Anti-seismic protection of historic constructions

Students will improve their knowledge of the issues covered in the context of this course, in order to be able a) to understand the fundamental principles governing the dynamic response of discrete and continuous systems; b) to understand and apply the new concepts in earthquake engineering (Simulation principles and inelastic behavior of structures. Contemporary methods of dynamic analysis and seismic protection of structures. Performance-based earthquake design. Life-cycle cost analysis of structures. Structural vulnerability and fragility curves. etc); c) to understand advanced issues related to engineering seismology and earthquake engineering (Impact of local site conditions - Amplification (or de-amplification) of the seismic motion. Dynamic soil-structure interaction. Structural integrity & vulnerability assessment. Seismic mitigation measures and structural upgrading interventions: analysis methods and applications. etc).

Topics developed:

a. Principles of earthquake resistant design of buildings and infrastructures.
b. Eurocode 8, EAK2000, and other contemporary international seismic norms.
c. Optimal seismic design and performance-based earthquake design.
d. Techno-economic life-cycle cost analysis of structures against seismic actions (initial cost and interventions, uncertainties, etc).
e. Numerical integration of dynamic equilibrium equations for single- and multi-degree of freedom engineering systems.
f. Numerical solution of equations of motion in the time and frequency domain.
g. Non-linear dynamic analysis of structures with simple and advanced methods.
h. Soil dynamics and dynamic soil-structure problems.
i. Special issues related to dynamic response of multi-degree systems (damping, seismic isolation, etc).
j. Uncertainties and reliability analysis.
k. Assessing and monitoring the structural integrity of existing structures against seismic actions.
l. Damage indices and probabilistic fragility curves of existing buildings and historic structures.
m. Seismic mitigation measures and structural upgrading interventions: regulations, analysis methods and application practices.
n. Pre- and post-seismic mitigation measures for reinforced concrete buildings and historic structures.
o. Computational dynamics with emphasis on earthquake engineering problems.

p. Advanced simulation issues related to dynamic non-linear response of structures.
q. Application of the finite element method in the static and dynamic analysis of complex structures using advanced software (commercial and/or open-source).