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COURSE: Structural Strengthening PZ/(Mod. II)

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ACADEMIC YEAR: 2019-2020

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TYPE OF EDUCATIONAL ACTIVITY: Affine

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TEACHER: Prof. Felice Carlo Ponzo,

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Language: ITA / ENG

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ECTS: 6

n. of hours:  
32 (lessons)  
22 (tutorials and practice)

Campus: Potenza  
School of Engineering

Semester: II

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#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course and in particular this modulus aims to provide students with the tools for understanding the static and dynamic behaviour of existing masonry and reinforced concrete buildings and for designing the strengthening of complex structures, even in seismic prone area, by using classic and innovative techniques.

The main skills gained will be:

**Knowledge and understanding capacity:** understanding of the static and dynamic behaviour of the structures, with particular reference to the masonry and reinforced concrete ones, and of the main structural seismic strengthening systems;

**Capacity of applying knowledge and understanding:** the student will have to prove their capacity in managing complex phenomena related to the particular type of considered materials and structures and to be able of performing the assessment of existing buildings after strengthening by using also complex designing tools;

**Autonomy of judgment:** The student must be able to independently evaluate the design optimal solutions according to the characteristics of the materials and of the considered structures and to the design objectives. He must also to know the main methodologies for assessing the safety for the analysed retrofitted structures.

**Communicative Skills:** The student must show the ability to easily explain to non expert persons the operating principles of the main innovative or not strengthening techniques for masonry and reinforced concrete structures as well as the ability to present an elaborate (project, thesis, Etc ...) by properly using the technical-scientific language.

**Learning Skills:** Depending on the information acquired during the frontal lessons, the student must be able to continuously and autonomously update their knowledge by consulting texts and technical / scientific papers of the disciplinary field of expertise in order to acquire the ability to follow in-depth Courses, Specialized Seminars and Masters.

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#### PRE-REQUIREMENTS

The students must know and assimilated the contents of the following exams: "Strength of Materials" and "Reinforced Concrete Structures".

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#### SYLLABUS

The course provides basic knowledge and specialized information on the main classic or innovative design techniques and methodologies for strengthening existing masonry and reinforced concrete structures.

In particular the main topics considered are:

- Reference standards: Existing Buildings, level of seismic protection, Safety assessment and verification criteria, Level of knowledge.
  - Masonry buildings: Classic and innovative strengthening techniques for the improvement of local and global behaviour (Hierarchy of failure modes); strengthening respect to i) crumbling
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phenomena of the wall texture, ii) collapse of the wall outside the floor, iii) collapse of the wall in the floor; Techniques for strengthening floors and roofs; Evaluation of the static and dynamic behaviour of masonry structures subject to strengthening measures; Structural analysis methods and applicability conditions;

- Reinforced concrete buildings: Classic and innovative strengthening techniques for improving local and global behaviour (Hierarchy of resistances); Application of base isolation and energy dissipation techniques for seismic protection of existing reinforced concrete structures; Evaluation of the static and dynamic behaviour of r.c. structures subject to reinforcement measures; Structural analysis methods and applicability conditions;
- Dynamic structural Identification techniques for structures, Health monitoring.

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#### TEACHING METHODS

The course is organized as following:

Theoretical lessons (48 hours);

Tutorials in classroom and in laboratory (33 hours);

Technical visits.

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#### EVALUATION METHODS

The main goal of the examination is to verify the learning level reached by the student with reference to the educational expected goals.

The exam is divided in two parts held on the same day.

Discussion of a project work drawn up in the classroom during tutorials, concerning the design and verification of an existing building seismic strengthening whose safety assessment was carried out during Module (I) of this teaching. Traditional and / or innovative intervention techniques will be applied for the design. The test is passed with a score higher than 18/30;

Oral examination aimed at evaluating the capacity of the student of connecting and comparing the different topics covered in the course. The test is passed with a score higher than 18/30;

The final vote is provided by the average of the two previous partial votes.

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Sisto Mastrodicasa, Dissesti Statici delle Strutture Edilizie, diagnosi e consolidamento, HOEPLI.

Manfredi G., Masi A., Pinho R., Verderame G., Vona M., 2007, Valutazione di edifici esistenti in C.A., Collana di manuali di progettazione antisismica, IUSS Press, Pavia.

Dolce M., Ponso F., Di Cesare A. Arleo G., (2010), Progetto di edifici con isolamento sismico, IUSS Press, Pavia.

Normative:

- DM 17.01.2018, Nuove norme tecniche per le costruzioni
- CIRCOLARE 21 gennaio 2019 , n. 7, Istruzioni per l'applicazione delle «Nuove norme tecniche per le costruzioni» di cui al decreto ministeriale 17 gennaio 2018.
- Norme UNI e CNR per le prove in situ ed in laboratorio
- Linee guida per FRP, 2009

Notes supplied are available on the course website:

<http://web.unibas.it/ponzo/index.php/11-didattica/3-riabilitazione-strutturale>

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#### INTERACTION WITH STUDENTS

During the first lesson, after describing the goals of the course, the program and the evaluation methods, the Professor provides to the students the website where they can find the on-line educational material and the recommended books. At the same time, he collects the list of the students, complete of all significant information (i.e. name, surname, email, badge number and so on..).

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Università degli Studi della Basilicata  
**Scuola di Ingegneria**

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Office hours (Ponzo): Tuesdays from 15:00 to 17:00.

In any case the professor is always contactable through the following email: felice.ponzo@unibas.it / marco.vona@unibas.it

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EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

Examination sessions Will be fixed all month

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SEMINARS BY EXTERNAL EXPERTS    YES X    NO

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FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.