UNICUSANO
ROME

Code: ICAR/06 **Credits: 6**
Matter: Geomatics
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
Prof. Francesca Giannone - francesca.giannone@unicusano.it

Introduction

1. *Objective of the course:*

The course "Geomatics" aims to give students a good knowledge of statistical methods and errors estimation for topographic measurements, numerical cartography and basic applications in GIS - Geographic Information System software, with particular attention to the computational aspects concerning georeferencing and management of numerical cartography.

Objectives

2. *Course Structure:*

The course is organized in four modules. The first module is focused on topographic networks adjustment: topographic tools and Italian geodetic networks, least squares estimation (method of indirect observations; linear and non-linear case). The knowledge acquired in theory lessons will be applied in the "virtual classroom" forum through two activities (E-tivity).
In the second module numerical cartography is presented. This module contains a reference of geodesy and traditional cartography used in Italy. Moreover, this module is focused on INSPIRE directive, cartographic products and services of IGMI-Istituto Geografico Militare Italiano, cartographic products available at regional level.
The third module is focused on GIS software for CN management georeferencing of raster files, datum and coordinate transformations, DTM (Digital Terrain Model), DEM (Digital Elevation Model), DSM (Digital Surface Model).

In the fourth module main function of QGIS software are presented: vector and raster layers (reference system, style, labels, join, clipping, buffer areas). Georeferencing and collimation of GCP, residual analysis. Furthermore, EPSG codes and IGMI technical note, proj.4 parameters are presented.

Competencies:

- knowledge of lest square method for topographic networks adjustment.
- knowledge and use of national numerical cartography.
- knowledge of georeferencing algorithm.
- knowledge of digital model
- knowledge of national and EU directives
- knowledge and use of main QGIS function.
- ability to use appropriate scientific terminology.

Syllabus

3. *Programme of the course:*

Subject 1. Topographic networks adjustment

Proposed topics: topographic tools and Italian geodetic networks, least squares estimation. Topographical application of least squares method: height differences, distance, whole circle bearing – WCB, azimuth angle. Exercises.

Subject 2. Numerical cartography

Proposed topics: geodesy and traditional cartography, Geoid, Ellipsoid, Coordinate systems, definition of main DATUM used in Italy, main projections, Gauss representation, Gauss-Boaga cartographic systems, UTM-WGS84-ETRF89, UTM-ED50. Numerical cartography - description of raster and vector numerical cartography. Raster: structure and file type, geometric and radiometric resolution. Vector format: geometric elements, attributes and topological relations. Products, services and EU INSPIRE directive: cartographic products and services of IGMI-Istituto Geografico Militare Italiano; cartographic products available at regional level; INSPIRE directive and products of "Geoportale Nazionale": WCS, WMS, WFS and coordinate conversion services

Subject 3.

Proposed topics: GIS software for CN management (basic operations). Georeferencing of raster files: standard geometric transformation; resampling algorithm (Nearest Neighbor, Bilinear and Cubic interpolation). Datum and coordinate transformations. DTM (Digital Terrain Model), DEM (Digital Elevation Model), DSM (Digital Surface Model). Digital models in TIN (Triangulated Irregular Network) and GRID (regular grid) format. Geomatic techniques for the production of digital models and accuracy levels.

Subject 4. QGIS

Proposed topics: import vector and raster layers; set reference system, style, labels; create join table, clipping, buffer areas. Georeferencing and collimation of GCP, residual analysis. EPSG codes used in Italy, proj.4 parameters.

Evaluation system and criteria

The exam consists of a written test and two E-tivities carried out during the course in virtual classes.
The written test normally includes 1 least square exercise and 2 theoretical question on the main topics covered in the course.
During the written test, it is NOT allowed to use handouts, notes, texts or forms.

Bibliography and resources

4. *Materials to consult:*
   The educational materials (lecture notes, slides and video lessons) are available on the Unicusano platform.

5. *Recommended bibliography:*
   Federica Migliaccio, Daniela Carrion, **"Sistemi informativi territoriali: principi e applicazioni",** UTET università
   Peter A. Burrough, Rachael A. McDonnell and Christopher D. Lloyd **"Principles of Geographical Information Systems"**, Oxford University Press