Selected problems in Geomatics

Course description sheet

Basic information

Field of study Geodesy, Surveying and Cartography **Major** Processing and geodata analysis **Organisational unit** Faculty of Geo-Data Science, Geodesy, and Environmental Engineering **Study level** Second-cycle (engineer) programme **Form of study** Full-time studies **Profile** General academic	**Didactic cycle** 2024/2025 **Course code** DGIKGMS.IIi4.00864.24 **Lecture languages** English **Mandatoriness** Obligatory **Block** Major Modules **Course related to scientific research** Yes

Course coordinator	Marcin Ligas
Lecturer	Marcin Ligas

Period	**Method of verification of the learning outcomes**	**Number of ECTS credits**
Semester 3	Completing the classes **Activities and hours** Auditorium classes: 30	3

Goals

C1	By the end of the course, the student should be familiar with scientific (also day-to-day, practical) vocabulary used in geodesy and relative disciplines. The course is a form of a reminder of basic problems encountered in geodesy/geomatics. One of the objectives is also to awake students' self-confidence in professional English.

Course's learning outcomes

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
Skills – Student can:			
U1	prepare a documented study of fundamental problems of geodesy and cartography, and present them orally in English	GIK2A_U01, GIK2A_U02	Participation in a discussion, Scientific paper, Presentation
U2	acquire, integrate and interpret information from the English-language literature on problems from physical geodesy, satellite geodesy, adjustment calculus and other aspects of broadly understood Geomatics	GIK2A_U01	Activity during classes, Scientific paper, Presentation
Social competences – Student is ready to:			
K1	broaden his or her current knowledge and understanding of the need for continuous self-education and self-development training	GIK2A_K01	Project, Report
K2	especially the improvement of language in terms of professional terminology	GIK2A_K01	Project, Report

Program content ensuring the achievement of the learning outcomes prescribed to the module

The purpose of this module is to provide a student with professional terminology from various fields of broadly understood geodesy/geomatics.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Auditorium classes	30
Preparation for classes	10
Realization of independently performed tasks	10
Preparation of project, presentation, essay, report	25
Contact hours	5
Student workload	**Hours** 80
Workload involving teacher	**Hours** 30

* hour means 45 minutes

Program content

No.	Program content	Course's learning outcomes	Activities
1.	The law of gravitation, The Newtonian potential of a body (Newtonian potential for bodies of simple geometrical form), Geopotential, level surfaces and plumb lines Height systems (orthometric, normal, dynamic), gravimetric reductions Adjustment of level nets, observation equations, unweighted and weighted cases (the method of least squares) Coordinate transformations, two - dimensional conformal and two - dimensional affine coordinate transformation, statistical inference on validity of transformation parameters Basics of satellite orbital motion, Kepler's laws, orbit parameters, perturbations Global Positioning System (GPS), space segment, control segment, GPS observables and data processing Geostatistical methods of interpolation (in connection to classes on Advanced Methods of Spatial Analysis), terminology on kriging ** The proper part of classes may be preceded by a short listening exercise.	U1, U2, K1, K2	Auditorium classes

Extended information/Additional elements

Teaching methods and techniques :

E-learning, Discussion, Work with source text

Activities	Methods of verification	Credit conditions
Audit. classes	Activity during classes, Participation in a discussion, Project, Report, Scientific paper, Presentation	

Additional info

Komunikacja ze studentami może odbywać się również przez uczelnianą platformę Office (Teams) lub jej bieżący odpowiednik a część zajęć może być prowadzona zdalnie.

Conditions and the manner of completing each form of classes, including the rules of making retakes, as well as the conditions for admission to the exam

Up to two absences are allowed. Assignments are mandatory to get credit and should be submitted on the set dates. Delays will result in lowering the grade. If a student has received a failing grade and has not completed the course in a primary term, he or she may be reassessed twice. A make – up assessment will have a written form and will encompass the entire presented material. The lecturer sets proper terms and conditions of reassessment.

Method of determining the final grade

oral presentation, vocabulary test, active participation, reading and understanding skills

Manner and mode of making up for the backlog caused by a student justified absence from classes

The way and mode of catching up on project classes resulting from the student’s absence will be determined individually.

Prerequisites and additional requirements

Basic knowledge of English

Rules of participation in given classes, indicating whether student presence at the lecture is obligatory

Auditorium classes: Studenci przystępując do ćwiczeń są zobowiązani do przygotowania się w zakresie wskazanym każdorazowo przez prowadzącego (np. w formie zestawów zadań). Ocena pracy studenta może bazować na wypowiedziach ustnych lub pisemnych w formie kolokwium, co zgodnie z regulaminem studiów AGH przekłada się na ocenę końcową z tej formy zajęć.

Literature

Obligatory

1. Hofmann-Wellenhof B., Moritz H.: Physical Geodesy, 2006, Springer.
2. Wolf P. R., Ghilani C. D.: Adjustment Computations: Statistics and Least Squares in Surveying and GIS, 1997, Wiley-Interscience
3. Strang G., Borre K., Linear algebra, Geodesy and GPS, 1997, Wellesley - Cambridge Press

Scientific research and publications

Publications

1. Marcin LIGAS, Cartesian to geodetic coordinates conversion on a triaxial ellipsoid, Journal of Geodesy, 2012, vol. 86 iss. 4, s. 249–256.
2. Marcin LIGAS, Various parametrizations of ”latitude” equation – Cartesian to geodetic coordinates transformation, Journal of Geodetic Science, 2013, vol. 3 no. 2, s. 87–94.
3. Marcin LIGAS, Dominik Prochniewicz, Procrustes based closed-form solution to the point-wise weighted rigid-body transformation in asymmetric and symmetric cases, Journal of Spatial Science, 2021 vol. 66 iss. 3, s. 445–457.
4. Maciej MICHALCZAK, Marcin LIGAS, Kriging-based prediction of the Earth's pole coordinates, Journal of Applied Geodesy, 2021 vol. 15 iss. 3, s. 233-241.
5. Marcin LIGAS, Błażej Łucki, Piotr BANASIK, A crossvalidation-based comparison of kriging and IDW in local GNSS/levelling quasigeoid modelling, Reports on Geodesy and Geoinformatics, 2022 vol. 114 iss. 1, s. 1–7.
6. Maciej MICHALCZAK, Marcin LIGAS, The (ultra) short term prediction of length-of-day using kriging, Advances in Space Research, 2022 vol. 70 iss. 3, s. 610-620.

Learning outcomes prescribed to a field of study

Code	Content
GIK2A_K01	działania w sposób kreatywny i przesiębiorczy z uwzględnieniem krytycznej oceny posiadanej wiedzy i potrzeby konsultacji eksperckich
GIK2A_U01	pozyskiwać, integrować i interpretować specjalistyczne informacje z literatury polskiej i obcej oraz z baz danych, szczególnie w zakresie geodezji i kartografii oraz formułować krytyczne oceny i wyczerpujące opinie
GIK2A_U02	przygotować opracowanie naukowe w języku polskim i krótką informację naukową w języku obcym, przedstawiające wyniki własnych badań naukowych oraz przygotować i przedstawić prezenetację zagadnień z zakresu geodezji i kartografii oraz wybranych zagadnień specjalistycznych