Università degli Studi della Basilicata
Scuola di Ingegneria

ACADEMIC YEAR : **2019-2020**			
COURSE: **Topography for Infrastructures and the Territory + Laboratory of Geomatics and GIS**			
TYPE OF EDUCATIONAL ACTIVITY: **(B) Characterizing**			
TEACHER : **Prof. Donato CIAMPA** (Part 1): **Topography for Infrastructures and the Territory** - 6 CFU **Prof. Aurelia SOLE** (Part 2): **Laboratory of Geomatics and GIS** - 3 CFU)			
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phone: **0971-20.51.17** **0971-20.24.73**			
Language: **Italian** (english language if are present foreign students)			
ECTS: **9** = (6 + 3) of which: • **3** ECTS for **Lessions** • **3** ECTS for **Tutorial/Practice** • **3** ECTS for **Laboratory activities**	n. of hours: **90** = (60 + 30) of which: • n.**30** hours per **Lessions** • n.**30** hours for **Tutorial/Practice** • n.**30** hours for **Laboratory activities**	Campus: **Potenza** **School of Engineering** Degree course: ***Techniques for Building and Land Management*** (L23)	Semester: **II**

Part 1: **TOPOGRAPHY FOR INFRASTRUCTURES AND THE TERRITORY** – 6 CFU
(Prof. Donato CIAMPA)

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The main objective of the course is provide to the students the bases of the operational techniques for the survey and the representation of the territory and the civil and rural structures and infrastructures. In particular:

- Acquisition of a good knowledge of surveying instruments traditional and modern;
- Acquisition of a good ability reading of topographic maps and the use of techniques and software for the surveying and tracking of roads and structures of Civil Engineering.
- Acquisition of a good knowledge of the latest techniques of surveying based on GPS satellite system and laser scanner 3D.

The main **knowledge** provided are:

- Elements of base Geodesy;
- Elements of cartographic representation;
- Elements of geometrical optics;
- Technical characteristics of surveying instruments;
- Basic competences about the survey and study of the topographical tracking;
- Basic competences for the monitoring and control of the civil and rural structures and infrastructures;
- Basic knowledge of geometrical tracking of civil and rural structures and infrastructures.

The main **skills** transferred are:

- Analysis of specific topographical problems;
- Identification of alternative solutions, techniques and most effective instruments;
- Identifying the advantages and disadvantages of each alternative solution.

In the specific teaching contributes to the following learning outcomes:

- **Knowledge and ability of comprehension:** the student must demonstrate of knowing and being able to understand the problems relative to the survey, tracking, construction, monitoring and testing of the civil and environmental structures.
- **Ability to apply knowledge and comprehension:** the student must demonstrate that he is able to use the

theoretical tools.

- **Autonomy of judgment:** the student must be able to deepen in an independent way what he has learned. It must develop an appropriate synthesis capacity and must be able to solve specific topographic problems.
- **Communication ability**: the student must be able to communicate and explain clearly the acquired knowledge, even to people who are not experts. It must also be able to use the technical-scientific language properly. The correct, clear and concise expression, therefore, constitutes an element of primary judgment.
- **Learning Ability:** The student must progressively become independent from the teacher. It must be able to update itself by consulting texts and publications in order to acquire the ability to attend deepening courses, specialized seminars, etc.

PRE-REQUIREMENTS

Knowledge of mathematical analysis, trigonometry, geometry, physics and statistics.

SYLLABUS

Introduction: Principles of survey. Definitions. Measurement and their units. Precision and accuracy in surveying.

Geodesy: Shape of the Earth. Earth gravity field. Equipotential surfaces. Geoid. Definition of height. Reference ellipsoid. Geoid undulations. Coordinate systems. Geometry of the ellipsoid of rotation. Normal sections. Principal sections. Reference surfaces used to approximate the ellipsoid.

Cartographic representations: The problem of map projections. Deformation modules. Analytical approach to map projections. Classification of map projections. Conformal projections. The conformal Gauss map. The Italian official cartography. The UTM mapping system.

Surveying: National geodetic networks: planimetric, leveling, IGM95 networks. Planimetric survey, reduction of distances to the reference surface. Main surveying schemes: triangulation, trilateration, intersection, open and closed polygonals, detailed survey. Vertical survey: orthometric height and ellipsoidic height. Trigonometric and geometric leveling: scheme, instrumentation, accuracy. Practical aspects of GPS surveying, sessions and independent baselines.

Instrumentation and operational methods: Geometrical optics. Measure of angles. Basic knowledge of error theory. Opto-mechanical theodolite. Main components: telescope, vertical and horizontal circles, circle reading and optical micrometer, optical plumb. Setting up. Reading method of azimuth angles. Bessel's method. Zenith angles. Electronic theodolites. Measure of distances. Geodimeters: operating principle, fundamental equation, accuracy of a geodimeter. Total stations. Leveling. Levels, types of levels, main components. Invar stadia. GPS: basic concepts, GPS constellation and control segment. GPS signal structure. GPS biases and errors. GPS receivers. WGS84. Pseudo-range and carrier phase measurements. Other GNSS systems. Laser scanner 3D.

Topography and Civil Engineering: Monitoring, control and geometric tracking of civil and rural structures and infrastructures.

TEACHING METHODS

The didactic organization provides for 60 total hours of which 30 hours of lession and 30 hours of tutorial and/or practice activities. The course includes a technical-operative seminar held by an external expert dedicated to the analysis of the arguments developed during the course. In the context of this seminar will be described and used different surveying instruments (opto-mechanical theodolites, electronic theodolites, total stations, laser scanners 3D, levels, GPS receivers, drones, etc.) and will be applied the principal techniques of surveying and tracking.

The course also requires the preparation of some short numerical exercises and/or written reports aimed to deepen the topics treated.

EVALUATION METHODS

Oral examination during which to ensure the knowledge and skills of the candidate. The questions are designed to check the clear understanding, by the candidate, of the phenomena and of the quantitative tools available to conduct the necessary analysis. The oral examination also includes a discussion on the numerical exercises and/or on written

reports that were developed by the student during course. The evaluation will take into account the level of maturity reached in the exercises. The final exam score is obtained by applying the weighted average (calculated on the CFU) of the marks obtained in Part 1 (*Topography for Infrastructure and Territory* - 6 CFU) and in Part 2 (*Laboratory of Geomatic and GIS* - 3 CFU). The final exam (Part 1 + Part 2) must be done on the same date.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Jerry A. Nathanson, Michael Lanzafama, Philip Kissam (2017), "*Surveying Fundamentals and Practices - 7th Edition*", ISBN-13: 978-0134414430. ISBN-10: 0134414438. Ed.Pearson.
- Barry Kavanagh, Diane K. Slattery (2014), "*Surveying with Construction Applications - 8th Edition*", ISBN-13: 9781292062006. ISBN: 1292062002. Ed. Pearson.
- Department of the Army-US Army Corps of Engineers (2007), "*Engineering and Design-Control and Topographic Surveying*", Manual 1 No. 1110-1-1005.
- Bezoari, Monti, Sellini, "*Fondamenti di rilevamento generale*", Hoepli Editore.
- *Cannarozzo Renato - Cucchiarini Lanfranco - Meschieri William*:
  - Misure Rilievo Progetto - Volume I: "*Superfici e sistemi di riferimenti, strumenti, misure*", Quinta Edizione (2017). Ed. Zanichelli. ISBN 9788808520906.
  - Misure Rilievo Progetto - Volume II: "*Il rilievo del territorio con tecniche tradizionali e con nuove tecnologie*", Quinta Edizione (2017). Ed. Zanichelli. ISBN 9788808438812.
  - Misure Rilievo Progetto - Volume III: "*Operazioni su superficie volumi e applicazioni professionali*", Quinta Edizione (2017). Ed. Zanichelli. ISBN 9788808468178.
- Course notes provided by the professor and available in electronic format.

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and methods of verification, the teacher provides students the educational material and simultaneously collects the list of students who intend to enroll in the course, together with name, surname, matriculation number and email address.

Prof. Ciampa receives students in *Geomatic Laboratory*, at the 4th floor of the School of Engineering, on Tuesday (10.30-12.30 during I Semester and 8.30-10.30 during II Semester). The Professors are always available through their e-mail and soon after each lesson.

EXAMINATION SESSIONS (FORECAST)[1]

13/06/2020, 17/07/2020, 16/09/2020, 14/10/2020, 18/11/2020, 16/12/2020.

SEMINARS BY EXTERNAL EXPERTS SI ■ NO □

FURTHER INFORMATION

The attendance of didactic activities is automatically satisfied at the end of the semester in which they are located.

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.

Part 2: **LABORATORY OF GEOMATICS AND GIS** – 3 CFU
(Prof. Aurelia SOLE)

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Application GIS for: geo-referencing of the data territorial; Global Positioning System (GPS) and their applications; acquire data from regional authorities in different formats and georeferencing according to the coding required, perform operations on spatial, generate digital terrain models with various methods, starting from elevation databases from different sources, prepare and generate data for thematic maps according to the required specifications.

PRE-REQUIREMENTS

Computer use and file management, word processing, spreadsheet; basic concepts of information technology; presentation tools; computer networks.

SYLLABUS

Model of data, data acquisition, interchange formats; problems of verification, Space Operations of vector data; space operations on raster data, Digital Terrain Models (Grid and TIN); Information derivable from a digital terrain model; Thematic map.

TEACHING METHODS

Laboratory tutorials, Project works.

EVALUATION METHODS

The practical test consists of a simulation, using the GIS software used during the course, with the aim of assessing whether the student has acquired the required skills. The time required for the test is 2 hours. The overall grade is given by the results of the practical test and the material related to the design laboratory carried out during the course. If f the test is insufficient it is necessary to repeat the tests.

The final exam score is obtained by applying the weighted average (calculated on the CFU) of the marks obtained in Part 1 (*Topography for Infrastructure and Territory* - 6 CFU) and in Part 2 (*Laboratory of Geomatic and GIS* - 3 CFU). The final exam (Part 1 + Part 2) must be done on the same date.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Lecture notes, user manual of software QGIS, GRASS. Course notes available online, manuals and materials related to the software used QGIS, GRASS. The data of the tutorials and the online materials are shared through a cloud to which all students of the academic year are enrolled of reference; https://elearning.unibas.it/enrol/index.php?id=91

INTERACTION WITH STUDENTS

At the beginning of the course, after having described objectives, program and methods of verification, the teacher makes available to the students the didactic material through a shared folder. At the same time, the list of students wishing to enroll in the course is provided, accompanied by name, surname, matriculation number and email address.

Office hours: at the end of the lessons, the teacher stays in the classroom for the students reception. In addition to the weekly reception, the teacher is available at any time for a contact with the students, through their e-mail or on the e-learning site https://elearning.unibas.it/enrol/index.php?id=91

EXAMINATION SESSIONS (FORECAST)[2]

13/06/2020, 17/07/2020, 16/09/2020, 14/10/2020, 18/11/2020, 16/12/2020.

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FURTHER INFORMATION

The attendance of didactic activities is automatically satisfied at the end of the semester in which they are located.