



# SEISMIC DESIGN OF BUILDING STRUCTURES

On Line Course via Zoom

8 November – 12 November 2021

## COURSE OBJECTIVES

Certain areas in South Africa have been identified by the Structural Loading Code as regions where buildings need to be designed for seismic loads. The aim of this course is to present the principles for the design and layout of structures subjected to seismic loads. The emphasis will be placed on design of reinforced concrete structures in areas of natural seismicity.

As long as some basic principles are adhered to, structures designed for moderate seismic loads need not be more expensive than others. Although the course will require participants to apply their minds to the theoretical background of seismic design, participants will be rewarded with a comprehension of the practical requirements and details to achieve seismic resistant structures.

The course will provide the background to seismic activity and the effects on buildings. Ductile element and material behaviour forms an integral part of the behaviour of buildings subject to seismic loads. The effect on building response as well as methods to achieve ductile behaviour will be addressed. The course will provide the theoretical background for and the application of design methods, including principles to be considered during conceptual design.

Introductory course notes documents will be made available to delegates before the course commences for reference and background reading prior to the course.

The course is recommended for structural engineers, who are involved in the design of building structures in areas of seismicity. Both practicing engineers and postgraduate students will benefit from the course.

The course may be completed for non-degree purposes, or as part of the Master's Degree programme at the University of Stellenbosch.

The course is also suitable for CPD purposes for practicing engineers, technologists and technicians.

# COURSE FORMAT, RESOURCES AND PARTICIPATION REQUIREMENTS

## Technical requirements for participants

Students and other participants attending this course will need a suitable internet link to access the content

## Course Format

The course will be presented using a selected combination of recorded video material, live video short conferencing sessions for questions and discussion, and documents made available on line.

The programme schedule is supplied as a guideline only. Presenters can elect to switch between live video, static video as well as guided reading and exercise sessions as required by the course material.

## Course delivery resources

The live video conferencing content for the course will be presented using the Zoom video conferencing platform.

Course material including notes, presentation slides, video recordings and tutorial questions will be made available via the web based content delivery platforms of the university i.e. <http://learn.sun.ac.za> for academic students and <http://online.sun.ac.za> for CPD candidates.

Students which do not have suitable internet connection infrastructure will be able to attend the course in a small conference room facility at the offices of the department of civil engineering at the Decanting Building on Hammanshand road. Limited seats are available. Please contact the course administrator if you need to make use of this facility.

## Participation and attendance verification requirements

**Participants completing the course for CPD purposes as well as students participating for attendance only credit will need to complete a selection of on line quizzes to formalise their participation in the on line course.**

Students attending the course for degree purposes will need to submit assignments for evaluation and sit a course exam.

## PRESENTERS



**Prof. Ricardo Monteiro**

### **University School for Advanced Studies IUSS Pavia - Italy**

Ricardo Monteiro is Associate Professor of Structural Engineering at the University School of Advanced Studies IUSS Pavia, where he is also the Deputy Director of the Understanding and Managing Extremes (UME) Graduate School (formerly ROSE School) and the Coordinator of the Italian (ROSE) and Erasmus Mundus (MEEES) MSc programmes in Earthquake Engineering and Engineering Seismology. He is also Senior Advisor for the European Centre for Training and Research in Earthquake Engineering (EUCENTRE) in Italy and the University of Porto, Portugal.

He has been involved in a number of European Research Projects, such as LESSLOSS, SYNERG-G, NERA, SASPARM, mostly dedicated to the seismic vulnerability assessment of bridges and buildings. Recently he coordinated research projects on seismic risk in Europe, North Africa and the Middle East (ITERATE and INFRA-NAT). He has been the advisor of over 40 MSc and 10 PhD theses in the field of extreme events and co-authored over 150 scientific publications. He has teaching experience in both Italy and Portugal, where he qualified in Civil Engineering at University of Porto. He then completed his PhD specializing in Earthquake Engineering, with a thesis on Probabilistic Seismic Assessment of RC Bridges.

## PRESENTERS



### **Mr Chris Palmer BSc Eng (Rand); GDE (UCT)**

#### **Specialist Consultant – Cape Town**

Chris Palmer is a professional engineer in active retirement. He spent over 2 decades in consulting engineering with Liebenberg & Stander (now Bergstan) – in structural engineering, including high-rise buildings, and project management (industrial projects as principal agent; management committee representative for design consortium for the Mossgas Offshore Gas Production platform), and then as managing partner – before opening his own project management practice in 1994 (projects include Table Mountain aerial cableway upgrade; Study manager for the Southern African Large Telescope at Sutherland; design management Mbombela World Cup soccer stadium and Cape Town domestic terminals) from which he retired a few years ago. Since retirement he developed an e-learning course for retail traders of the financial derivatives markets; completed Oxford University courses including philosophy of science, as well as assisting consultants with structural work, and with project management assignments.

His interest in earthquake engineering in general was stimulated while completing the designs of water storage tanks and towers subjected to seismic actions (inverted pendulums, dynamic water sloshing). An invitation to join a working group, under the chairmanship of Professor Roth of Pretoria University, to consider revisions to the current code prompted a period of interactions with staff of the structural department at Stellenbosch University and a critical review that he undertook of the detail of the SANS code, including comparative calculations of designs by SANS and Eurocode 8 requirements.

He currently offers education and training services in earthquake engineering for application in South Africa, and consulting services in the design of seismic resistant buildings.

## PRESENTERS



### **Dr. Giammaria Gabbianelli**

#### **University School for Advanced Studies IUSS Pavia - Italy**

Giammaria Gabbianelli, Ph.D., is a Post-Doctoral researcher at the University School for Advanced Studies IUSS Pavia (Italy). He graduated at the University of Pavia (Italy) with an M.Sc. in Civil Engineering (2013) and he obtained a Ph.D. (2016) in Civil Engineering from the Department of Civil Engineering and Architecture of the University of Pavia (Italy). From 2017 to 2019 he collaborated first as researcher at the EUCENTRE Foundation and then as Post-Doctoral researcher at the University of Pavia. His research has been focused on modelling, numerical analysis and development of software with different formulations, assessment of steel structures with thin-walled profiles, steel storage racks, seismic vulnerability of reinforced concrete structures, non-structural elements, steel storage tanks, decks, local vulnerability of airport buildings. Currently, his research activities concern design approaches to optimize structural performance in terms of expected annual economic losses.

## PROGRAMME - 5 DAY COURSE (On Line via Zoom)

Date	Lecture Topics
<b>8 November 2021</b>	
<b>08:30 - 09:00</b>	Registration – Testing of connection to on line system
<b>10:30 – 12:00</b>	Short content recap, Questions and Discussion forum: L1: Introduction L2: Elements of seismology L3: Force-deformation characteristics of RC elements
<b>14:00 – 15:30</b>	Tutorial – Homework assignment 1 (HW1) – Part A - Section analysis and design action
<b>9 November 2021</b>	
<b>10:30 – 12:00</b>	Short content recap, Questions and Discussion forum: L4: Elastic and inelastic response spectra L4.1: SDOF time-history analysis L4.2: Elastic response spectra L4.3: Strength and ductility L4.4: Inelastic response spectra
<b>14:00 – 15:30</b>	Tutorial – Homework assignment 1 (HW1) – Part B - Section analysis and design action
<b>10 November 2021</b>	
<b>10:30 – 12:00</b>	Short content recap, Questions and Discussion forum: L5: Seismic design methods L5.1: Introduction to Force based design L5.2: Equivalent lateral force method L5.3: Response spectrum method
<b>14:00 – 15:30</b>	Tutorial – Homework assignment 2 (HW2) - Building analysis
<b>11 November 2021</b>	
<b>10:30 – 12:00</b>	Short content recap, Questions and Discussion forum: L6: Design and detailing of buildings L6.1: Capacity design L6.2: Structural detailing in capacity design
<b>14:00 – 15:30</b>	Tutorial – Homework assignment 3 (HW3) - Design and detail of RC wall

**12 November 2021**

<b>10:30 – 12:00</b>	Short content recap, Questions and Discussion forum: L7: Conceptual seismic design L8: Seismic design methods L8.1: Additional considerations on force based design L8.2: Introduction to Direct displacement-based design
<b>14:00 – 15:30</b>	Seismic hazards in South Africa and their recognition in the National Building Code The South African and European Union seismic codes Analysis and design fundamentals; Practical considerations and notes.

*NOTE: For all the topics, reference will be made to Eurocode 2, 8 and SANS10160-4*



**Course administrator:**

**Ms. Tsholo Seroalo**

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**Course Coordinator:**

**Dr J A vB Strasheim**

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**WE ARE LOOKING FORWARD TO WELCOMING YOU AT THIS COURSE**