

## **Syllabus Geomatics 2023-24**

### **Course Aim:**

The course enables students to learn the fundamentals of geospatial data, allowing them to manage georeferenced data with a focus on cartographic coordinates by means of a Geographic Information System (GIS). It will provide fundamentals of geodesy and map projection to give the students specific knowledge about global and local geodetic Datum and Universal Traverse Mercator. The course enables students to learn the principles and uses of modern surveying practice. It will provide fundamentals of terrestrial (Total station, laser scanner) and spatial (GNSS system) surveying and its integration on a field survey. Computational techniques and mathematical modeling are presented, including least squares adjustment.

### **Knowledge: Students will be able to:**

1. Learn principles, theories, and uses of surveying.
2. Geodetic Datum and Coordinate Systems:
  - The figure of the Earth and geodetic surfaces
  - Global and local datum and coordinate systems
3. Applications of geodetic surveying on UTM map
4. Use Computational techniques and mathematical modeling including least squares adjustment.
5. Use of QGIS.
  - import and export vector and raster data
  - produce a map in the appropriate Datum
  - editing data with GIS processing

### **Syllabus**

The tasks of the course are the following: revision of cartesian coordinates and angular system; introduction to spatial data (Vector and Raster Model); geodesy (the geoid, the ellipsoid, the heights); global coordinates systems (Cartesian geocentric, geographic); local coordinate system (north-oriented cartesian reference system); geodetic Datum (global and local datum ); introduction to QGIS; EPSG classification, Datum in the GIS; map projections and UTM map; ground-based surveys (total station, terrestrial laser scanner);satellite-based survey (GNSS), theories and technics; integration of a ground-based and a satellite-based survey; computational statistical techniques, mathematical modeling (regression line, helmert transformation) and least squares adjustment.

### **Professional skills**

1. Knowledge of a GIS (QGIS).
2. Height system definition and transformation between different height
3. Using GPS for surveying including the basics of GPS technology:
4. Be familiar with the different types of measurements
5. Be able to integrate GNSS data and terrestrial data
6. Mapping: Be able to read a UTM projected map and to produce a map layout.

The course is based on theoretical and practical lessons. Numerical or practical exercises will be carried out during the course using Excel sheet and QGIS software. Enrolment in e-learning is mandatory.

### **Exam**

The exam is based on a written test that is required to manipulate, transform, and represent different kinds of terrestrial data. It is realized using a personal computer GIS software and Excel sheet. An oral discussion will follow the written test. The student has to deliver a map as required in the test and an Excel sheet with all the calculations.

The course includes several assignments provided through the Elearning platform that have to be delivered and evaluated during the course (until +3 points on the final mark will be provided if there is a proved active participation during the lesson).

### **Materials:**

All the materials can be downloaded on elearning.

Lecture notes

Pdf Book. Geodesy. Martin Vermeer, November 19, 2019.

The text of previous exams

The frequency is strongly recommended