Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: **Topography And Survey Design for Road Infrastructures**			
ACADEMIC YEAR: **2017-2018**			
TYPE OF EDUCATIONAL ACTIVITY: **Free choice**			
TEACHER: **Donato CIAMPA**			
e-mail: donato.ciampa@unibas.it		website: **https://elearning.unibas.it/**	
phone: **0971-20.51.17**		mobile:	
Language: **Italian**			
ECTS: **6**	n. of hours: **60** of which: • n.**36** hurs for **Lessons** • n.**24** hours for **Tutorials/ Practice**	Campus: **Potenza** **School of Engineering** Program:	Semester: **I**

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 structures of Civil Engineering. 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 Engineering structures;
- Basic knowledge of geometrical tracking of roads and of the structures of Civil Engineering.

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 acquired to solve engineering problems with particular reference to the Road Infrastructures.
- **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 in the fields of civil engineering and road infrastructure.
- **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 and Masters.

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. 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 and control of structures of Civil Engineering. Geometric tracking of roads and structures of Civil Engineering.

TEACHING METHODS

The didactic organization provides for 60 total hours of which 36 hours of lecture and 24 of practice. The course includes a technical-operative seminar with a duration of eight hours 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 overall evaluation will take into account the level of maturity reached in the exercises.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- 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*", Quarta Edizione (2012). Ed. Zanichelli. ISBN 978.88.08.05927.7
  - Misure Rilievo Progetto - **Volume II**: "*Il rilievo del territorio con tecniche tradizionali e con nuove tecnologie*", Quarta Edizione (2012). Ed. Zanichelli. ISBN 978.88.08.22358.6;

- Misure Rilievo Progetto - **Volume III**: "*Operazioni su superficie volumi e applicazioni professionali*", Quarta Edizione (2012). Ed. Zanichelli. ISBN 978.88.08.12381.7.

➢ Course notes provided by the professor and available in electronic format (dropbox shared folder).

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 (E-learning university platform, dropbox folder, etc.) 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]

12/02/2018, 12/03/2018, 16/04/2018, 21/05/2018, 25/06/2018, 23/07/2018, 17/09/2018, 22/10/2018, 19/11/2018, 17/12/2018.

SEMINARS BY EXTERNAL EXPERTS YES ■ 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.