Università degli Studi della Basilicata
Scuola di Ingegneria

| | | | |
|---|---|---|---|
| COURSE: Part of "**DESIGN OF ROADS, RAILWAYS AND AIRPORTS**" **(3 ETCS)** (included in **Materials for Roads, Railways and Airports construction + Design of Roads, Railways and Airports - 12 ETCS)** | | | |
| ACADEMIC YEAR: **2017-2018** | | | |
| TYPE OF EDUCATIONAL ACTIVITY: **Affine** | | | |
| TEACHER: **Prof. Donato CIAMPA (3 ETCS), Prof. Michele AGOSTINACCHIO (Person in charge - 9 ETCS)** | | | |
| e-mail: donato.ciampa@unibas.it | | website: **https://elearning.unibas.it/** | |
| phone: **0971-20.51.17** | | mobile: | |
| Language: **Italian** | | | |
| ECTS: **3** | n. of hours: **27**<br>of which:<br>• n.**16** hurs for **Lessons**<br>• n.**11** hours for Tutorials/ Practice | Campus: **Potenza**<br>**School of Engineering**<br>Program: **Master's degreee in Civil Engineering** | Semester: **Annual** |

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Acquire the theoretical tools and techniques addressed in the design and the advanced design of the road and rail infrastructures in relation to the environmental impact.

The main **knowledge** provided are:

- Advanced geometric design;
- The problem of rockfall and the road infrastructure protection;
- The thermal analysis of the rail track;
- The retaining structures and the reinforced earth;
- Road barriers.

The main **skills** transferred are:

- Design of specialized road lanes;
- The study and the design of rockfall protection structures;
- The thermal hysteresis cycles of the railway rails;
- Design of the retaining structures and reinforced earth;
- Legislative and technological aspects of road barriers.

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 both the problems relative to the advanced geometric design of Road Infrastructures and the selection and dimensioning of accessories elements (retaining structures, road barriers, etc.).
- **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 problems in the fields of road and railway infrastructures.
- **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

It is suggested to pass previously the exam of "*Basics of Roads, Railways and Airports*".

SYLLABUS

**Multiparameter clothoids**: Intrinsic equation. Transverse acceleration and recoil. Relations between r, s, A e τ. Cartesian equation. Mathematical expressions of $X_M$ and ΔR. Long and short tangent. Tabs of the unitary curves (A=1) n function of n. Use of simplified mathematical expressions and evaluation of the error. The deceleration curves (Nemesdy and Blaschke). Multiparameter clothoids with exponent that best approximates the ideal braking curve. "Biparametrica" or "Biiperclotoide" curve.

**Rockfall protection structures**: The problem of rockfall. Coating of rocky slopes with wire mesh. Rockfall barriers. Ditches and earth embankments rockfall. Rockfall galleries.

**Road barriers**: Current laws. Steel elements. Concrete elements. Crash test and computational simulation models.

**Level Of Service (LOS) of road infrastructures**: Levels of Service roads. Numerical application.

**Long Welded Rail (L.W.R.)**: The railway superstructure. Thermal of railway rails. Stress state and deformation of the Long Welded Rail. Maintenance of Long Welded Rail.

**Rigid retaining structures, flexible retaining structures and reinforced earth structures**: Types of retaining walls. Elements on the calculation of reinforced concrete walls. Pseudo-static method of Mononobe OKABE. Design of retaining flexible structures. Reinforced earth with steel elements (design, functional criteria, assembly). Seismic calculation by SEED method. Reinforced earth with geosynthetic. Creeb walls. Gabions in double torsion metal mesh.

TEACHING METHODS

The didactic organization provides for 27 total hours of which 16 hours of lecture and 11 of practice. The course includes a design exercise (road intersection) and a numerical exercitation (Level of Service of a road infrastructure). The design exercise will be developed into groups of three students.

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 positive evaluation of guided exercises developed during the course represents a prerequisite to access to the oral examination. The overall evaluation will take into account the level of maturity reached in the exercises.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Agostinacchio M., Ciampa D., Olita S. (2010), *Strade Ferrovie Aeroporti* III edizione, EPC Srl, Roma.
- Agostinacchio M., Ciampa D., Olita S. (2011), *La Progettazione delle Strade* II edizione, EPC Srl, Roma.
- Agostinacchio M., Olita S. (2002), *Elementi di ritenuta paramassi*, EPC Libri, Roma.
- Ferrari P., Giannini F. (1997), *Ingegneria Stradale* Vol. 1 e 2, ISEDI.
- Giannini F., La Camera F., Marchionna A. (1993), *Appunti di Costruzione di Strade Ferrovie ed Aeroporti*, Masson ed. ESA.
- La Camera F. (1992), *Il calcolo del progetto stradale la planimetria*, Masson ed. ESA.
- 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 (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 and Architectural Photogrammetry*" Laboratory, at the 4$^{th}$ floor of the School of Engineering (room n.13), 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.

Università degli Studi della Basilicata
Scuola di Ingegneria

| |
|---|
| EXAMINATION SESSIONS (FORECAST)[1]<br>12/02/2018, 12/03/2018, 16/04/2018, 14/05/2018, 25/06/2018, 18/07/2018, 17/09/2018, 22/10/2018, 19/11/2018, 17/12/2018. |
| SEMINARS BY EXTERNAL EXPERTS YES ■ NO □ |
| FURTHER INFORMATION<br>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.