MODULE SPECIFICATION

Module code	
Module title in Polish	**Geodezja wyższa i astronomia geodezyjna**
Module title in English	**Geodesy and Geodetical Astronomy**
Module running from the academic year	**2016/2017**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Surveying and Cartography**
Level of qualification	first cycle (first cycle, second cycle)
Programme type	academic (academic/practical)
Mode of study	full-time (full-time/part-time)
Specialism	All
Organisational unit responsible for module delivery	The Department of Geotechnical Engineering, Geomatics and Waste Management
Module co-ordinator	Prof. Jacek Szewczyk, PhD hab., Eng.
Approved by:	Ryszard Florek-Paszkowski, PhD, Eng.

B. MODULE OVERVIEW

Module type	core module (core/programme-specific/elective HES*)
Module status	compulsory module (compulsory/optional)
Language of module delivery	English
Semester in the programme of study in which the module is taught	semester 5
Semester in the academic year in which the module is taught	**Winter semester** (winter semester/summer semester)
Pre-requisites	None (module code/module title, where appropriate)
Examination required	**Yes** (Yes/No)
ECTS credits	4

* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per	**30**	**15**			

semester					

Politechnika Świętokrzyska
al. Tysiąclecia Państwa Polskiego 7; 25-314 Kielce
tel.: 41 34 24 850, fax: 41 34 42 860
e-mail: wisge@tu.kielce.pl

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to acquire knowledge and skills as regards basic problems of advanced geodesy which covers, e.g. the issues of preparing surveys for large areas; familiarising students with the impact of the gravity field on the results of surveys, height systems as well as spatial reference systems.

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student has knowledge as regards the scope of basic surveying problems; a student is also able to correctly define basic notions referring to advanced geodesy and geodetic astronomy (including spherical trigonometry and time scales and systems).	l/c	GiK_W01, GiK _W10	T1 A_W01
W_02	A student has systemised theoretical knowledge, which is necessary to understand and realise calculations concerning the understanding and realisation of calculations in terms of spherical surveying and geodetic astronomy.	l/c	GiK _W15	T1A_W03, T1A_W04, T1A_W05, TA1_W07
W_03	A student has knowledge on the issues concerning advanced geodesy in surveying practice.	l/c	GiK _W10	T1A_W03
W_04	A student has knowledge on physical geodesy which concerns the gravity field of the Earth as well as tidal phenomena and height systems; furthermore, a student has basic knowledge on the magnetic field of the Earth; in addition, a student knows the principles of taking absolute and relative gravimetric surveys.	l/c	GiK _ W31	T1A_W03, T1A_W04, T1A_W05, TA1_W07
U_01	A student is capable of converting coordinates between spherical, spatial, and cartographic systems; moreover, a student can make an optimal selection of cartographic projection.	l/c	GiK _U10	T1A_U07, T1A_U08
U_02	A student is able to prepare and realise the algorithms to solve a determined surveying problem.	l/c	GiK _U16	T1A_U08, T1A_U13
U_03	A student is able to utilise relative gravimetric measurements, calculate gravimetric reductions and anomalies; furthermore, a student can calculate systemic levelling and tidal corrections for surveys.	l/c	GiK _ U27	T1A_U16
K_01	A student understands the necessity and knows the possibilities of continuous education and raising his/her professional, personal, and social competences.	l/c	GiK _K01	T1A_K01
K_02	A student is aware of the necessity of self-betterment as well as acting in a professional and responsible manner according to the principles of professional ethics.	l/c	GiK _K02	T1A_K01, T1A_K02, T1A_K05, T1A_K07

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1	Introduction, an outline of the research concerning advanced geodesy. Basic notions and definitions.	
2	Spherical trigonometry. Spherical and Cartesian coordinates (together with the relationships	

	between them).	
3	An ellipsoid. Parameters describing it. Coordinate systems on an ellipsoid. Normal sections and main curvature radiuses. Euler's formula.	
4	Meridians and parallels on an ellipsoid, a geodesic line and its differential equation.	
5	The elements of physical geodesy. Field of gravity as its significance in engineering practice. Tidal phenomena. Magnetic field.	
6	Actual and normal field of gravity. Normal acceleration, anomalies and gravimetric reductions. The concept of a geoid.	
7	Gravimetric surveys. Relative and absolute deviations for the vertical line. Basic surveying equation. The methods of determining distances of a geoid from an ellipsoid.	
8	The concept of a geopotential number. Height systems (geopotential, dynamic, and orthometric). Molodensky's systems of normal heights and a normal correction. Levelling control network in Poland in survey results concerning displacement field for the area of Poland.	
9	Introduction to geodetic astronomy (basic notions and definitions). A systems of astronomic coordinates (a horizontal, hourly, and equinox one). The astronomical triangle and the phenomena of a daily motion.	
10	Solar and sidereal time, atomic time scales. The application of time scale in surveying practice.	
11	Astronomical refraction, diel and annual parallax, annual aberration. The phenomena connected with the rotational and vortex motion of the Earth, precession and nutation, and pole motion.	
12	Spatial reference system. ITRS and ETRS systems. The ITRF and ETRF system. Basic geodetic horizontal in Poland.	

2. Topics to be covered in the classes

No.	Topics	Module outcome code
1.	**Spherical trigonometry:** - basic formulas concerning spherical trigonometry - solving spherical triangles - coordinate calculus on a sphere	
2.	**Coordinate systems on a sphere and ellipsoid:** - converting coordinates between the following systems (Cartesian, geographical, and azimuth) - converting coordinates between the following systems (geodetic, geocentric, and topocentric)	
3.	**Geometry of an ellipsoid:** - determining basic ellipsoid parameters - calculating mean values of curvature radiuses and mean curvature radius - calculating the length of a meridian and parallel arch	
4.	**Earth field of gravity:** - relative gravimetric surveys - calculating the value of standard acceleration - calculating acceleration gradient in the field of gravity - calculating acceleration reduction	
5.	**Height systems in levelling:** - calculating the following corrections (dynamic, orthometric, and standard in precision levelling)	
6.	**The elements of geodetic astronomy:**	

	- solving tasks connected with the phenomena resulting from diel motion - basic calculations as regards geodetic astronomy - converting solar and sidereal time	
7.	**The elements of satellite geodesy:** - the equations of motion concerning artificial satellites - integrating GNSS survey and levelling results	

Assessment methods

Module outcome code	**Assessment methods** *(Method of assessment; for module skills − reference to specific project, laboratory and similar tasks)*
W_01	A test during the classes and reports during the classes
W_02	An examination and a test during the classes
W_03	An examination
W_04	An examination and a test during the classes
U_01	A test during the classes and reports during the classes
U_02	A test during the classes and an examination
U_03	A test during the classes and an examination
K_01	A test during the classes, reports during the classes, and a discussion with students
K_02	Reports during the classes, common reports, and a discussion with students

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**30**
2	Contact hours: participation in classes	**15**
3	Contact hours: participation in laboratories	
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**3**
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	**2**
8		
9	**Number of contact hours**	**50** *(total)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**2**
11	Private study hours: background reading for lectures	**7**
12	Private study hours: preparation for classes	**7**
13	Private study hours: preparation for tests	**7**
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	**20**
18	Private study hours: preparation for an examination	**9**
19		
20	**Number of private study hours**	**50***(total)*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**2**
22	**Total study time**	**100**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**4**
24	**Number of practice-based hours** *Total practice-based hours*	**0**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**0**

E. READING LIST

References	1. Heiskanen W.A., Moritz H., *Physical Geodesy*. Institute of Physical Geodesy, Technical University, Graz, 1981. 2. Moritz H., *The Figure of the Earth*, Herbert Wichmann Verlag GmbH, Karlsruhe 1990. 3. Torge W., *Gravimetry*, Walter de Gruyter, Berlin, New York, 1989.
Module website	