

Satellite geodesy and project ETG5140

ECTS credits: **6 EAP**

assessment form: **exam**

Course aims

Review the usage of extraterrestrial objects and satellite technologies for geodetic positioning. The emphasis is on the applications of the principles and methods of contemporary global navigational satellite systems (GNSS).
To provide practical skills for performing geodetic GNSS (global navigational satellite system) measurements, data processing and reporting.

The content of the course:

Coordinate and time systems. Absolute and relative positioning. TRANSIT, VLBI, SLR, GPS, GLONASS; GALILEO. Components of navigational systems. Doppler's effect. GPS satellite signal and its processing. Pseudorange, code and carrier phase measurements. Cycle slips. Observation equations, differencing. GPS receivers and antennas. Kepler's laws. Satellite orbits and disturbances. Data formats. Almanacs and ephemerides. Static and kinematic GPS measurements. Data processing software and its usage. Usage of GNSS permanent stations. Requirements for the reporting on GNSS works. Satellite technology for establishing modern geodetic networks.
GNSS heighting, relevant geoid models.

Homework and practical assignments on the following general topics:

- 1) Data formats of the satellite measurement output files
- 2) Computing visibility of GPS satellites
- 3) Employing Kepler's parameters for computing the position of a satellite in different time epochs.
- 4) Computing absolute position of a point and estimating its accuracy

Compile and defend course project on the topic of establishment of modern geodetic networks. The project contains: static, rapid static and RTK-GPS measurements and data processing; utilizing GNSS data from GPS permanent stations, measurements, data processing and reporting on GNSS works.

Learning outcomes (basic level):

A successful student :

1. Explains the basics of various space technologies for geodetic positioning
2. Able to carry out static, kinematic and real time kinematic (RTK) GPS measurements and data processing (if needed utilises the GNSS networks), compile relevant technical reports
3. Knows and uses the basics of establishing, measuring and data processing of modern geodetic networks.

Learning outcomes	Grading method	Evaluation criteria
1. Explains the basics of various space technologies for geodetic positioning	Oral test and evaluation of the home assignment	Pass/fail assessment <i>The threshold corresponds to the basic level</i> Solution of home assignments: 1) Data formats of the satellite measurement output files 2) Computing visibility of GPS satellites 3) Employing Kepler's parameters for computing the position of a satellite in different time epochs. Adequate explanation of solving the assignments.
2. Able to carry out static, kinematic and real time kinematic (RTK) GPS measurements and data processing (if needed utilises the GNSS networks), compile relevant technical reports	Evaluation of the laboratory practice and home assignment	Pass/fail assessment <i>The threshold corresponds to the basic level</i> Solution of home and laboratory assignments: 1) Computing absolute position of a point and estimating its accuracy 2) static, rapid static and RTK-GPS measurements and data processing; utilizing GNSS data from GPS permanent stations. Adequate explanation of solving the assignments.
3. Knows and uses the basics of establishing, measuring and data processing of modern geodetic networks.	Oral test and evaluation of the home assignment	Pass/fail assessment <i>The threshold corresponds to the basic level</i> Compile and defend course project on the topic of establishment of modern geodetic networks. The project contains: static, rapid static and RTK-GPS measurements and data processing; utilizing GNSS data from GPS permanent stations, measurements, data processing and reporting on GNSS works.
	Preconditions of the assessment	Passing of the home/practical assignments and a successful defence of the course

		project are the exam prerequisite.
	Formation of the final grade	<p>The grade (0 to 5) of the exam depends on the adequacy of the answers. The examination result forms 100% of the overall grade</p> <p>The written final exam comprises practical computations and the theoretical questions. Flawless solution of each examination task provides the maximum amount of points (that is noted on the examination sheet). Insignificant shortages and miscalculations mistakes in answers are allowed, however, these reduce the amount of points proportionally.</p> <p>However, failed or less than 50% complete answers yield 0 points for the examination task in question.</p> <p>The examination is passed if both of the following conditions are fulfilled:</p> <ul style="list-style-type: none"> a) At least 50% of computational tasks have been solved b) At least 50% of textual/theoretical tasks have been answered <p>Thereafter the points are added up and the final grade is calculated as follows. If the sum of points is: 50 – 60, the mark is “1”; 61 – 70, the mark is “2”, (corresponds to the basic threshold) 71 – 80, the mark is “3”, 81 – 90, the mark is “4”, 91 and more, the mark is “5”.</p>