



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

# Steady State Design of Biological Nutrient Removal Systems

Presented in person at UCT and online, 18 – 29 September 2023



# Introduction



## The Master's course

This course develops the knowledge and skills needed for understanding the purpose and sludge treatment unit operations of a wastewater treatment plant. The student shall be able to:

- (1) Understand in detail the kinetics included in nitrification - denitrification (ND) and excess biological phosphorus removal (EBPR) models and the inter-action, capabilities, and limitations.
- (2) Know the strength and weakness of the various ND and Excess EBPR system configurations.
- (3) Apply the steady state models to design and analysis of biological nutrient removal (BNR) plants to estimate reactor volume, oxygen demand and effluent quality.
- (4) Know quantitatively the effect of recent BNR system intensification strategies including membrane solid liquid separation or external nitrification.

## Continuing Professional Development

The course is offered to Continuing Professional Development delegates from which a participant can obtain CPD credits. Please note: If you are interested in attending this course for credit purposes towards MSc degree, you will need to formally register for the MSc Programme or as an occasional student. If you attend the course as a CPD participant, credit cannot be claimed in retrospect. A certificate of attendance will be awarded to CPD participants. Participants need to attend 80% of the lectures to qualify for an attendance certificate.

## Who should attend?

The course is best suited for Water and Wastewater Treatment Professionals, including Engineers and Scientists, Consultants, Contractors, Operators, Project managers, City and Public Works Officials, Urban Planners, and other design professionals who deal with issues related to wastewater treatment. An NQF level 8 qualification is a requirement, and prospective participants will be required to submit copies of their qualification and a short CV.

## Format

This course will be presented in a hybrid format i.e., face-to-face, and online over 9 days (excluding the weekend and public holiday).

The face-to-face presentations/ lectures will take place at the Postgraduate Seminar Room, level 3, New Engineering Building, upper campus, UCT.

The online presentation will be via MS TEAMS. Participants are expected to have computer access with good wifi or data reception and will be responsible for ensuring they have backup systems during loadshedding.

Further information will be available in the week before the course starts.

# Course Content

This advanced course in steady state design of biological nutrient removal systems includes: denitrification, development of the steady state nitrification denitrification (ND) model; effect of ND on reactor volume, effluent alkalinity and oxygen demand; the role of readily biodegradable (RB) and slowly biodegradable (SB) organics; denitrification potential; effect of the influent TKN/COD ratio on unaerated mass fraction, N removal and effluent quality; calculation of inter-reactor recycle ratios for design and analysis of pre-, post- and combined denitrification systems. Characteristics of polyphosphate accumulating organisms (PAOs); development and use of biological excess phosphorus removal (BEPR) steady state model; design and analysis of NDBEPR of systems, chemical P precipitation and its effect on BEPR; new developments and novel applications; the impact of membrane solid/liquid separation and external nitrification on NDBEPR system design.

## Course Overview

|                     |   |
|---------------------|---|
| <b>Name</b>         | Steady State Design of Biological Nutrient Removal Systems: CIV5048Z  |
| <b>Duration</b>     | 18 – 29 September 2023  |
| <b>Venue</b>        | Post-graduate Seminar Room, Level 3, New Engineering Building <u>and</u> online   |
| <b>CPD</b>          | 9 CPD points, ECSA Validation No: UCTWQEDBNR23  |
| <b>Participants</b> | Water and Wastewater Treatment Professionals, including Engineers and Scientists, Consultants, Contractors, Operators, Project managers, City and Public Works Officials, Urban Planners, and other design professionals who deal with issues related to wastewater treatment. An NQF level 8 qualification is a requirement, and prospective participants will be required to submit copies of their qualification and a short CV. |
| <b>Fees</b>         | Standard delegate: R15 700<br>UCT student or staff fee: R7850   |

## Course Presenters

---



**David Ikumi** is an Associate Professor for Water Quality Engineering for the Department of Civil Engineering at University of Cape Town and performs his research under the Water Research Group, which is a part of the transdisciplinary Future Water Research Institute. He is also the convenor for Water Engineering Studies, the director of the UCT Water Research Group and the academic lead for Water Institute of Southern Africa (WISA) modelling and data (MAD) division. His research interests are around the development, refinement and application of system-wide mathematical models for water and resource recovery facilities (WRRFs). He has developed and contributed to the development of various steady state and dynamic plant-wide mathematical models. He has contributed to various projects involving the process design of full-scale waste treatment systems and their optimised operation. He is also involved in the development of methods for the calibration and use of plant-wide wastewater treatment models for their application in industrial projects.

---

# Registration

## Registration and Cancellation

- [Register online](#)
- 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/cpd/applications](http://www.cpd.uct.ac.za/cpd/applications)

## Certificates and CPD Points

- A certificate of attendance will be awarded to CPD participants for each course. Participants need to attend 80% of the lectures to qualify for an attendance certificate.
- According to guidelines set out by the Engineering Council of South Africa, attendance of this course will earn participants points towards Category 1 (Developmental Activities). The ECSA validation number for this course is UCTWQEDBNR23
- Please note: If you are interested in attending this course for credit purposes, you will need to register for the Master's Programme or as an occasional student. If you attend the course as a CPD participant, credit cannot be claimed in retrospect.
- 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.

---

**Web:** <http://www.cpd.uct.ac.za>

**E-mail:** [ebe-cpd@uct.ac.za](mailto:ebe-cpd@uct.ac.za)

---

### Physical address

CPD Programme  
Room 6.10, 6th Floor  
New Engineering Building  
Upper Campus  
University of Cape Town  
South Africa

### Postal address

CPD Programme  
EBE Faculty  
University of Cape Town  
Private Bag X3  
Rondebosch 7701  
South Africa

---

### Programme administrators

Gillian Williams: +27 (0)21 650 7239  
Sandra Jemaar: +27 (0)21 650 5793  
Heidi Tait: +27 (0)21 650 4922

### Course presenter

A/Prof David Ikumi  
[david.ikumi@uct.ac.za](mailto:david.ikumi@uct.ac.za)

---