Course	Lecturer	About the course
Advanced Seismic Engineering of Foundation-Structure Systems and Underground Facilities	**Daniel Dias**  Professor, Laboratory 3SR University of Grenoble Alpes, France	This course will provide an introduction to geotechnical earthquake engineering, with a focus on the seismic resilience of foundation-structure systems and underground facilities. It will begin with the fundamentals of soil dynamics, dynamic loading, basic vibration theory, dynamic properties of soils, wave propagation in soils, ground response analysis, soil-structure interaction, and soil liquefaction. In the second part of the course, attention will shift to recent developments in the seismic resilience of foundation-structure systems and underground infrastructures.

Course	Lecturer	About the course
Next-generation Smart, Carbon-Neutral and Resilient Infrastructure and Construction	**Tony T.Y. Yang**  Professor, Department of Civil Engineering Director, Smart Structures Laboratory University of British Columbia, Canada	Civil infrastructure is facing significant demands from rapid population growth, aging and natural disasters. The next-generation civil infrastructure needs to be smart, carbon-neutral and resilient. This presentation presents the state-of-the-art technologies in high-performance, carbon neutral, earthquake resilient structural systems, and AI inspections and robotic construction.

Course	Lecturer	About the course
Introduction to Causal Machine Learning with Earthquake Engineering Applications	**Henry V. Burton**  Presidential Chair and Associate Professor, Department of Civil and Environmental Engineering University of California, Los Angeles, USA	Collecting and analyzing empirical data are essential to learning and implementing lessons in earthquake engineering This course will introduce students to the fundamentals of causal inference and demonstrate how these principles and models can be applied to earthquake engineering problems. Specific applications of causal machine learning that will be discussed include (i) quantifying the benefit of seismic interventions using reconnaissance data, (ii) evaluating the effectiveness of ground motion intensity measures and (iii) extracting causal information from data generated by disparate structural experiments.

Course	Lecturer	About the course
Innovative Materials to Improve Seismic Resilience of Bridges and Structures	**Bijan Khaleghi**  Chair, International Association of Bridge and Earthquake Engineering (IABEE) Associate Professor and Co-Director, Florida International University, USA Adjunct Professor, Saint Martin's University, USA	This course provides a comprehensive review of seismic current design requirements for infrastructures, to bridge the gap between theoretical research and field applications by providing sufficient insight into the physical principles, and implementation projects. This course covers state-of-the-art seismic topics including: 1-Improving seismic resiliency with super-elastic materials in bridge bents, 2-Seismic resiliency and post-earthquake functionality of bridge with self-centering capability, 3-Tsunami resiliency of bridges, 4- Seismic retrofit and strengthening of bridges with ultra high-performance concrete (UHPC), 5-Concrete filled steel tubes (CFST) for bridge projects with enhanced seismic performance, and 6-Seismic resiliency of bridges, tunnels, and underground structures.

Course	Lecturer	About the course
Self-Centering Systems for Resilient Seismic Design	**Constantin Christopoulos**  Professor and Director, Department of Civil and Mineral Engineering Director, Structural Testing Facilities University of Toronto, Canada	This lecture series first provides an overview of the expected seismic performance of current structural systems with an emphasis on the damage state that is expected severe earthquakes. The development, validation and implementation of new systems, including self-centering energy dissipative frames and bracing systems, controlled rocking systems and rocking podium systems will then be presented. An overview of the nonlinear dynamics of self-centering systems will be discussed with an emphasis on how to engineer these systems for stable and predictable response. Results from large-scale experiments and numerical studies the highlights their improved seismic performance will be presented. Finally, some insights on design methods and strategies for implementation and codification of these systems will also be discussed.

Course	Lecturer	About the course
Characterizing Hazards and Impacts of Induced Seismicity	**Derek Elsworth**  G. Albert Shoemaker Chair and Professor, Department of Energy and Mineral Engineering Pennsylvania State University, USA	Contemporary methods of energy conversion that reduce carbon intensity and address the energy transition draw heavily on fluids and minerals in the subsurface. This includes sequestering CO2, fuel switching to lower-carbon sources, recovering deep geothermal energy via EGS, and diurnal and inter-seasonal storage of heat, H2 and energized fluids (CAES) together with conventional resources and underground construction. We explore the mechanics of induced seismicity related to fluid injection as related to unconventional energy resources and the spectrum of seismicity in mines and tunneling and in hazardous gas outbursts. We explore the use of machine learning to provide insights into key process controls, inform physically-based models and use these to understand the hazard and mitigate risks.

Course	Lecturer	About the course
Methods for Assessing and Improving Seismic Resilience of Buildings	**Huanjun Jiang**  Professor, College of Civil Enigeering, Tongji University	This lecture addresses methods for evaluating and enhancing building seismic resilience. First, conventional assessment frameworks from guidelines are summarized, which rate seismic resilience based on post-earthquake casualties, restoration cost, and downtime. Then, a new method based on quantification of time-varying building function is proposed, integrating consequence analysis of components, logic trees connected with fuzzy operators, and logic system of buildings including relevance between stories to address uncertainty in evaluations. Also, the repair scheme is considered in computation of the time-varying function loss during the whole recovery process. The proposed method is embedded in probabilistic performance-based earthquake engineering (PBEE), in which uncertainty factors during the whole life cycle of buildings can be considered. Case study is provided to demonstrate the applicability of the proposed method. Finally, strategies for improving resilience of buildings are discussed, focusing on three types of earthquake resilient structures, i.e. rocking structures, self-centering structures, and the structures with replaceable components.