Quasi-stereographic projection. Conformal transformation. Criteria of map classification. General principles of map compilation. Cartographic generalization. Map reproduction. Topographic maps in Poland since 1945. Topographic map compilation. Thematic cartography. Computer-aided cartography.

**Goals:** to introduce students to the theory of map projections, to familiarize them with the basics of the compilation and reproduction of topographic and thematic maps.

**Preceding subjects:** geodesy, mathematics.

**Teaching method:** lectures with visual aids: slides, transparencies; laboratory classes and a visit to a cartographic publishing house.

**References:**

- Gajderowicz I., 1999, *Kartografia matematyczna dla geodetów*, Wyd. AR-T, Olsztyn .  
Byearman L., 1989, *Redakcja map i reprodukcja kartograficzna*, Wyd. AR-T, Olsztyn.  
Menno-Jan Kraak, F. Ormeling, 1998, *Kartografia; wizualizacja danych przestrzennych*, Wyd. Nauk. PWN, Warszawa.  
Ratajski L., 1989, *Metodyka kartografii społeczno-gospodarczej*. PPWK, Warszawa – Wrocław, wyd. II.  
Aleksiejewicz Saliszczew K., 1998, *Kartografia ogólna*, Wyd. Nauk. PWN Warszawa, wyd. II.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: C**

<b>Subject:</b> Electronic measuring techniques	<b>Code:</b> 07.6-08-C/9	<b>Semester:</b> 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Andrzej Wanic, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Mechanical-optical systems of engineering and precision leveling instruments and theodolites with various reading/registration systems. Testing and adjustment of optical surveying equipment. Electronic distance measurement (impulse and phase methods). Total stations. Electronic angle-measurement systems (code, impulse, dynamic). Electromagnetic wave propagation in the atmosphere. Lasers. Wall marks.

**Goals:** to familiarize students with the structure and use of measuring instruments (optical and electronic), to prepare them for carrying out surveying tasks with the help of modern surveying equipment.

**Preceding subjects:** geodesy.

**Teaching method:** lectures and classes with visual aids: slides, transparencies and video types.

**References:**

Płatek A., 1991, *Geodezyjne dalmierze elektromagnetyczne i tachymetry elektroniczne. Część I: geodezyjne dalmierze elektromagnetyczne do pomiarów terenowych*, PPWK, Warszawa-Wrocław.

Płatek A., 1992, *Geodezyjne dalmierze elektromagnetyczne i tachymetry elektroniczne. Część II: optyczne dalmierze interferencyjne, teodolity i tachymetry elektroniczne*, PPWK, Warszawa – Wrocław.

Tatańczyk J. 1994, *Wybrane zagadnienia z instrumentoznawstwa geodezyjnego*, AG-H, Kraków.

Tatańczyk. J. 1977, *Nowe konstrukcje geodezyjnych przyrządów kątomierzowych*, AG-H, Kraków.

Wanic A. 1998, *Instrumentoznawstwo geodezyjne. Przewodnik do ćwiczeń, Część I*. Wydanie II, AR-T, Olsztyn.

Wanic A., 1997, *Instrumentoznawstwo geodezyjne. Przewodnik do ćwiczeń. Część II*, AR-T, Olsztyn.

Ząbek J. i in., 1984, *Ćwiczenia z geodezji I*, PWN, Warszawa.

**Assessment:** classes - test + a practical exam in the use of optical and electronic measuring instruments.

**LEVEL: C**

<b>Subject:</b> Basics of town-and-country planning	<b>Code:</b> 02.0-08-C/10	<b>Semester:</b> 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Professor Ryszard Cymerman, PhD.

**Organizational unit:** Department of Land Planning and Management.

**Status in the curriculum:** compulsory.

**Description:** Planning decisions at a level of communes. Local town-and-country development plans. Land use planning. Decisions concerning land development and management.

**Goals:** to familiarize students with the basics of land management.

**Teaching method:** lectures with visual aids: slides, transparencies.

**References:**

Cymerman R., *Planowanie i zagospodarowanie przestrzenne w gospodarce nieruchomościami.*

**Assessment:** classes – tests with a possibility of repeat.  
Examination at the end of semester 4.

**LEVEL: C**

<b>Subject:</b> Land information systems	<b>Code:</b> 07.9-08-C/11	<b>Semester:</b> 4, 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+4

**Coordinator(s):** Professor Stanisław Surowiec, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

Status in the curriculum: **compulsory**.

**Description:** Computer, vector and raster graphics. Relational databases. Spatial information systems, GIS.

**Goals:** to discuss the theoretical and technological bases of spatial information systems and the GIS.

**Preceding subjects:** geodesy, land registration, computer science, cartography.

**Teaching method:** lectures with audiovisual aids: slides, transparencies, video projections; classes at a computerized laboratory.

**References:**

Gaździcki J., 1990, *Systemy Informacji Przestrzennej*, PPWK.

Gaździcki J., 1995, *Systemy Katastralne*, PPWK.

Rybiński H., 1993, *Bazy Danych*, Akademicka Oficyna Wydawnicza.

Banachowski L., 1998, *Bazy Danych*, Akademicka Oficyna Wydawnicza.

Zabrodzki J., 1994, *Grafika komputerowa*, Wydawnictwa Naukowo-Techniczne, Warszawa.

Kistowski M., 1997, *Systemy Informacji Geograficznej*, Bogucki Wydawnictwo Naukowe.

**Assessment:** classes – test with a possibility of repeat Examination at the end of semester 5.

**LEVEL: C**

<b>Subject:</b> Environmental protection	<b>Code:</b> 07.2-08-C/13	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits: 4</b>

**Coordinator(s):** Iwona Marcinkowska, PhD.

**Organizational unit:** Department of Land Planning and Management.

**Status in the curriculum:** compulsory.

**Description:** Basic concepts of environmental protection. Farmland protection: threats to farmland, release of cropland and forest land for other purposes, release charge. Rural landscape assessment. Devastated land reclamation. The reclamation process. The directions and costs of land reclamation. Documentation (specifications, cost estimate) of land reclamation. Ecological development of rural areas.

**Goals:** to discuss the basics of environmental protection, and environmental aspects of planning in the field of geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies; classes – project drawing.

**References:**

- Bartkowski T., 1979, *Kształtowanie i ochrona środowiska*, PWN, Warszawa.
- Cymerman R., Hopfer A., 1980, *Ochrona środowiska w planowaniu i urządzaniu terenów wiejskich*, PWN, Warszawa.
- Cymerman R., 1991, *Geodezyjne problemy rekultywacji gruntów*, Wydawnictwo ART, Olsztyn.
- Cymerman R., 1990, *Rekultywacja gruntów zdewastowanych*, Wydawnictwo ART, Olsztyn.
- Ekorozwój obszarów wiejskich*, Zeszyty Problemowe Postępów Nauk Rolniczych PAN, Zeszyt 401, PWN, Warszawa.

**Assessment:** drawing up and defense of projects, tests with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Basics of Earth science	<b>Code:</b> 13.9-08-C/12	<b>Semester:</b> 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 4</b>

**Coordinator(s):** Professor Janusz Gotkiewicz, PhD.

**Organizational unit:** Department of Pedology and Soil Conservation.

**Status in the curriculum:** compulsory

**Description:** The natural environment of Poland. The role of soils, soil resources, soil use structure. Soil properties. Soil classification. Evaluation of agricultural production area. Soil maps. Soil taxonomy in Poland. Soil conservation. Agriculture in Poland. Directions of agricultural production. Cultivation, fertilization and protection of plants. Technology of growing selected cereal, root, oil-bearing and leguminous plants. Meadows and pastures. Presentation of experimental and production fields.

**Goals:** to familiarize students with the basics of agriculture and pedology.

**References:**

- Przedwojski R., 1985, *Gleboznawstwo z podstawami geomorfologii, mineralogii petrografii*, Skrypty ART, Olsztyn.  
Mizerski W., 2000, *Geologia dynamiczna dla geografów*, PWN, Warszawa.  
Uggla H., 1983, *Gleboznawstwo rolnicze*, PWN, Warszawa.  
Dobrzański B., 1993, *Gleboznawstwo*, PWRiL, Warszawa.

**Assessment:** classes – tests with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Real estate administration	<b>Code:</b> 07.6-08-C/17	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Radosław Wiśniewski, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** The basics of real estate administration in urban areas. Procedures of administrating real estates owned by the State Treasury and local government units. Forms and legal bases of trade in real estates. Administration of real estate reserves. Tendering procedure and sale without inviting tenders in the case of real estates owned by the State Treasury and local government units. Long-term usufruct of real property. Prices, charges/fees, damages/compensation and payments for real estates. Expropriation of real estates and restitution of real estates expropriated before. Consolidation and division, partition of real property. Adjacent fees. Right of pre-emption, right of priority. Real estate administration in other countries.

**Goals: to familiarize students with the legal and economic bases of real estate administration in urban areas.**

Preceding subjects: **theory and principles of real estate valuation, law, economics.**

**Teaching method:** lectures with visual aids: slides, transparencies; classes, including seminars and making an inventory.

**References:**

Bieniek G. i inni, 2000, *Komentarz do ustawy o gospodarce nieruchomościami*, ZCO, Zielona Góra.

Kuryj J., R. Wiśniewski, R. Żróbek (red.), 2000, *Gospodarka nieruchomościami*, UWM, Olsztyn.

**Ignatowicz J., 1997, *Prawo rzeczowe*, PWN, Warszawa.**

Assessment: **classes – drawing up and defense of projects, tests with a possibility of repeat.**

**Examination (written and/or oral) at the end of semester 5.**

**LEVEL: C**

<b>Subject:</b> Field training in surveying after the 1st year	<b>Code:</b> 07.6-08-C/18	<b>Semester:</b> Po 2
<b>Form:</b> Field training	<b>Number of hours/semester:</b> 60 classes	<b>Number of ECTS credits:</b> 4,5

**Coordinator(s):** Krzysztof Świątek, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:**

1. Topographic surveys in selected areas.
2. Establishment and measurement of traverses tied up at both ends.
3. Construction of planimetric and contour maps.
4. Drawing up technical reports on topics 1 and 2.

**Goals:** to help students acquire skill at land surveying, doing the necessary calculations and compiling planimetric and contour maps.

**Preceding subjects:** geodesy, mathematics.

**Teaching method:** practical land surveying.

**Assessment:** drawing up technical reports. Oral examination.

**LEVEL: C**

<b>Subject:</b> Field training in surveying after the 2nd year	<b>Code:</b> 07.6-08-C/19	<b>Semester:</b> Po 4
<b>Form:</b> Field training	<b>Number of hours/semester:</b> 60 classes	<b>Number of ECTS credits:</b> 4,5

**Coordinator(s):** Waldemar Kamiński, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Practical application of the knowledge gained during lectures in semesters 3 and 4.

**Teaching method:** practical land surveying.

**Assessment:** drawing up technical reports.

**LEVEL: C**

<b>Subject:</b> Field training in engineering geodesy	<b>Code:</b> 07.6-08-C/20	<b>Semester:</b> Po 6
<b>Form:</b> Field training	<b>Number of hours/semester:</b> 60 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Gabriel Kopiejewski, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Practical application of the knowledge gained during lectures in semesters 5 and 6, concerning basic engineering surveys, such as terrain geodetic surveys, measurement of displacement and deformation in engineering structures, inventory field surveying, quantity surveys of territorial development facilities, drawing up as-built documentation.

**Goals:** to familiarize students with innovative techniques applied to engineering surveys.

**Preceding subjects:** engineering geodesy.

**Teaching method:** practical land surveying.

**Assessment:** drawing up geodetic as-built documentation.

**LEVEL: C**

<b>Subject:</b> Field training in geodesy	<b>Code:</b> 07.6-08-C/21	<b>Semester:</b> 8
<b>Form:</b> Field training	<b>Number of hours/semester:</b> 30 classes	<b>Number of ECTS credits:</b> 2,5

**Coordinator(s):** Krzysztof Świątek, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** high-precision leveling: determination of height differences by direct leveling, data evaluation and point height determination.  
Gravity measurement of high-precision leveling spans with gravimeters and data evaluation.  
Technical reports on the above topics.

**Goals:** to help students acquire skill at high-precision leveling and familiarize them with gravity measurement techniques.

**Preceding subjects:** geodesy, physics, mathematics.

**Teaching method:** practical land surveying.

**Assessment:** drawing up technical reports. Oral examination.

**LEVEL: C**

<b>Subject:</b> Field training in photogrammetry	<b>Code:</b> 07.6-08-C/22	<b>Semester:</b> Po 6
<b>Form:</b> Field training	<b>Number of hours/semester:</b> 30 classes	<b>Number of ECTS credits:</b> 2

**Coordinator(s):** Piotr Sawicki, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Carrying out (in groups) of the following tasks:

1. Aerotriangulation.
2. Digital map compilation by stereo digitization.
3. Measurement of deformation of engineering structures by single-image analytical photogrammetry.

**Goals:** practical application of photogrammetric methods while solving measurement problems; mastering skill at photograph measurement and processing.

**Preceding subjects:** mathematics, physics, computing methods in geodesy, geodesy, computer science.

**Teaching method:** classes – a practical study of computer-aided measuring and photogrammetric methods.

**Assessment:** drawing up photogrammetric projects and technical reports.

**LEVEL**

**D**

**LEVEL: D**

<b>Subject:</b> Map plotting	<b>Code:</b> 07.6-08-D/1	<b>Semester:</b> 1, 2
<b>Form:</b> Classes	<b>Number of hours/semester:</b> 30 classes	<b>Number of ECTS credits:</b> 2+2

**Coordinator(s):** Elżbieta Lewandowicz, PhD.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** The basics of plotting: map scale, conventional signs, cartographic lettering, map frames. Lettering in topographic maps, field sketches. Digital drawing. The basics of AutoCad. Graphic objects, plotting aids, drawing pads, footnotes. Contour drawing. Base maps: vector, object or contour base map. Map objects. Design terrain object symbols. Map editing in geodetic and non-geodetic applications. Plotting devices.

**Goals:** to help students master skill at traditional and computer-aided plotting, to familiarize them with the geodetic technical specifications of the K series.

**Teaching method:** lectures with audiovisual aids: slides, transparencies, video projections; the use of the latest AutoCad versions, geodetic applications and original educational programs; classes conducted at the Digital Map Compilation Laboratory.

**References:**

- Autodesk 1999: AutoCAD 2000. Podręcznik użytkownika.*  
Bem S., 1996, *Rysunek map*, PPWK, Warszawa.  
Dąbrowska D., Wenta J., *Godła mapy; komputerowy program edukacyjny.*  
*Instrukcja obsługi programu C-geo dla Windows. Sofiline.*  
*Instrukcja obsługi programu Mikromapa. Coder.*  
*Wybrane branżowe instrukcje i wytyczne techniczne.*

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: D**

<b>Subject:</b> Real estate cadastre	<b>Code:</b> 07.6-08-D/2	<b>Semester:</b> 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Kazimierz Zwirowicz, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory.

**Description:** Land and building registers and territorial development and technical infrastructure registers as sources of information about real estates. Land and building registers versus land and mortgage registers. Purposes, scope and structure of registration and record keeping. Record sets and files. System keeping and updating (modernization).

**Goals:** to discuss the bases of creation and keeping of systems of information on real estates.

**Preceding subjects:** geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies, classes in small groups, with the use of descriptive and cartographic materials.

**References:**

- Ewidencja gruntów.* Praca zbiorowa pod red. Ryszarda Cymermana, 1987, PWN Warszawa.  
*Ustawa z dnia 17 maja 1989 r. – Prawo geodezyjne i kartograficzne* (Dz.U.nr 30, poz.163) wraz z przepisami wykonawczymi.  
*Ewidencja gruntów, budynków i sieci uzbrojenia terenu.* Praca zbiorowa pod red. A. Hopfera, 2000 r., wydawnictwo Uniwersytetu Warmińsko-Mazurskiego w Olsztynie.  
Gaździcki J., 1990, *Systemy informacji przestrzennej*, PPWK, Warszawa.  
Gaździcki J., 1995, *Systemy katastralne*, PPWK, Warszawa.  
Grzechnik B., Marzec Z., 1998, *Mapy dla celów prawnych, podziały i scalenia oraz rozgraniczenie nieruchomości*, Agencja Geodezyjno-Prawna „Grunt”, Warszawa.  
*Wybrane branżowe instrukcje i wytyczne techniczne.*

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat. Examination (written or oral) at the end of semester 6.

**LEVEL: D**

<b>Subject:</b> Rural area management	<b>Code:</b> 07.6-08-D/3	<b>Semester:</b> 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5+5

**Coordinator(s):** Professor Stanisław Surowiec, PhD.

**Organizational unit:** Department Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory.

**Description:** Spatial structure. Land holding. Setting lines of demarcation between real estates. Thematic maps used while planning new management structure in rural areas. Map content and scale, territorial development, geodetic control networks.

Evaluation of the physiographic, soil and spatial conditions in rural areas for the purposes of their development, rearrangement and consolidation. General plans of the spatial organization/arrangement in rural areas. Land appraisal. The scope and principles of drawing up detailed development plans and land consolidation plans. Gathering geodetic data for updating land records. Land management – purposes, definitions, regulations. Complex rearrangement of rural areas.

**Goals:** to discuss the basics of spatial economy in rural areas and the role of geodetic-cartographic documentation in its processes; to familiarize students with the procedures of land consolidation.

**Preceding subjects:** real estate cadastre, geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies, classes in small groups, with the use of descriptive and cartographic materials.

**References :**

Bajerowski T. i inni, 1992, *Ćwiczenia z geodezyjnych urzędzeń terenów rolnych i leśnych*, Skrypty AR-T w Olsztynie.

*Ćwiczenia z geodezyjnych urzędzeń terenów rolnych*. Cz. 1, 1980. Praca zbiorowa. Skrypty AR-T w Olsztynie.

Hopfer A., M. Urban, 1984, *Geodezyjne urządzenie terenów rolnych*, PWN, Warszawa.

Hopfer A., 2000, *Ewidencja gruntów, budynków i sieci uzbrojenia terenu*, Skrypty UWM, Olsztyn.

**Assessment:** classes – tests with a possibility of repeat.  
Examination (written or oral) at the end of semester 8.

**LEVEL: D**

<b>Subject:</b> Processing of remote sensing data	<b>Code:</b> 07.6-08-D/5	<b>Semester:</b> 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Marek Mróz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Energetic photometry. Radiation of real bodies – emissivity and albedo. Spectral characteristics of selected objects (soil, plants, water) in the visible, near and middle infrared. The formation of a digital, multispectral satellite image. Digital processing of satellite images. Image visualization. Image statistics, histograms, improvement of the image visual quality – global and local transformations (contrast modifications, high-pass and low-pass filtering). Methods of histogram matching. Geometric correction of digital satellite images. Multispectral image processing. Microwave active remote sensing. Radar images. Multi-source data processing.

**Goals:** to familiarize students with methods of digital data processing in remote sensing, used for drawing satellite image maps and thematic maps of land cover/ land use.

**Preceding subjects:** mathematics, physics, computing methods in geodesy, photogrammetry and remote sensing.

**Teaching method:** lectures with audiovisual aids and multimedia technologies; classes – practical application of selected methods of image processing.

**References:**

Ciołkosz A., A. Kęsik, 1989, *Teledetekcja satelitarna*, PWN, Warszawa.

Sitek Z., 1997, *Zarys teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.

Sitek Z., 1994., *Wprowadzenie do teledetekcji lotniczej i satelitarnej*, Wyd. AGH, Kraków.

**Assessment:** classes – tests with a possibility of repeat, drawing up and defense of projects.

**LEVEL: D**

<b>Subject:</b> Digital maps	<b>Code:</b> 07.6-08-D/7	<b>Semester:</b> 6
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/45 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Danuta Dąbrowska, PhD.

**Organizational unit:** Department of Surveying.

**Status in the curriculum:** compulsory.

**Description:** Data models. Functions and formats of data input. Topology of digital map. Coherence of digital map database. Units sorting digital map objects. Transformations of database sets. Basic maps and derived maps. Database management. Digital map revision (updating). Digital terrain models – DTM and their geodetic derivatives. Accuracy of geodetic information based on DTM. 2D+H and 3D digital maps. Functions of modeling relational databases of digital map. The use of digital map basic sets for other spatial analyses based on geodetic data (fuzziness). Distribution of geodetic information. Standards of geodetic information exchange. Integration of independent databases of digital maps. Accuracy of digital maps.

**Language of instruction:** Polish.

**Goals:** to familiarize students with methods of managing digital map database sets, created in various computer systems.

**Preceding subjects:** basics of computer science, geodesy, plotting, land information systems.

**Teaching method:** lectures with audiovisual aids: slides, transparencies, video projections; classes conducted at the Digital Map Compilation Laboratory, with the use of the latest versions of platform programs and geodetic applications, with two students at a computer.

**References:**

- Osada E., 2001, *Geodezja*, Oficyna Wydawnicza Politechniki Wrocławskiej. Wrocław.
- Gaździcki J., 1990, *Systemy informacji przestrzennej*, Państwowe Przedsiębiorstwo Wydawnictw Kartograficznych im. Eugeniusza Romera, Warszawa-Wrocław.
- Gaździcki J., 2001, *Leksykon geomatyczny*, Polskie Towarzystwo Informatyki Przestrzennej, Warszawa.
- Subieta K., 1998, *Obiektość w projektowaniu i bazach danych*, Akademicka Oficyna Wydawnicza PLJ, Warszawa.
- Wybrane prace naukowe i naukowo - techniczne. Instrukcje obsługi.*

**Assessment:** oral reports on particular tasks. Final test (written).

**LEVEL: D**

<b>Subject:</b> Theory and principles of real estate valuation	<b>Code:</b> 07.6-08-D/7	<b>Semester:</b> 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Sabina Żróbek, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** Legal bases of real estate valuation. The concept of property value. Real estates as a commodity. Value determinants. The bases of valuation – price, income, cost. Classification of valuation methods. Kinds and sources of data used in the course of valuation. The purposes of valuation. Rules of granting a license to property appraisers. The ethics code of property appraisers. Responsibility and professional standards of property appraisers. Appraisal reports as a form of presenting the valuation process.

**Goals:** to present the legal and methodological bases of the valuation process, to introduce students to practical valuation carried out in the next semesters.

**Teaching method:** lectures with audiovisual aids.

**References:**

*Ustawa z dnia 21 sierpnia 1997 o gospodarce nieruchomościami (Dz.U. Nr 115/97 z późniejszymi zmianami).*

*Rozporządzenie z 7 lipca 1998 roku w sprawie szczegółowych zasad wyceny nieruchomości oraz zasad i trybu sporządzania operatu szacunkowego.*

*Standardy Zawodowe Rzeczoznawców Majątkowych.* Praca zbiorowa pod red. Zdzisława Małeckiego, wyd. PFSRM, Warszawa 2000.

Cymerman R., A. Hopfer, 1997, *System szacowania nieruchomości*, wyd. ZCO, Zielona Góra.

Hopfer A., H. Jędrzejewski, R. Żróbek, S. Żróbek, 1996, *Wycena nieruchomości i przedsiębiorstw, Tom I. Szacowanie nieruchomości*, wyd. TWIGGER, Warszawa.

**Assessment:** classes – drawing up and defense of projects, test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Technique and technology of real estate valuation	<b>Code:</b> 07.6-08-D/8	<b>Semester:</b> 6, 7, 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 4+5+5

**Coordinator(s):** Professor Sabina Żróbek, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** Market value as a basis for real estate valuation. The principles and methods of real estate valuation. Procedures and techniques of valuation. Determination of the final result of valuation. The principles of drawing up appraisal reports – their updating, verification and expressing opinions on their content.

**Goals:** to familiarize students with valuation techniques and procedures in the case of comparable sales, income, cost and combined approaches concerning built-up real estates, building land, forest and agricultural real properties.

**Preceding subjects:** theory and principles of real estate valuation.

**Teaching method:** lectures with audiovisual aids; classes – drawing up appraisal reports preceded by an inspection of the real estate valued.

**References:**

S. Żróbek, M. Belej, 2000, *Podejście porównawcze w szacowaniu nieruchomości*, wyd. Educaterra, Olsztyn.

Hopfer A., R. Żróbek, S. Żróbek, 1999, *Szacowanie wartości nieruchomości podejściem dochodowym*, wyd. TWIGGER, Warszawa.

Konowalczuk J., T. Kurowska, L. Ostrowski, K. Urbańczyk, 2000, *Wycena nieruchomości rolnych*, PFSRM, Warszawa.

*Standardy Zawodowe Rzeczoznawców Majątkowych*, Praca pod red. Zdzisława Maleckiego, 2000, wyd. PFSRM, Warszawa.

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat. Examination (written and/or oral at the end of semester 7).

**LEVEL: D**

<b>Subject:</b> Basics of agriculture and land management	<b>Code:</b> 01.6-08-D/10	<b>Semester:</b> 4
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3

**Coordinator(s):** Professor Ryszard Cymerman, PhD.

**Organizational unit:** Department of Land Planning and Management.

**Status in the curriculum:** compulsory.

**Description:** Agriculture as a branch of production. Agrarian structure. Rural areas and their functions. The principles and tools of land management.

**Goals:** to familiarize students with one of the basic forms of land management.

**Teaching method:** Lectures and classes with the use of teaching aids.

**Assessment:** classes – tests with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Basics of forestry and forest management	<b>Code:</b> 01.6-08-D/11	<b>Semester:</b> 7
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 3,5

**Coordinator(s):** Andrzej Nowak, Associate Professor, PhD.

**Organizational unit:** Department of Land Planning and Management.

**Status in the curriculum:** compulsory.

**Description:** Forest, forest environment – concepts, characteristics and functions. Elements of forest typology. Spatial division (structure) of forests. Forest resources survey (inventory). The scope of surveying work in forests. Forest taxation. The principles of forest resources management, the scope of forest management work. Forest management documentation. The principles of determining the stand volume. Forest economy.

**Goals:** to discuss the principles of forest economy and drawing up forest management documentation.

**Teaching method:** lectures with visual aids: slides, transparencies; classes – a study of five topics.

**References:**

*Ustawa o lasach* (jednolity tekst Dz. U. nr 56/2000, poz. 679).

*Rozporządzenie MOŚZNiL w sprawie szczegółowych zasad sporządzania planu urządzenia lasu, uproszczonego sporządzania planu urządzenia lasu oraz inwentaryzacji stanu lasu* (Dz. U. nr 3/1999 poz. 16).

Czuraj M., 1972, *Urządzanie lasu: dla techników leśnych*, PWRiL, Warszawa.

**Assessment:** classes – test with a possibility of repeat, drawing up and defense of projects.

**LEVEL: D**

<b>Subject:</b> Banking and finance	<b>Code:</b> 04.3-08-D/13	<b>Semester:</b> 5
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 1

**Coordinator(s):** Andrzej Muczyński, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** The banking system and its organization. Banking operations and transactions: internal (active, passive) and external – description and characteristics. Money value calculation in time. Securities and their valuation. Analysis of balance, profit and loss account and cash flows at an enterprise. Indices of enterprise efficiency used for evaluation of financial liquidity, debt rate and profitability.

**Goals:** to discuss the basic forms of bank operation stimulating the activity of economic subjects, and the methods of evaluating the economic and financial position of these subjects.

**Teaching method:** lectures with visual aids: slides, transparencies; classes devoted to analyses and computations.

**References:**

Bień W., 1991, *Czytanie bilansu przedsiębiorstw*, Stowarzyszenie Księgowych w Polsce, Warszawa.

Bień A., W. Bień, 1996, *Kalkulacja ceny pieniądza w lokatach, pożyczkach i kredytach*, Difin, Warszawa.

Bień W., 1996, *Rynek papierów wartościowych*, Difin, Warszawa.

Dębniwska M., M. Tkaczuk, 1998, *Finanse w obrocie nieruchomościami*, Zachodnie Centrum Organizacji, Olsztyn-Zielona Góra.

Dobosiewicz Z., 1997, *Podstawy bankowości*, PWN, Warszawa.

**Assessment:** classes - test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Basics of econometrics	<b>Code:</b> 14.3-08-D/13	<b>Semester:</b> 8
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits: 5</b>

**Coordinator(s):** Zbigniew Paprzycki, PhD.

**Organizational unit:** Department of Applied Mathematics.

**Status in the curriculum:** compulsory.

**Description:** Econometric methods; the concept of model, model classifications, model selection and analysis, interpretation and use of models. Presentation of models typical of micro- and macroeconomic phenomena. Forecasting on the basis of econometric and adaptation models, and on the basis of time series analysis. Multi-equation models.

**Goals:** to familiarize students with methods used for the description, analysis and proper evaluation of the relationships observed in spatial economy and other fields of human activities.

**Preceding subjects:** economics, mathematics, computing methods in geodesy.

**Teaching method:** lectures; classes at a computerized laboratory, model creation and analysis.

**References:**

Goryl A., Z. Jędrzejczak, K. Kukuła i inni, 1996, *Wprowadzenie do ekonometrii w przykładach i zadaniach*, PWN, Warszawa.

Praca zbiorowa pod redakcją M. Cieślak, 1997, *Prognozowanie gospodarcze. Metody i zastosowania*, PWN, Warszawa.

Goldberger A. S., 1972, *Teoria ekonometrii*, PWE, Warszawa.

Welfe A., W. Welfe, 1996, *Ekonometria stosowana*, PWE, Warszawa.

**Assessment:** classes – test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Field training in cadastral surveys	<b>Code:</b> 07.6-08-D/15	<b>Semester:</b> Po 6
<b>Form:</b> Field training	<b>Number of hours/semester:</b> 30 classes	<b>Number of ECTS credits:</b> 2

**Coordinator(s):** Professor Stanisław Surowiec, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory.

**Description:** Cadastral surveys constitute the basis for the creation, keeping and updating (modernization) of land and building registers (cadastre). Modernization of land and building registers is especially important at present, due to the issuing of new provisions and regulation. Data on land, its owners and tenants are subject to revision and updating. New data on buildings and quarters are added. Data on land, its owners and tenants are updated from time to time (by surveying and analysis of land and mortgage registers, respectively), whereas data on buildings must be updated on a regular basis, especially in rural areas.

**Goals:** to familiarize students with the rules of gathering information necessary for the creation, keeping and updating (modernization) of land and building registers, as well as drawing up final documentation.

**Teaching method:** analysis of land and building registers, conducting surveys and making descriptions of land, buildings and quarters for the purposes of their registration (cadastre), drawing up reports.

**Assessment:** verification of the compliance of the reports drawn up by students with the relevant regulations and Instruction G-5/G-8/.

## 6.6. List of subjects taught during 1.5-year complementary master's studies

Field of studies: **GEODESY AND CARTOGRAPHY**

Majors: *geodesy and real estate valuation*

Subject	Code	Number of hours			ECTS credits	Assessment
		lectures	classes	total		
1	2	3	4	5	6	7
<b>1<sup>st</sup> year / 1<sup>st</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	FT
Economics	14.3-08-B/10	15	15	30	4	FT
Mathematics	11.1-08-B/11	15	30	45	5.5	FT
Electronic measuring techniques	07.6-08-C/28	-	30	30	3	FT
Higher geodesy	07.6-08-C/29	15	15	30	4	FT
Geodesy	07.6-08-C/31	15	30	45	5.5	E
Land information systems and thematic cartography	07.6-08-C/32	15	30	45	5.5	E
Remote sensing	07.6-08-D/20	15	30	45	5.5	FT
Valuation methods	07.6-08-D/22	15	15	30	4	FT
Field training in surveying	07.6-08-C/23	-	30	30	2	FT
Field training real estate valuation	07.6-08-D/26	-	30	30	2.5	FT
<b>1<sup>st</sup> year / 2<sup>nd</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	FT
Satellite geodesy	07.6-08-C/30	15	15	30	4	E
Law	10.0-08-C/33	15	15	30	4	FT
Real estate administration	07.6-08-D/21	15	15	30	4	E
Rural area management	07.6-08-D/23	15	15	30	4	FT
Technology of real estate valuation	07.6-08-D/25	15	30	45	5	E
Seminar	07.6-08-E/3	-	15	15	2	FT
<b>2<sup>nd</sup> year / 3<sup>rd</sup> semester</b>						
Foreign language	09.1-00-A/1	-	30	30	0	Z
Rural area management	07.6-08-D/23	15	15	30	1	Z
Enterprise valuation	04.9-08-D/24	15	30	45	2	E
Seminar	07.6-08-D/25	-	30	30	1	Z
Master's thesis	07.6-08-E/6	-	-	-	30	E

*FT* – the basis for assessment (getting credit) is a final test

*E* – the basis for assessment (getting credit) is an exam

***LEVEL A***

**LEVEL: A**

<b>Subject:</b> Foreign language	<b>Code:</b> 09.1-00-A/1	<b>Semester:</b> 1, 2, 3
<b>Form:</b> Classes	<b>Number of hours/semester</b> 30 classes	<b>Number of ECTS credits:</b> 0

**Coordinator(s):** lecturer in a given language.

**Organizational unit:** Foreign Language Study Center.

**Status in the curriculum:** compulsory.

**Description:** Learning of a chosen foreign language by gaining knowledge of its phonetic systems, grammatical structures and vocabulary at an elementary level, and improving language skills at an advanced level.

**Language of instruction:** chosen from among those taught at the University (English, Belarus, French, Spanish, German, Russian, Ukrainian).

**Goals:** to prepare students for both passive and active use of the language at an advanced level.

**References:** *depending on the level of advance.*

**Assessment:** final test.

**Registration required:** yes.

***LEVEL B***

**LEVEL: B**

<b>Subject:</b> Economics	<b>Code:</b> 14.3-08-B/10	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits: 4</b>

**Coordinator(s):** Stefan Strumiłło, PhD.

**Organizational unit:** Department of Economics.

**Status in the curriculum:** compulsory.

**Description:** Management as a decision-making process. Market microanalysis. Customer behavior. Producer behavior. Introduction to macroeconomics and national income account. National budget in a free-market economy. International trade.

**Goals:** to familiarize students with the basic concepts and problems of macroeconomics.

**Teaching method:** lectures.

**References:**

Begg D., 2001, *Ekonomia*, PWE, Warszawa.

Dębniewski G., R. Hryciuk, *Makroekonomia*

*Elementarne zagadnienia ekonomii*, praca zbiorowa pod red. R. Milewskiego, PWN  
Warszawa, 1997.

**Assessment:** test with a possibility of repeat

**LEVEL: B**

<b>Subject:</b> Mathematics	<b>Code:</b> 11.1-08-B/11	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5.5

**Coordinator(s):** Zofia Fiedorowicz, PhD.

**Organizational unit:** Department of Applied Mathematics.

**Status in the curriculum:** compulsory.

**Description:** Elements of differential geometry, paying particular attention to geometry of curves and surfaces. Regular surface projection. 1<sup>st</sup> and 2<sup>nd</sup> quadratic forms of surface. Surface curvature. Geodetic lines.

**Goals:** to study curves and surfaces from the perspective of geodetic and cartographic applications.

**References:**

Gdowski B., 1982, *Elementy geometrii różniczkowej z zadaniami*, PWN, Warszawa.  
Sikorski R., 1972, *Wstęp do geometrii różniczkowej*, PWN, Warszawa.

**Assessment:** classes – tests with a possibility of repeat.

*LEVEL C*

**LEVEL: C**

<b>Subject:</b> Electronic measuring techniques	<b>Code:</b> 07.6-08-C/28	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 30 classes	<b>Number of ECTS credits: 3</b>

**Coordinator(s):** Andrzej Wanic, Associate Professor, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Mechanical-optical systems of engineering and precision leveling instruments and theodolites with various reading/registration systems. Electronic distance measurement (impulse and phase methods). Total stations. Electronic angle-measurement systems (code, impulse, dynamic). Electromagnetic wave propagation in the atmosphere. Lasers. Wall marks.

**Goals:** to familiarize students with the operation of mechanical-optical systems of engineering and precision leveling instruments and theodolites, their calibration and adjustment, automatic data registration in total stations, and their transmission to the computer.

**Preceding subjects:** geodesy.

**Teaching method:** classes with audiovisual aids: slides, transparencies and video tapes.

**References:**

Plątek A., 1991, *Geodezyjne dalmierze elektromagnetyczne i tachymetry elektroniczne. Część I: geodezyjne dalmierze elektromagnetyczne do pomiarów terenowych*, PPWK, Warszawa-Wrocław.

Plątek A., 1992, *Geodezyjne dalmierze elektromagnetyczne i tachymetry elektroniczne. Część II: optyczne dalmierze interferencyjne, teodolity i tachymetry elektroniczne*, PPWK, Warszawa – Wrocław.

Tatańczyk J. 1994, *Wybrane zagadnienia z instrumentoznawstwa geodezyjnego*, AG-H, Kraków.

Tatańczyk. J. 1977, *Nowe konstrukcje geodezyjnych przyrządów kątomierzowych*, AG-H, Kraków.

Wanic A. 1998, *Instrumentoznawstwo geodezyjne. Przewodnik do ćwiczeń, Część I*. Wydanie II, AR-T, Olsztyn.

Wanic A., 1997, *Instrumentoznawstwo geodezyjne. Przewodnik do ćwiczeń. Część II*, AR-T, Olsztyn.

Ząbek J. i in., 1984, *Ćwiczenia z geodezji I*, PWN, Warszawa.

**Assessment:** tests (theoretical and practical) in the operation of optical and electronic measuring instruments.

**LEVEL: C**

<b>Subject:</b> Higher geodesy	<b>Code:</b> 07.6-08-C/29	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory.

**Description:** The problems and purposes of higher geodesy. Figure of the Earth. Gravity field. Disturbances in the gravity field. Precise leveling. Spheroid geometry. Curves on the ellipsoid surface. Determination of geodetic coordinates on the ellipsoid. Correlation between geodetic and astronomical coordinates. Ellipsoid projection on the plane. TM, UTM and Gauss-Kruger projections, projective reductions. Systems of state coordinates. Primary (fundamental, basic) horizontal and vertical geodetic control networks. Modernization of geodetic networks in Poland. The creation, keeping and updating of spatial information systems.

**Goals:** to extend knowledge about the figure of the Earth, systems of coordinates and their transformations.

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes including field training.

**References:**

Czarnecki K., 1995, *Geodezja współczesna*, Wiedza i Życie, Warszawa.  
*Geodezja wyższa i astronomia geodezyjna*, Praca zbiorowa, PWN, Warszawa-Wrocław, 1981.  
*Niwelacja precyzyjna*, Praca zbiorowa, PPWK, Warszawa-Wrocław, 1993.  
*Ćwiczenia z geodezji wyższej*, Praca zbiorowa, PWN, Warszawa, 1974.  
*Geodezja wyższa i astronomia geodezyjna. Zadania i Przykłady*, Praca zbiorowa pod red. Romana Hlibowickiego, PWN, Wrocław, 1988.

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat.

**LEVEL: C**

<b>Subject:</b> Satellite geodesy	<b>Code:</b> 07.6-08-C/30	<b>Semester:</b> 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Stanisław Oszczak, PhD.

**Organizational unit:** Department of Satellite Geodesy and Navigation.

**Status in the curriculum:** compulsory.

**Description:** The use of satellite systems in geodesy and navigation. Reference systems. Satellite orbits. Determination of satellite position on the basis of satellite ephemerides. Satellite signal structure. Observation data. Absolute methods and the DGPS and their use for the purposes of spatial information systems. Practical geodetic surveys - GPS. Field observation procedure. Coordinate transformations. Mathematical models of coordinate determination. Observation post-processing. GPS network adjustment and coordinate transformation to local systems. Methods of real-time positioning: DGPS and RTK. The future of GPS.

**Goals:** to discuss the principles of satellite positioning (GPS) for geodetic and navigation purposes.

**Preceding subjects:** geodesy

**Teaching method:** lectures with visual aids: slides, transparencies; practical classes including field training.

**References:**

A. Leick, 1996, *GPS Satellite Surveying*, J Wiley & Sons.  
Hofmann-Wellenhof B., H. Lichtenegger and J. Collins, 1997, *GPS Theory and Practice*.  
Czarnecki K., 1995, *Geodezja współczesna*, Wiedza i Życie, Warszawa.

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat. Examination at the end of semester 2.

**LEVEL: C**

<b>Subject:</b> Geodesy	<b>Code:</b> 07.6-08-C/31	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5.5

**Coordinator(s):** Mirosław Grala, PhD.

**Organizational unit:** Institute of Geodesy.

**Status in the curriculum:** compulsory.

**Description:** Geodetic surveys of special-purpose structures. Geodetic monitoring of displacement for the purposes of building engineering. Quantity surveys of construction elements and units of structures. Procedures of building surveys from the perspective of diagnostic needs and international standardization. The problem of automation in geodesy and surveying.

**Goals:** to familiarize students with the formal requirements that must be met by surveyors in the case of special-purpose investments, including the techniques applied and the course of works.

**Preceding subjects:** geodesy.

**Teaching method:** lectures with visual aids: slides, transparencies, cartographic materials and projects; classes at a laboratory, field training.

**References:**

Opracowanie monograficzne pod redakcją W. Prószyńskiego, *Geodezyjny monitoring przemieszczeń podczas wznoszenia obiektów w głębokich wykopach*.

Praca zbiorowa pod red. Jana Gocęła, 1994, *Geodezja inżynierska, t. I, II, III, IV*, PPWK, Warszawa.

Jasiak A., H. Lelonkiewicz, M. Wójcik, I. Wyczałek, 1999, *Pomiary inżynierskie*, Wydawnictwo Politechniki Poznańskiej.

**Assessment:** classes – drawing up and defense of projects, test with a possibility of repeat. Examination (written) at the end of semester 1.

**LEVEL: C**

<b>Subject:</b> Land information systems and thematic cartography	<b>Code:</b> 07.6-08-C/32	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5.5

**Coordinator(s):** Professor Stanisław Surowiec, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory.

**Description:** spatial information systems, GIS.

**Goals:** to familiarize students with the principles of creating spatial information systems and the GIS.

**Preceding subjects:** geodesy, land registration, computer science, cartography.

**Teaching method:** lectures with audiovisual aids: slides, transparencies, video projections; classes at a computerized laboratory.

**References:**

Gaździcki J., 1990, *Systemy Informacji Przestrzennej*, PPWK.

Gaździcki J., 1995, *Systemy Katastralne*, PPWK.

Rybiński H., 1993, *Bazy Danych*, Akademicka Oficyna Wydawnicza.

Banachowski L., 1998, *Bazy Danych*, Akademicka Oficyna Wydawnicza.

Zabrodzki J., 1994, *Grafika komputerowa*, Wydawnictwa Naukowo-Techniczne, Warszawa.

Kistowski M., 1997, *Systemy Informacji Geograficznej*, Bogucki Wydawnictwo Naukowe.

**Assessment:** classes – test with a possibility of repeat.  
Examination at the end of semester 1.

**LEVEL: C**

<b>Subject:</b> Law	<b>Code:</b> 10.0-08-C/33	<b>Semester:</b> 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Romuald Waśniewski, PhD.

**Organizational unit:** Faculty of Law and Administration.

**Status in the curriculum:** compulsory.

**Description:** Types and characteristics of ownership transformations in State-owned agricultural real properties (holdings). Legal bases of land consolidation and land protection; insurance of farm buildings.

**Goals:** to familiarize students with property rights and legal regulations in the field of geodesy and cartography.

**Teaching method:** lectures, auditory classes.

**References:**

Ignatowicz J., 1997, *Prawo rzeczowe*, PWN, Warszawa.

**Assessment:** classes – test with a possibility of repeat.

***LEVEL D***

**LEVEL: D**

<b>Subject:</b> Remote sensing	<b>Code:</b> 07.6-08-D/20	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5.5

**Coordinator(s):** Marek Mróz, PhD.

**Organizational unit:** Department of Photogrammetry and Remote Sensing.

**Status in the curriculum:** compulsory.

**Description:** Physical bases of remote sensing. Energetic photometry. Basic notions of energetic photometry. "Atmospheric windows". Spectral characteristics of selected objects (soil, plants, water) in the visible, near and middle infrared. Photographic registration in the visible range and near infrared. Photointerpretation. Principles and methodology of photointerpretation. Photographic techniques. Additive and subtractive color creation. Interpretation of images generated by various techniques. The formation of a satellite digital image. Types of imaging systems and their geometry. Stages of sensing. Satellite systems. Thermal infrared. Applications for agricultural and environmental purposes. Digital processing of satellite images. Image visualization. Global and local transformations. Color compositions "false color, pseudo-natural colors". Computer-aided photointerpretation. Geometric correction of digital satellite images. Classification of multispectral images. The use of satellite images in agriculture, forestry, spatial planning and the GIS.

**Goals:** to familiarize students with the basics of remote sensing image registration and processing, and applications of remote sensing techniques.

**Preceding subjects:** mathematics, physics, computing methods in geodesy, photogrammetry and remote sensing.

**Teaching method:** lectures with audiovisual aids and multimedia technologies; classes – practical application of selected methods of image processing and drawing up thematic maps.

**References:**

- Ciołkosz A., J. Miszański, J. R. Olędzki, 1999, *Interpretacja zdjęć lotniczych i satelitarnych*, PWN, Warszawa.
- Ciołkosz A., Kęsik, 1989, *Teledetekcja satelitarna*, PWN, Warszawa.
- Sitek Z., 1992, *Zarys teledetekcji lotniczej i satelitarnej*, Wydawnictwo AG-H, Kraków.
- Sitek Z., 1997, *Wprowadzenie do teledetekcji lotniczej i satelitarnej: pozyskiwanie danych, przetwarzanie danych*, Wydawnictwo AG-H, Kraków.

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Real estate administration	<b>Code:</b> 07.6-08-D/21	<b>Semester:</b> 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Radosław Wiśniewski, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory

**Description:** Fees and payments connected with real estates. Rights in property in real estate administration (the Civil Code, the Law on Land Management and Real Estate Administration, other regulations). The rights concerning real estates and their relationships. The systemic approach to real estate administration. Systems of information about the city and its resources (economic zones, economic subjects in real estate management and administration, the principles of conflict solving in urban areas). The assumptions of individual and mass valuation and the application of their results. Cadastral (fiscal) value. Cost-benefit analysis of developmental projects. City management – rules and detailed procedures.

**Goals:** to familiarize students with the legal and economic bases of real estate administration in urban areas.

**Preceding subjects:** law, technologies of real estate valuation.

**Teaching method:** lectures with visual aids: slides, transparencies; classes, including seminars.

**References:**

Bieniek G. i inni., 2000, *Komentarz do ustawy o gospodarce nieruchomościami*, ZCO, Zielona Góra.

Kuryj J., R. Wiśniewski, R. Żróbek (red.), 2000, *Gospodarka nieruchomościami*, wydawnictwo UWM w Olsztynie.

Ignatowicz J., 1997, *Prawo rzeczowe*, PWN Warszawa.

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat. Examination (written and/or oral) at the end of semester 2.

**LEVEL: D**

<b>Subject:</b> Valuation methods	<b>Code:</b> 07.6-08-D/22	<b>Semester:</b> 1
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 4

**Coordinator(s):** Professor Sabina Żróbek, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory

**Description:** Legal acts concerning real estate valuation. Professional standards of property appraisers. Individual value versus market value. The application of the residual method. Sensitiveness analysis. Determination of the mortgage-lending value of a real estate. The concept of common taxation. Legal and technical procedures of determining the cadastral value.

**Goals:** to familiarize students with currently binding legal acts and professional standards; to discuss the specific character of valuation for the needs of mortgage banks and for the purposes of ad valorem tax calculation.

**Teaching method:** lectures with audiovisual aids; classes with the use of computers and software.

**References:**

*Ustawa z dnia 21 sierpnia 1997 roku o gospodarce nieruchomościami* (Dz.U. Nr 115/97 z późniejszymi zmianami)

*Ustawa z dnia 29 sierpnia 1997 roku o listach zastawnych i bankach hipotecznych* (Dz.U. Nr 140/97).

*Rozporządzenie z 7 lipca 1998 roku w sprawie szczegółowych zasad szacowania nieruchomości oraz zasad i trybu sporządzania operatu szacunkowego* (Dz.U. Nr 98/98)

Hopfer A., R. Żróbek, S. Żróbek, 1999, *Wartość dochodowa w szacowaniu nieruchomości*, wyd. TWIGGER, Warszawa.

**Assessment:** classes – drawing up and defense of projects, test with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Rural area management	<b>Code:</b> 07.6-08-D/23	<b>Semester:</b> 2, 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester</b> 15 lectures/15 classes	<b>Number of ECTS credits:</b> 4+1

**Coordinator(s):** Professor Stanisław Surowiec, PhD.

**Organizational unit:** Department of Rural Surveying and Cadastre.

**Status in the curriculum:** compulsory.

**Description:** Common agricultural policy in the European Union versus the development of agrarian structures in the member states. Prospects for rural area development and land management in Poland in the pre-accession period and after joining the structures of the European Union. The purposes, strategies and priorities of using the funds from the programs Phare and Sapard in Poland. The prospective role of regional and structural policy of the European Union and Poland in the development of agrarian structures in rural areas. Land management in Poland – the activities of the State Treasury Agency for Agricultural Property and the Agency for the Modernization and Restructuring of Agriculture.

**Goals:** to discuss the problems connected with agriculture restructuring in Poland and our integration with the European Union.

**Preceding subjects:** land information systems and thematic cartography.

**Teaching method:** lectures with visual aids: slides, transparencies; classes in small groups, with the use of descriptive and cartographic materials, site inspections.

**References:**

Adamowicz M., 1994, *Rolnictwo w procesie integrowania Polski z Unią Europejską. T. 2, Instytucje rolnicze w procesie przeobrażeń rynkowych*, Szkoła Główna Gospodarstwa Wiejskiego, Warszawa.

Czykier-Wierzba D., 1995, *Rolnictwo polskie a integracja z Unią Europejską*, Wydawnictwo Uniwersytetu Gdańskiego.

*Ustawa z dnia 19.10.1991 r. o gospodarowaniu nieruchomościami rolnymi Skarbu Państwa*

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat.

**LEVEL: D**

<b>Subject:</b> Enterprise valuation	<b>Code:</b> 04.9-08-D/24	<b>Semester:</b> 3
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 2

**Coordinator(s):** Andrzej Muczyński, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** Types of economic subjects and the principles of their establishment. The purposes of enterprise valuation and types of value estimated. Methods of economic subject valuation on the basis of material substance valuation. The income and combined methods in enterprise valuation. Valuation on the basis of quotation on the capital market.

**Goals:** to familiarize students with the basic principles and methods of enterprise valuation.

**Preceding subjects:** methods of real estate valuation, technology of real estate valuation.

**Teaching method:** lectures with visual aids: slides, transparencies; classes in small groups, with the use of descriptive and analytical materials.

**References:**

Kufel, M., 1992, *Metody wyceny przedsiębiorstw*. PWN, Warszawa.

Bień, W., 1997, *Ocena efektywności finansowej spółek prawa handlowego*. Finans Serwis, Warszawa.

Sierpińska M., T. Jachna, 1998, *Ocena przedsiębiorstw według standardów światowych*, Wyd. III, PWN, Warszawa.

**Assessment:** classes – drawing up and defense of projects, test with a possibility of repeat. Examination (written) at the end of semester 3.

**LEVEL: D**

<b>Subject:</b> Technology of real estate valuation	<b>Code:</b> 07.6-08-D/25	<b>Semester:</b> 2
<b>Form:</b> Lectures, classes	<b>Number of hours/semester:</b> 15 lectures/30 classes	<b>Number of ECTS credits:</b> 5

**Coordinator(s):** Janusz Jasiński, PhD.

**Organizational unit:** Department of Land Management and Regional Development.

**Status in the curriculum:** compulsory.

**Description:** Procedures of real estate valuation taking into account special conditions. The effect of environmental factors on real estate valuation. Real estate valuation for insurance purposes. Valuation of foreign property. Valuation of land designed for highway construction. Valuation of historical monuments. Valuation of land occupied by electrical equipment and electrically-operated devices.

**Goals:** to familiarize students with the procedures of real estate valuation, practical valuation of special-purpose real estates.

**Preceding subjects:** valuation methods.

**Teaching method:** lectures with visual aids: slides, transparencies, with the use of building valuation catalogues; classes.

**References:**

*Standardy zawodowe rzeczoznawców majątkowych*, Praca zbiorowa pod red, Zdzisława Małeckiego, PFSRM, Warszawa, 2000.

*Ustawa z dnia 21.08.1997 r. o gospodarce nieruchomościami*, jednolity tekst z 2000 r., Dz. U. Nr 46, poz. 543.

*Rozporządzenie Rady Ministrów z dnia 07.07.1998 r. w sprawie szczegółowych zasad wyceny nieruchomości oraz zasad i trybu sporządzania operatu szacunkowego.*

**Assessment:** classes – drawing up and defense of projects, tests with a possibility of repeat. Examination (written or oral) at the end of semester 2.