



Dept. of Civil Engineering | Master's Module | CPD course

Concrete Technology for Engineers and Technicians

Online, 12 April – 14 May 2021



Introduction



Engineers and technicians are required to make reasonable assumptions and provide economical solutions for the design of reinforced concrete structures such as bridges, culverts, buildings, and industrial and civil infrastructure. An important part of this process is the choice of appropriate concrete material properties and the relevant specification of mix constituents, mix proportions and construction methods.

Modern design methods usually involve the use of software packages in which predefined values for relevant concrete properties, such as strength and deformation characteristics, are made. Accepting such predefined assumptions without accounting for specific project requirements, and site conditions may result in conservative and uneconomic design of reinforced concrete structures. In addition, innovative and modern types of concrete are often not considered in the design process as many structural engineers have limited knowledge of fundamental concrete materials technology.

The workshop will refresh the engineer's and technician's knowledge and understanding of concrete properties to enable him/her to rationally specify economic design solutions for reinforced concrete structures. Based on fundamental aspects of concrete materials technology, the workshop will discuss design procedures and constituent material choices for general and specific requirements. Important properties such as strength and strength development, elastic deformations, shrinkage and creep, and durability will be discussed. The presentations cover fundamental materials aspects, design methods, test procedures and prediction models for concrete properties.

The underlying aims of the workshop are to highlight the importance of materials in the design and performance of concrete structures and to facilitate a good understanding of modern concrete technology in order to promote economic and sustainable design of reinforced concrete structures.

Course Content

- Concrete mix composition and materials
- Fresh and hardened concrete properties
- Critical review of common design assumptions and code provisions (SABS and EN)
- Cement types and hydration process (principles, property development, hydration heat), highlighting how to influence hydration and property development through the choice of constituent materials and mix parameters
- Modern admixtures for concrete: types, applications, and limitations
- Quality control of concrete
- Construction methods
- Compressive strength of concrete (design assumptions, strength classes, influencing factors, prediction models)
- Tensile and flexural strength (common values, relationship between compressive and tensile strength, significance in design, test methods)
- Concrete behaviour under load (deformation principles, failure and fracture)
- Elastic properties (importance and relevance, design assumptions and prediction models, test methods, material influences)
- Shrinkage and creep (importance in design, structural effects, design assumptions and prediction models, test methods and their limitations, material influences)
- Special requirements for concrete (early age properties, workability, strength development, heat of hydration)
- Concrete durability (overview on deterioration mechanisms, design for durability, material choice, prediction models and test methods)
- Special concretes (self-compacting concrete, high strength concrete, high performance concrete)

Course Outcomes

At the end of the course the participants will:

- Understand the various constituents of concrete
- Design a concrete mix based on clear performance criteria
- Understand the various concrete construction methods, their application and limitations
- Be able to perform quality control during concrete manufacture and construction
- Specify relevant tests for fresh and hardened concrete
- Select suitable concrete mixes for durable structures

Delivery mode

(Online: Starts on 12 April 2021)

The course is designed as a 5-day contact-mode equivalent online course. It will be presented through formal pre-recorded lectures, videos, pre-recorded practical demonstrations, and a series of live seminar-type discussions on Zoom, as well as short assignments and online quizzes.

In order to give participants sufficient time to engage with the course content, the course delivery is structured over a period of 5 weeks. The scope of each week covers the material that would have commonly been presented face-to-face in one day of presentations. Each week is structured as follows:

- Monday – Thursday: Pre-recorded lectures (approximately 5 – 8 lectures of 15 - 25 minutes each), supported with a written script (text-book type) and supplementary videos; all material is made available online on the course website. Multiple viewing is possible and delegates can design their own time-table according to their personal schedules.
 - o It is expected that delegates complete the engagement with the weekly content by Thursday.
- Monday – Thursday: The course presenter is available for consultation (online chatroom, accessible to all delegates); the course convener attends to the chatroom every day.
- Thursday / Friday: Delegates are requested to complete a short online Quiz (multiple choice) to self-assess their understanding.
- Friday: 90-minute live session on Zoom (recorded): summary of weekly content, discussions, Q&A

Detailed course schedule

Week 1

- 1.1 Introduction; concrete as a construction material
- 1.2 Desirable concrete properties
- 1.3 Cementitious materials: overview
- 1.4 Common cementitious binder types and their application
- 1.5 Aggregates for concrete: selection and quality control
- 1.6 Chemical admixtures for improvement of concrete properties

Week 2

- 2.1 Concrete mix proportioning
- 2.2 Formwork for concrete
- 2.3 Manufacture and handling of concrete
- 2.4 In-situ versus Readymix concrete
- 2.5 Precast concrete construction

Week 3

- 3.1 Properties of fresh concrete
- 3.2 Testing and quality control of fresh concrete
- 3.3 Production methods
- 3.4 Curing and protection of concrete elements and structures
- 3.5 Reinforcement for concrete: types, installation, protection
- 3.6 Surface texture and aesthetics of concrete

Week 4

- 4.1 Hardened concrete properties
- 4.2 Compressive strength: relevance and influencing factors
- 4.3 Design, specification and quality control: compressive strength
- 4.4 Tensile and flexural strength
- 4.5 Concrete deformations: thermal and shrinkage
- 4.6 Creep deformations

Week 5

- 5.1 Deterioration mechanisms
- 5.2 Designing for durability of concrete
- 5.3 Prevention of reinforcement corrosion
- 5.4 Self-compacting concrete
- 5.5 High strength and high performance concrete
- 5.6 Course summary, implementation of knowledge, lessons learnt

Course Presenters



Prof. Hans Beushausen is a researcher and lecturer in the fields of structural engineering, construction material technology, structural condition assessment, and concrete repair technology at the University of Cape Town. He is the Director of the Concrete Materials & Structural Integrity Research Unit ([CoMSIRU](#)) at UCT, which focuses on infrastructure performance and renewal research. His research interests include concrete durability, performance assessment of concrete structures, repair systems for concrete structures, and bonded concrete overlays.

Guest lecturers from industry will be invited to contribute to the course.

Course Overview

Name	Concrete Technology for Engineers and Technicians
Duration	Equivalent to 5 days (40 hours) over 5 weeks, 12 April – 14 May 2021
Venue	Presented online
CPD	5 CPD points, ECSA Validation No: UCTCTET21
Participants	Suitable for engineers, technicians, students and academics
Fees	Standard fee: R10 930.00

Registration

Registration and Cancellation

- [Register for this course](#)
- Registration covers attendance of all sessions of the course and course material.
- Registrations close one week before the start of the course. Confirmation of acceptance will be sent on receipt of a registration form.
- **Cancellations must be received one week before the start of a course, or the full course fee will be charged.**
- For more information on application and registration procedures, please visit our website: www.cpd.uct.ac.za

Certificates and CPD Points

A certificate of attendance will be awarded to participants who attend at least 80% of the live Zoom sessions and complete each weeks lessons.

CPD participants can also request a formal university transcript, which will show this course as part of a Professional Development Career.

Contact details:

For more information or details on CPD courses, visit our website or contact us.

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