
CIVIL ENGINEERING

The Department offers the following postgraduate degree programmes:

Civil Infrastructure Management and Maintenance
Geotechnical Engineering
Structural Engineering and Materials
Transport Studies
Urban Infrastructure Design and Management
Water Quality Engineering

Research Entities:

Centre for Transport Studies
Concrete Materials and Structural Integrity Research Unit
Geotechnical Engineering
Structural Engineering and Mechanics
Urban Water Management Research Unit
Water Quality Engineering

The Department of Civil Engineering is housed in the New Engineering Building, situated on the top terrace of the Upper Campus. This brand new facility is shared with the Department of Chemical Engineering and the Faculty Office.

Staff

Professor and Head of Department

P Moyo, PrEng BSc(Eng) *Zimbabwe* MSc(Eng) *Newcastle-upon-Tyne* PhD *Nanyang* FSAAE
MSAICE MIABSE MISHMII

Professors

N P Armitage, PrEng BSc(Eng) *Natal* MSc(Eng) *CapeTown* PhD *Stell* FSAAE FSAICE FWISA
FSAIMunE Fellow IWA Mem IAHR Mem IAHS
H Beushausen, Dipl-Ing HAW Hamburg MSc(Eng) PhD *Cape Town*
M Vanderschuren, BSc(Eng) *Tilburg* MScEng *Delft* PhD *Enschede* MSAICE MSASITS
A Zingoni, PrEng BSc(Eng) *Zimbabwe* MSc(Eng) *London* DIC PhD *London* CEng FIStructE
FZweIE MASSAf FIABSE FSAAE
MHP Zuidgeest, MSc(Eng) PhD(Eng) *Twente*

Associate Professors

R Behrens, Pr Pln BA MCRP PhD *Cape Town*
D Kalumba, BSc(Eng) *Makerere* MSc(Eng) *Cape Town* PhD *Newcastle-upon-Tyne*
S Skatulla, Dipl-Ing *Karlsruhe* PhD *Adelaide*

Emeritus Professor

MG Alexander, PrEng BSc(Eng) MSc(Eng) PhD *Witwatersrand* FSAICE FSAAE, MASSAf MICT
GA Ekama, BSc(Eng) PhD *Cape Town* SFWISA FRSSAf FSAAE MASSAf MWEF MIWA

Emeritus Associate Professors

MO de Kock, PrEng BSc(Eng) *Cape Town*
R Del Mistro, PrEng TRP(SA) BSc(Eng) Diploma TE(IHE) MURP *Cape Town* PhD *Pretoria*
RO Heckroodt, MSc DSc *Pretoria* Dip Ceram *Leeds* FSAIMM FI Ceram (UK)
FA Kilner, PrEng MA *Oxon* MSc(Eng) *London* DIC

ADW Sparks, PrEng CEng BSc(Eng) *Natal* MSc(Eng) *Witwatersrand* MICE FSAICE
MOPResSocSAMRoySocSA

Senior Lecturers

DS Ikumi, PhD *Cape Town*

K Mudenda, PrEng BEng *Zambia* MSc(Eng) *Cape Town*

DG Randall, PrEng BSc(Eng)Chem PhD *Cape Town* MSAICHe MWISA MIMWA

Academic Development Senior Lecturer

NS Wolmarans, BSc(Eng) MSc(Eng) PhD *Cape Town*

Lecturer

FC Chebet, BSc(Eng) *Makerere* MSc(Eng) *Manchester*

L Nolutshungu, MSc(Eng) *Cape Town*

Senior Research Officer

KJ Carden, BSc MSc(Appl Sci) PhD *Cape Town*

Research Officer

H Schalekamp, BAS BArch MPhil PhD *Cape Town*

Honorary Research Associates

E Beukes, PhD *Cape Town*

LA Kane, BEng *Cardiff* MSc(Eng) *Cape Town*

K MacHutchon, PhD *Stellenbosch*

P Mguni, BSc *Zimbabwe* MSc *Aalborg* PhD *Copenhagen*

S Phayane, PrEng MEng *Cape Town*

M Santhanam, BTech *IIT Madras* MS PhD *Purdue*

I Tchegnina Ngassam, PhD *Paris-Est*

Adjunct Staff

V Collis, PrEng PrArch BSc(Eng) *Cape Town*

Principal Technical Officer

TBC

Laboratory Manager/Principal Scientific Officer

N Hassen

Water Quality Laboratory Manager

N Thela, NDip Chem Eng *MUT* BTech Chem Eng *DUT* BSc Hon(Appl Sci) *Pretoria*

Chief Technical Officer

A Rule

Senior Technical Officer

T Mukaddam, ND Civil Eng *CPUT*

Departmental Manager

AB Dalwai, BSocSc *Cape Town*

Administrative Officer - Postgraduate

R Geswindt

122 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Administrative Officer – Undergraduate

I Ncube

Research Administrative Staff

A Sulo, ND Financial Management *PE FET College*

G Verster

Finance Assistant

A Courie

Senior Secretary

C Wright

Receptionist

Z Mcoteli

Laboratory Technical Staff

L Adams

H Mafungwa

C May

E Witbooi

Workshop Assistant

M Swayiza

Postgraduate Programmes

Master's Programmes

Master of Science in Engineering specialising in Civil Engineering

The Department of Civil Engineering prepares candidates for the Master of Science in Engineering. Masters degree programmes are offered which comprise different levels of research versus course work, thus allowing students to educate themselves according to their particular strengths and career choices. The majority of courses are block week and cover a variety of topics

The Master of Science in Engineering can be either by dissertation only [EM023] or by coursework (approved by your supervisor) and dissertation [EM024].

EM023 Research Master's by dissertation

[EM023CIV01]

Core Course

Code	Course	NQF Credits	HEQSF Level
CIV5000W	Dissertation Civil Engineering	180	9
END5050X	Master's journal paper	0	9
	Total credits	180	

EM024 Research Master's by coursework and dissertation

[EM024CIV01]

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5000Z	Dissertation Civil Engineering	120	9

Code	Course	NQF Credits	HEQSF Level
	Elective courses approved by supervisor	60	9
CIV5109Z	Dissertation Preparation	0	9
END5050X	Master's journal paper.....	0	9
	Total credits.....	180	

Civil Infrastructure Management and Maintenance [CIV07]

Professor and Programme Convener:

H Beushausen, Dipl-Ing HAW *Hamburg* MSc(Eng) PhD *Cape Town*

The primary aim of the MEng and MSc(Eng) specialising in Civil Infrastructure Management & Maintenance is to produce graduates with the necessary knowledge and skills to engage effectively in structural and materials engineering with respect to maintenance, rehabilitation and management of civil infrastructure. The broad areas of interest are deterioration science, assessment technologies, renewal engineering and project management.

All programmes can be completed in a minimum of two years full-time or may be taken over an extended period of a maximum of five years.

Master of Science in Engineering specialising in Civil Infrastructure Management and Maintenance

[EM023CIV07]

Code	Course	NQF Credits	HEQSF Level
CIV5000W	Dissertation.....	180	9
END5050X	Master's journal paper.....	0	9
	Total credits.....	180	

Master of Science in Engineering specialising in Civil Infrastructure Management & Maintenance

[EM024CIV07]

Code	Course	NQF Credits	HEQSF Level
CIV5000Z	Dissertation.....	120	9
CIV5109Z	Dissertation Preparation	0	9
CIV5067Z	Advanced Infrastructure Management	20	9
CIV5138Z	Deterioration and Condition Assessment of Concrete Structures	20	9
END5050X	Master's journal paper.....	0	9
	Elective courses from the list below.....	20	9
	Total credits.....	180	

Elective Courses (minimum of 20 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5139Z	Repair & Rehabilitation of Concrete Structures.....	20	9
CIV5140Z	Strengthening and Retrofitting of Concrete Structures	20	9
	Approved elective as an alternative to the above	20	9

Master of Engineering specialising in Civil Infrastructure Management and Maintenance

[EM017CIV07]

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5017Z	Minor Dissertation	60	9
CIV5067Z	Advanced Infrastructure Management	20	9
CIV5138Z	Deterioration and Condition Assessment of Concrete Structures	20	9
CIV5139Z	Repair & Rehabilitation of Concrete Structures	20	9
CIV5140Z	Strengthening and Retrofitting of Concrete Structures.....	20	9
CON5016Z	Project Planning & Implementation	20	9
	Elective courses from the list below	20	9
	Total credits	180	

Elective Courses

Code	Course	NQF Credits	HEQSF Level
CIV5002Z	Structural Concrete Properties & Practice	16	9
CIV5113Z	Structural Dynamics with Applications.....	16	9
CIV5115Z	Bridge Management & Maintenance.....	10	9
CIV5118Z	Safety of Special Structures.....	10	9
CIV5119Z	Structural Performance Assessment & Monitoring	20	9
	Approved elective as an alternative to the above list.....	20	9

Master of Engineering in Civil Infrastructure Management and Maintenance

[EM033CIV07]

Programme Convener:

TBC

A candidate for the Master of Engineering in Civil Infrastructure Management and Maintenance is required to complete core courses totalling 100 credits, a research project totalling 45 credits, and approved elective courses totalling a minimum of 35 credits, and to comply with the prescribed curriculum.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5067Z	Advanced Infrastructure Management	20	9
CIV5138Z	Deterioration and Condition Assessment of Concrete Structures	20	9
CIV5139Z	Repair & Rehabilitation of Concrete Structures	20	9
CIV5119Z	Structural Performance Assessment & Monitoring	20	9
CIV5136Z	CIMM Project.....	45	9
	Elective courses from the list below	55	9
	TOTAL	180	

Elective Courses (minimum of 35 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5002Z	Structural Concrete Properties & Practice	16	9
CIV5113Z	Structural Dynamics with Applications.....	16	9
CIV5115Z	Bridge Management & Maintenance.....	10	9

Code	Course	NQF Credits	HEQSF Level
CIV5118Z	Safety of Special Structures	10	9
CIV5025Z	Contract Law for Engineers	12	9
CIV5131Z	Research Design and Methodology for Civil Engineers	16	9
CON5014Z	Project Management & Systems Theory	20	9

Master of Science in Engineering specialising in Geotechnical Engineering [EM024CIV08]

Associate Professor and Programme Convener:

D Kalumba, BSc(Eng) *Makerere* MSc(Eng) *Cape Town* PhD *Newcastle-upon-Tyne*

The master's programme with a specialisation in Geotechnical Engineering is intended to support high level training and enhance both the technical skills of recent graduates or experienced personnel who work in, or aspire to a career in civil engineering construction, consulting, environmental and related industries.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5000Z	Dissertation	120	9
CIV5109Z	Dissertation Preparation	0	9
CIV5110Z	Laboratory and Field Techniques	16	9
CIV5114Z	Foundation Design	16	9
END5050X	Master's journal paper	0	9
	Core Elective Courses	16	9
	Elective courses	12	9
	Minimum total credits	180	

Core Elective Courses (minimum of 16 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5122Z	Advanced Soil Mechanics OR	16	9
CIV5143Z	Rock Mechanics	16	9

Elective Courses (minimum of 12 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5111Z	Ground Improvement Techniques	20	9
CIV5124Z	Geosynthetics Engineering	16	9
CIV5149Z	Slope Stability and Lateral Earth Supports	20	9
CIV5050Z	Soil Modelling and Numerical Methods	20	9

Enrichment courses (compulsory for MScEng)

Code	Course	NQF Credits	HEQSF Level
CHE5055Z	Research Communication and Methodology OR	16	9
CIV5131Z	Research Design and Methodology	16	9

Master of Geotechnical Engineering [EM028CIV08]

Associate Professor and Programme Convener:

D Kalumba, BSc(Eng) *Makerere* MSc(Eng) *Cape Town* PhD *Newcastle-upon-Tyne*

The Master of Geotechnical Engineering (MGeotech) programme is designed to aid in the development of graduates in their careers as geotechnical engineers through courses that offer in-depth understanding of the principles of geotechnical engineering as well as the necessary knowledge and skills to engage effectively in providing solutions to engineering challenges involving the ground control and ground stability in civil engineering construction projects.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5129W	Geotechnical Engineering Project	45	9
CIV5110Z	Laboratory and Field Techniques	16	9
CIV5114Z	Foundation Design	16	9
CIV5149Z	Slope Stability and Lateral Earth Supports	20	9
	Elective courses	87	9
	Minimum total credits	180	

Elective Courses (minimum of 87 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5111Z	Ground Improvement Techniques	20	9
CIV5122Z	Advanced Soil Mechanics	16	9
CIV5124Z	Geosynthetics Engineering	16	9
CIV5143Z	Rock Mechanics	16	9
CIV5150Z	Soil Modelling and Numerical Methods	16	9
CIV5131Z	Research Design and Methodology	16	9

Structural Engineering and Materials

Associate Professor and Programme Convener:

S Skatulla Dipl-Ing *Karlsruhe* PhD *Adelaide*

The programme offers high level training in structural design, structural analysis and structural materials by providing sound theoretical background and encouraging critical and innovative thinking. Students benefit from expertise in concrete technology, concrete durability, structural performance and design, computational mechanics and finite element analysis. The programme is supported by excellent laboratory and computing facilities and draws from cutting edge research including the in-house developed structural analysis software SESKA.

All programmes can be completed in a minimum of two years full-time or may be taken over an extended period of a maximum of five years.

Master of Engineering specialising in Structural Engineering and Materials [EM017CIV04]

A candidate for the MEng in Structural Engineering and Materials [EM017CIV04] is required to complete 120 credits coursework and a 60 credit minor dissertation.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5017Z	Minor Dissertation.....	60	9
CIV5113Z	Structural Dynamics with Applications.....	16	9
CIV5100Z	Plate and Shell Structures.....	16	9
CIV5142Z	Introduction to Finite Element Modelling in Structural Analysis .	16	9
	Elective Courses.....	72	9
	Total credits.....	180	

Elective courses (minimum of 72 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5002Z	Structural Concrete Properties and Practice	16	9
CIV5006Z	Advanced Structural Concrete Engineering	16	9
CIV5041Z	Bridge Analysis and Design	16	9
CIV5108Z	Advanced Mechanics of Materials	16	9
CIV5112Z	Stability and Design of Steel Structures	16	9
CIV5119Z	Structural Performance Assessment & Monitoring.....	20	9
CIV5138Z	Deterioration and Condition Assessment of Concrete Structures .	20	9
CIV5139Z	Repair and Rehabilitation of Concrete Structures	20	9

Master of Science in Engineering specialising in Structural Engineering and Materials

[EM024CIV04]

A candidate for the MSc Eng [EM024] is required to complete prescribed courses of a minimum value of 60 credits and a 120 credit dissertation.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5000Z	Dissertation.....	120	9
CIV5109Z	Dissertation Preparation	0	9

Select at least two of the following courses:

Code	Course	NQF Credits	HEQSF Level
CIV5108Z	Advanced Mechanics of Materials	16	9
CIV5113Z	Structural Dynamics with Applications.....	16	9
CIV5142Z	Introduction to Finite Element Modelling in Structural Analysis .	16	9

Elective Courses

Code	Course	NQF Credits	HEQSF Level
CIV5112Z	Stability and Design of Steel Structures.....	16	9
CIV5002Z	Structural Concrete Properties and Practice	16	9
CIV5100Z	Plate and Shell Structures.....	16	9
CIV5119Z	Structural Performance Assessment & Monitoring.....	20	9
MEC5064Z	Finite Element Analysis	12	9
CIV5139Z	Repair and Rehabilitation of Concrete Structures	20	9
CIV5138Z	Deterioration and Condition Assessment of Concrete Structures .	20	9
CIV5041Z	Bridge Analysis and Design	16	9
MEC5063Z	An introduction to Finite Elements	12	9

Enrichment Courses

Code	Course	NQF Credits	HEQSF Level
CIV5131Z	Research Design and Methodology.....	16	9

128 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Additional courses can be selected from the postgraduate programme of the University of Stellenbosch or from the Center for Research in Computational and Applied Mechanics (CERECAM) at UCT or from the postgraduate programme of Geotechnical Engineering for both the MScEng and MEng degrees.

Master of Structural Engineering and Materials

[EM032CIV04]

A candidate for the Master of Structural Engineering and Materials is required to complete core courses totalling 96 credits, a research project totalling 45 credits, and approved elective courses totalling a minimum of 55 credits, and to comply with the prescribed curriculum.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5002Z	Structural Concrete Properties and Practice	16	9
CIV5006Z	Advanced Structural Concrete Engineering	16	9
CIV5112Z	Stability and Design of Steel Structures	16	9
CIV5100Z	Plate and Shell Structures	16	9
CIV5113Z	Structural Dynamics with Applications	16	9
CIV5131Z	Research Design and Methodology	16	9
CIV5137Z	MSEM Project	45	9
	Elective courses from the list below	39	9
	Total credits	180	

Elective Courses (minimum of 39 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5108Z	Advanced Mechanics of Materials	16	9
CIV5118Z	Safety of Special Structures	10	9
CIV5115Z	Bridge Management and Maintenance	10	9
CIV5041Z	Bridge Analysis and Design	16	9
CIV5025Z	Contract Law for Engineers	12	9
CIV5138Z	Deterioration and Condition Assessment of Concrete Structures	20	9
CIV5119Z	Structural Performance Assessment of Concrete Structures	20	9
CIV5139Z	Repair and Rehabilitation of Concrete Structures	20	9
MEC5064Z	Introduction to Finite Elements	12	9
MEC5063Z	Finite Element Analysis	12	9
CIV5142Z	Introduction to Finite Element Modelling in Structural Analysis	16	9

Transport Studies

Associate Professor and Programme Convener:

R Behrens, Pr Pln BA MCRP PhD *Cape Town*

The programme offers degrees specialising in transport studies, with a specific focus on the planning and management of urban passenger transport systems. The primary aim is to produce graduates from a range of postgraduate disciplines with the necessary knowledge and skills to engage effectively with the challenge of creating affordable, efficient, sustainable, safe, equitable and environmentally sound urban transport systems, and to contribute to the implementation of new and demanding policy directives. Curriculum content is cross-disciplinary in orientation and exposes students to a broad range of the analytical, evaluative, planning and management issues they are likely to encounter in the field.

Master of Engineering specialising in Transport Studies

[EM017CIV06]

A candidate for the MEng in Transport Studies is required to complete core courses totalling 120 credits (including a 60 credit minor dissertation) plus approved elective courses totalling a minimum of 60 credits, and to comply with the prescribed curriculum. Candidate elective courses may be selected from within the Transport Studies programme and from other programmes of study.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5017Z	Minor Dissertation.....	60	9
CIV5132Z	Transport Demand Analysis and Project Assessment	20	9
CIV5133Z	Transport Modelling.....	20	9
CIV5071Z	Public Transport System Design and Operations Management	20	9
	Approved elective courses.....	60	9
	Total credits.....	180	

Master of Philosophy specialising in Transport Studies

[EM026CIV06]

A candidate for the MPhil degree is required to complete prescribed courses of a minimum value of 60 credits and a 120 credit dissertation.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5134W	Dissertation.....	120	9
CIV5109Z	Dissertation Preparation	0	9

Select three of the following courses:

Code	Course	NQF Credits	HEQSF Level
CIV5035Z	Management of Transport Supply and Demand.....	20	9
CIV5038Z	Integrated Land Use Transportation Planning.....	20	9
CIV5132Z	Transport Demand Analysis and Project Assessment	20	9
CIV5036Z	Local Area Transport Planning Management and Design.....	20	9
CIV5039Z	Non-motorised Transportation	20	9
CIV5133Z	Transport Modelling.....	20	9
CIV5070Z	Public Transport Policy and Regulation.....	20	9
CIV5071Z	Public Transport System Design and Operations Management	20	9
CIV5127Z	Discrete Choice Modelling and Stated Choice Survey Design	20	9
	Total credits.....	180	

Students are also eligible to complete the MPhil degree as a 180 credit dissertation.

Master of Philosophy specialising in Transport Studies

[EM027CIV06]

A candidate for the MPhil in Transport Studies is required to complete core courses totalling 120 credits (including a 60 credit minor dissertation) plus approved elective courses totalling a minimum of 60 credits, and to comply with the prescribed curriculum.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5037Z	Minor Dissertation.....	60	9
CIV5035Z	Management of Transport Supply and Demand.....	20	9
CIV5038Z	Integrated Land Use-Transport Planning	20	9

130 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Code	Course	NQF Credits	HEQSF Level
CIV5132Z	Transport Demand Analysis and Project Assessment	20	9
	Approved elective courses	60	9
	Total credits	180	

Elective Courses (minimum of 60 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5036Z	Local Area Transport Planning Management and Design	20	9
CIV5039Z	Non-motorised Transportation.....	20	9
CIV5133Z	Transport Modelling	20	9
CIV5070Z	Public Transport Policy and Regulation	20	9
CIV5071Z	Public Transport System Design and Operations Management	20	9
CIV5127Z	Discrete Choice Modelling and Stated Choice Survey Design	20	9

Master of Transport Studies

[EM029CIV06]

A candidate for the Master of Transport Studies is required to complete core courses totalling not less than 60 credits, approved elective courses totalling a minimum of 80 credits, research projects totalling a minimum of 50 credits, and to comply with the prescribed curriculum.

Core Courses

Code	Course	NQF Credits	HEQSF Level
CIV5135W	Research Project 1: Transport planning and engineering methods	25	9
CIV5073W	Research Project 2: Transport policy and planning case study.....	25	9
CIV5035Z	Management of Transport Supply and Demand	20	9
CIV5038Z	Integrated Land Use-Transport Planning.....	20	9
CIV5132Z	Transport Demand Analysis and Project Assessment	20	9
	Approved elective courses	80	9
	Total credits	190	

Elective Courses (minimum of 80 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5036Z	Local Area Transport Planning, Management and Design	20	9
CIV5039Z	Non-motorised Transportation.....	20	9
CIV5133Z	Transport Modelling	20	9
CIV5070Z	Public Transport Policy and Regulation	20	9
CIV5071Z	Public Transport System Design and Operations Management	20	9
CIV5127Z	Discrete Choice Modelling and Stated Choice Survey Design	20	9

Master of Philosophy specialising in Engineering Education

[EM026CIV09]

Doctor and Convener:

CB Shaw, BSc HDE MPhil(EngMan) PhD *Cape Town*

The Faculty of Engineering and the Built environment offers a structured MPhil programme in Engineering Education. Students are required to complete a minimum of 60 credits of coursework, 45 credits of which are core to the programme. The additional credits will include an elective course approved by the supervisor. To qualify for the MPhil degree specialising in Engineering Education candidates are required to complete a supervised dissertation equivalent to a further 120 credits. The dissertation should incorporate any or all of the following: design of an engineering education research project involving advanced concepts and theoretical principles located in the engineering education research field; a research project of a theoretical or practical nature; a critical review of a

specified topic based upon a comprehensive search of the literature or available data, a rigorous analysis of empirical data, and the development of a coherent discussion of the analysis, or any other study acceptable to the Faculty. Students will register for the dissertation in the home department of their supervisor.

Core Course

Code	Course	NQF Credits	HEQSF Level
MEC5102Z	Knowledge and Practices in Engineering Education.....	15	9
EEE5148Z	Theoretical Foundations in Engineering Education Research.....	15	9
CIV5109Z	Dissertation Preparation	0	9
CIV5147Z	Methodologies in Engineering Education Research.....	15	9
Elective	Subject to approval by supervisor	15	9
CIV5148W	Dissertation Engineering Education.....	120	9
	Total credits.....	180	

Water Quality Engineering**Senior Lecturer and Programme Convener:**

DS Ikumi, PhD *Cape Town*

The primary aim of the MEng and MScEng specialising in Water Quality Engineering is to produce graduates with the necessary knowledge and skills to engage effectively in theory, design, modelling and operation Waste Water Treatment, Urban Water and Water Distribution.

Master of Engineering specialising in Water Quality Engineering**[EM017CIV02]****Core Courses**

Code	Course	NQF Credits	HEQSF Level
CIV5017Z	Minor Dissertation.....	60	9
CIV5032Z	Introduction to Wastewater Treatment.....	4	9
CIV5045Z	The Activated Sludge System	10	9
CIV5046Z	Sedimentation in Water Treatment.....	8	9
CIV5047Z	Sewage Sludge Treatment.....	8	9
CIV5048Z	Design of Biological Nutrient Removal Systems.....	20	9
CIV5050Z	Integrated Wastewater Treatment Plant Design.....	20	9
	Pre-approved elective credits	50	9
	Total credits.....	180	

Elective Courses (select 50 credits)

Code	Course	NQF Credits	HEQSF Level
CIV5049Z	Modelling & Simulation of Wastewater Treatment.....	12	9
CIV5051Z	Aquatic Chemistry Part A.....	14	9
CIV5052Z	Aquatic Chemistry Part B.....	14	9
CIV5054Z	Advanced Chemical, Physical & Biological Processes Modelling.....	10	9

Master of Science in Engineering specialising in Water Quality Engineering**[EM023CIV02]****Core Courses**

Code	Course	NQF Credits	HEQSF Level
CIV5000W	Dissertation.....	180	9
END5050X	Master's journal paper.....	0	9
	Total credits.....	180	

Master of Science in Engineering specialising in Water Quality Engineering**[EM024CIV02]****Core Courses**

Code	Course	NQF Credits	HEQSF Level
CIV5000Z	Dissertation	120	9
CIV5109Z	Dissertation Preparation	0	9
END5050X	Master's journal paper	0	9
CIV5032Z	Introduction to Wastewater Treatment	4	9
CIV5045Z	The Activated Sludge System	10	9
CIV5046Z	Sedimentation in Water Treatment	8	9
CIV5047Z	Sewage Sludge Treatment	8	9
CIV5048Z	Design of Biological Nutrient Removal Systems	20	9
CIV5050Z	Integrated Wastewater Treatment Plant Design	20	9

Elective Courses

Code	Course	NQF Credits	HEQSF Level
CIV5049Z	Modelling & Simulation of Wastewater Treatment	12	9
CIV5051Z	Aquatic Chemistry Part A	14	9
CIV5052Z	Aquatic Chemistry Part B	14	9
CIV5054Z	Advanced Chemical, Physical & Biological Processes Modelling	10	9

Doctoral Programmes**Doctor of Philosophy****[ED001CIV01]**

Code	Course	NQF Credits	HEQSF Level
CIV6000W	Thesis	360	10
CIV6001W	Thesis (Engineering Education)	360	10

Course descriptions are set out in the section Courses Offered. The course code abbreviation for Civil Engineering is CIV.

Course Outlines**CIV5000W MASTERS IN CIVIL ENGINEERING DISSERTATION**

180 NQF credits at HEQSF level 9

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

CIV5000Z MASTERS IN CIVIL ENG - DISSERT PART

120 NQF credits at HEQSF level 9

Course entry requirements: CIV5109Z

Course outline:

The dissertation should incorporate any or all of the following: design of all or part of an engineering project to a specification involving advanced concepts and theoretical principles; a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data, development of an item of equipment or a technique involving novel features; or advanced design, or any other study acceptable to the Faculty.

DP requirements: None

Assessment: Written work counts 100%.

CIV5002Z STRUCTURAL CONCRETE PROPERTIES & PRACTICE

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: BScEng

Course outline:

The aims of the course are to provide structural engineers with fundamental and practical knowledge in concrete materials technology, to establish an understanding on modelling and designing concrete properties relevant to structural design, and to create awareness on chemical and physical material characteristics of cementitious construction materials. The topics covered in this course include: constituent materials (cements, admixtures, cement extenders, aggregates); desirable properties for concrete (plastic and hardened properties, including strength, creep, shrinkage, elastic modulus, durability); concrete mix design; prediction and modelling of concrete structural properties; concrete failure and fracture; concrete quality control; deterioration mechanisms; special concretes such as high strength concrete, self compacting concrete and fibre reinforced concrete. The course includes lectures, industrial visits, seminars, projects, and laboratory sessions.

Lecture times: 40 hours (1 week block lectures)

DP requirements: Attendance of lectures and practicals; submission of assignments and project reports.

Assessment: Research paper 15%, research oral presentation 10%, laboratory report 15%, final examination 60% (closed book).

CIV5006Z ADVANCED STRUCTURAL CONCRETE ENGINEERING

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: BScEng; CIV3049S (or equivalent), CIV4045F (or equivalent)

Course outline:

The aims of this course are to provide structural engineers with an understanding of structural failure mechanisms of reinforced concrete slabs, to present analysis and design methods for reinforced concrete slabs at the ultimate limit state, and to introduce design principles for composite concrete-to-concrete structures. The course contents include: yield line analysis and design of reinforced concrete slabs (yield line patterns, failure mechanisms, internal and external work done, detection of the critical bending moment, unusual slab geometries, optimization of reinforcement arrangements, etc.); Hillerborg strip method of analysis and design of concrete slabs (principles and theory of analysis and design, design optimization, bending moment redistribution, optimization of reinforcement layout); and composite structural systems (ultimate limit state analysis and design principles, practical considerations).

DP requirements: Attendance of lectures, an average assignment mark of 50%.

Assessment: Assignments 40%, final exam 60% (closed book).

CIV5017Z MINOR DISSERTATION

60 NQF credits at HEQSF level 9

Convener: As per programme requirement

Course entry requirements: Core MEng courses to be completed

Course outline:

Candidates will undertake a project of a development, review, or practical nature on a prescribed Civil Engineering topic. The project may be undertaken individually or as a group project and a project report must be written. The project will require approximately 600 hours of work.

DP requirements: None

Assessment: Written work 100%.

CIV5025Z CONTRACT LAW

12 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: Suitable undergraduate degree

Course outline:

The course aims to review the Law of Contract to develop a framework for the analysis of standard documentation for both main and subsidiary civil engineering contracts. Important aspects of mediation, arbitration and court procedures are stressed as is the need to identify and resolve legal problems through timeous negotiation. Disputes which have gone to law or arbitration will be studied to illustrate principles.

DP requirements: None

Assessment: Assignments 50%, final examination 50%.

CIV5030Z CIVIL ENGINEERING PROJECT

20 NQF credits at HEQSF level 9

Convener: As per programme requirement

Course entry requirements: Completion of appropriate postgraduate courses.

Course outline:

On the recommendation of the supervisor and with the agreement of the Head of Department, a student registered for an MSc(Eng) may be permitted to enter into a programme of individual study on a specialised topic. A statement of objectives must be agreed upon, and the course of study will be guided by the supervisor. The programme will involve the student in about 200 hours of work, and a written report must be submitted. The written report will be examined, and a further oral examination may be held.

Details of project topics are available from the Department.

DP requirements: None

Assessment: Written project 100%.

CIV5032Z PRINCIPLES OF WASTEWATER TREATMENT & WASTEWATER CHARACTERISATION

Not offered in 2019

4 NQF credits at HEQSF level 9

Convener: Dr D Ikumi

Course outline:

This advanced course on the principles of wastewater treatment and wastewater characterisation includes: objectives of wastewater treatment; wastewater chemical and physical characterization; measurement of energy, nitrogen and phosphorus in municipal wastewater; effect of settlement and filtration. Also covered are: characterisation of primary sludge for anaerobic digestion, and an overview of unit operations in wastewater treatment.

DP requirements: None

Assessment: Examination 100%.

CIV5035Z MANAGEMENT OF TRANSPORT SUPPLY AND DEMAND

20 NQF credits at HEQSF level 9

Convener: Associate Professor R Behrens**Course outline:**

This course aims to develop an advanced understanding of transport systems management. Topics include: the rationale for the management of transport systems through alternatives to large scale infrastructure provision; transport impact assessment and access management as a means of managing the impacts of new land use development on transport systems; 'road space management' as a means of prioritising public transport vehicles; 'transport system management' as a means of managing transport supply; 'travel demand management' as a means of managing travel behaviour; and the use of 'intelligent transport systems' in supply and demand management.

DP requirements: None**Assessment:** Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5036Z LOCAL AREA TRANSPORT PLANNING, MANAGEMENT AND DESIGN*Not offered in 2019*

20 NQF credits at HEQSF level 9

Convener: Associate Professor R Behrens**Course outline:**

This advanced course in local area transport planning, management and design includes: the planning and implementation of transport improvements at a local area (as opposed to citywide) scale; urban design, landscaping and geometric design of streets; the design and management of local area movement networks; and accommodating pedestrians, bicycles and persons with movement disabilities in local area movement networks.

DP requirements: None**Assessment:** Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5037Z MINOR DISSERTATION

60 NQF credits at HEQSF level 9

Course outline:

This minor dissertation course includes the selection of an approved research problem/topic; the preparation of research project/proposal; conducting a literature review; conducting research, including information/data acquisition and analysis, and the preparation of minor dissertation for examination (a word length of 15 000 words should not normally be exceeded).The project will require approximately 600 hours of work.

CIV5038Z INTEGRATED LAND USE TRANSPORT PLANNING

20 NQF credits at HEQSF level 9

Convener: Associate Professor R Behrens**Course outline:**

This course aims to develop an advanced understanding of the integration of land use planning and transport planning process. Topics include: theoretical perspectives on the relationship between transport systems and urban activity systems; co-evolution of transport systems and urban form; sustainable transport and the problem of 'automobile dependent' cities; planning paradigms and rationales for public intervention into land use and transport systems; legislative, institutional and financial frameworks for land use and transport planning in South Africa; conceptual framing and practical application of approaches to integrated land use-transport planning in the South African context and local and international case studies and experiences.

DP requirements: None

136 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Assessment: Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5039Z NON-MOTORISED TRANSPORTATION

20 NQF credits at HEQSF level 9

Convener: Professor M Vanderschuren

Course outline:

This course aims to develop an advanced understanding of planning and design of non-motorised transportation infrastructure. Topics include: current South African realities and the importance of non-motorised travel modes; planning frameworks for non-motorised transportation infrastructure improvements and network management; methods of site and network analysis, and approaches to modelling and simulation; footway and pathway design; the design of pedestrian precincts; low-cost bicycle supply and promotion; cycleway and bicycle parking design and pedestrian and bicycle crossing facilities.

DP requirements: None

Assessment: Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5040W MASTERS DISSERTATION: TRANSPORT STUDIES

180 NQF credits at HEQSF level 9

Convener: As per programme requirement.

Course outline:

The dissertation should incorporate any or all of the following: a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

DP requirements: None

Assessment: 100% written work.

CIV5041Z BRIDGE ANALYSIS & DESIGN

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: BScEng

Course outline:

This course aims to develop an advanced understanding of conceptual and structural analysis and design of concrete bridges. Topics include: conceptual design of bridges (design objectives and basis of design, design procedures, examples of good design, load bearing systems); preliminary structural design (load models, normative guidelines, analytical models); modelling of concrete bridges (typical finite element models, movable loads, dynamic loading); construction technology (principles and application of various construction methods); prestressing of concrete bridges (design principles, tendon layouts, methods of prestressing, prestress losses, etc.); concrete technology aspects (suitable concrete types, special design requirements for bridges, durability aspects); structural condition assessment (principles of non-destructive dynamic testing and verification of load-bearing capacity).

DP requirements: Attendance of lectures and practicals, submission of assignments and project reports.

Assessment: Assignments and projects 50%, final examination 50%.

CIV5045Z THE ACTIVATED SLUDGE SYSTEM

Not offered in 2019

10 NQF credits at HEQSF level 9

Convener: Dr D Ikumi

Course entry requirements: CIV5032Z

Course outline:

This course aims to develop an advanced understanding of the activated sludge system. Topics include: biological process modelling of the activated sludge system including nitrification; material mass balances; reactor kinetics; biological process kinetic equations of ordinary heterotrophic organism and autotrophic nitrifier organism growth and endogenous respiration; development of the steady state activated sludge model; application to design, selection of sludge age, impact of primary settling, sewage sludge disposal. Aeration is also covered.

DP requirements: None

Assessment: Examination 100%

CIV5046Z SEDIMENTATION IN WATER & WASTEWATER TREATMENT

Not offered in 2019

8 NQF credits at HEQSF level 9

Convener: Dr D Ikumi

Course entry requirements: CIV5032Z

Course outline:

This advanced course in sedimentation in water and wastewater treatment includes: classes of settling; factors affecting settling tanks; column test for water-treatment solids settling characterization; application to sizing settling tanks (classes 1 and 2 settling); effect of flocculation; flux theory and application to sizing wastewater treatment plant settling tanks (classes 3 and 4); measures of activated sludge settleability and relationships between them; comparison of flux theory with other design procedures; and computational fluid dynamics modelling of settling tanks.

DP requirements: None

Assessment: Examination 100%

CIV5047Z SEWAGE SLUDGE TREATMENT

Not offered in 2019

8 NQF credits at HEQSF level 9

Convener: Dr D Ikumi

Course entry requirements: CIV5032Z, CIV5046Z

Course outline:

This advanced course in sewage sludge treatment includes: an introduction to sewage sludge reuse and disposal guidelines in South Africa; characterization of primary and waste activated sludge in the context of mass balances over the entire wastewater treatment plant; sludge thickening with gravity sedimentation and flotation; development and validation of steady state aerobic digestion model for primary and waste activated sludge stabilisation and application to design and analysis including oxygen transfer and sludge thickening considerations; kinetics, stoichiometry and weak acid/base chemistry of anaerobic digestion; development, validation and application of steady state anaerobic digestion model, generation of sludge treatment liquors and the impact of their recirculation on effluent quality, and nutrient (N and P) reduction in sludge treatment liquors.

DP requirements: None

Assessment: Examination 100%.

CIV5048Z STEADY STATE DESIGN OF BIOLOGICAL NUTRIENT REMOVAL SYSTEMS

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Dr D Ikumi

138 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Course entry requirements: CIV5045Z

Course outline:

This advanced course in steady state design of biological nutrient removal systems includes: ensuring nitrification; nitrification capacity, kinetics of 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 un aerated mass fraction, N removal and effluent quality; calculation of inter-reactor recycles 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; novel applications; the impact of membrane solid/liquid separation and external nitrification on NDBEPR system design.

DP requirements: None

Assessment: Examination 100%

CIV5049Z MODELLING & SIMULATION OF WASTEWATER TREATMENT SYSTEMS

12 NQF credits at HEQSF level 9

Convener: Dr Ikumi

Course entry requirements: CIV5048Z

Course outline:

This advanced course in the modelling and simulation of wastewater treatment systems includes: kinetics of the readily biodegradable (RBCOD) and slowly biodegradable (SBCOD) organics utilization by ordinary heterotrophic organisms (OHOs), nitrification by autotrophic nitrifying organisms (ANOs) in aerobic systems; modifications for application to anoxic-aerobic systems; kinetics of RBCOD conversion to short chain fatty acids (SCFA) in the anaerobic reactor, kinetics of SCFA uptake, P release and substrate storage under anaerobic conditions and substrate utilisation (growth) and P uptake and aerobic conditions by PAO's; model presentation in Petersen matrix format; links to and simplifications of kinetics for steady state BNR models; programming, modelling and simulation of BNR activated sludge systems with the pre-coded UCTOLD and UCTPHO programmes and the ASIM or AQUASIM shell packages. Filamentous organism type and identification, control by means of kinetic and metabolic selection; and causes and control of filamentous organism proliferation in BNR systems.

DP requirements: None

Assessment: Examination 100%.

CIV5050Z INTEGRATED WASTEWATER TREATMENT PLANT DESIGN

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Dr D Ikumi

Course entry requirements: CIV5045Z, CIV5046Z, CIV5047Z

Course outline:

This advanced course in integrated wastewater treatment plant design includes: calculating daily composite average flow and loads from diurnal data; influent flow balancing; integrated wastewater treatment plant modelling and design; major project brief; economic evaluation of different wastewater treatment plant layouts to achieve different technical, and environmental and economic objectives.

DP requirements: None

Assessment: Major project 100%.

CIV5051Z AQUATIC CHEMISTRY PART A

14 NQF credits at HEQSF level 9

Convener: Dr D Ikumi**Course entry requirements:** None**Course outline:**

This advanced course in aquatic chemistry covers: chemical thermodynamics; acids and bases, activity, pH equilibria of weak acid base systems, master variable diagrams, titration of acids and bases, reference species; alkalinity acidity and pH, buffering intensity, detailed treatment of the carbonate system; precipitation and dissolution, Caldwell-Lawrence conditioning diagrams, critical evaluation of the Langelier index; and terrestrial and ground water stabilization.

DP requirements: None**Assessment:** Examination 100%.

CIV5052Z AQUATIC CHEMISTRY PART B

14 NQF credits at HEQSF level 9

Convener: Dr D Ikumi**Course entry requirements:** CIV5051Z**Course outline:**

This advanced course in aquatic chemistry covers: mixed weak acid systems; alkalinity, acidity and Deffeyes types single aqueous phase diagrams; application to pH control in anaerobic digester; the nitrogen and sulphur systems;. Kinetics of precipitation reactions; redox equilibrium systems; Pourbaix (pe-pH) diagrams; application to the chemistry of iron, manganese, lead, chlorine and nitrates in treated and wastewaters; kinetics of redox reactions; and applications to physico-chemical treatment processes.

DP requirements: None**Assessment:** Examination 100%.

CIV5054Z ADVANCED CHEMICAL, PHYSICAL & BIOLOGICAL PROCESSES MODELLING

10 NQF credits at HEQSF level 9

Convener: Dr D Ikumi**Course entry requirements:** CIV5049Z, CIV5051Z, CIV5052Z**Course outline:**

This advanced course in chemical, physical and biological processes modelling includes: aqueous mixed weak acid base chemistry of the carbonate, phosphate, ammonia, short chain fatty acid and sulphur systems; kinetics of gas evolution and stripping; modelling multiple mineral precipitation in 3 phases such as in mineral precipitation in anaerobic digester liquor aeration; integrated chemical, physical and biological processes modelling of activated sludge and anaerobic digestion; modelling acidogenic, methanogenic and sulphidogenic systems.

DP requirements: None**Assessment:** Examination 100%.

CIV5064Z URBAN TRANSITIONS IN THE GLOBAL SOUTH*Not offered in 2019*

20 NQF credits at HEQSF level 9

Convener: Professor E Pieterse**Course entry requirements:** Any suitable four-year degree**Course outline:**

The aim of this course is to provide students with a wide-ranging introduction to the dynamics of differential urbanization processes in the global South with an eye on understanding the role of infrastructure in advancing more sustainable urban forms and patterns. The overarching learning objectives of the module are to understand the nature, drivers and consequences of the second urban transition from a sustainability perspective, as well as to make connections between urbanisation and

140 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

long-term sustainability outcomes in different contexts, settings and scales. Topics covered include problems and issues of developing cities, poverty, exclusion, informality, livelihoods, economic development, governance and infrastructure.

Lecture times: 40 hours (1 week block lectures)

DP requirements: Complete all assignments.

Assessment: Coursework 35%, take home paper 65%.

CIV5067Z ADVANCED INFRASTRUCTURE MANAGEMENT

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: Any suitable four-year degree

Course outline:

The aim of this module is to expose students to the concepts of municipal infrastructure management. These concepts include the context for Infrastructure Management Planning, the process of Infrastructure Management Planning and the techniques required to prepare an Infrastructure Management Plan.

DP requirements: None

Assessment: Assignments 40%; take home examination 60%.

CIV5070Z PUBLIC TRANSPORT POLICY AND REGULATION

20 NQF credits at HEQSF level 9

Convener: Associate Professor R Behrens

Course entry requirements: None

Course outline:

This course aims to develop an understanding of public passenger transport system policy analysis and regulation. Topics include: Legislative and planning frameworks: institutional, legislative, financing and planning frameworks for integrated public transport infrastructure provision and service operation. Public transport policy: policy debates on subsidisation and competition regulation; mode alternatives analysis; international case studies of public transport system reform. Paratransit reform: operator consolidation and transition; fleet renewal; service upgrade; integration with scheduled services. Public transport system regulation and competition: industry structures; approaches to regulation and competition; licensing and contracting. Quality of service: quality-of-service measurement; passenger satisfaction measurement; passenger information systems and wayfinding.

DP requirements: None

Assessment: Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5071Z PUBLIC TRANSPORT SYSTEM DESIGN AND MANAGEMENT

20 NQF credits at HEQSF level 9

Convener: Professor M Zuidgeest

Course entry requirements: None

Course outline:

This course aims to develop an advanced understanding of public passenger transport system design and operations management. Topics include: Public transport system concepts: basic bus and rail system concepts; alternative technologies and operating characteristics. Public transport system design: route network planning; service planning; road and rail right-of-way design and vehicle prioritisation; signalling systems; station and interchange design; demand estimation; passenger capacity analysis. Public transport system operations management: service quality assessment, scheduling and rostering; train movement control systems; reliability, disruption and incident management; performance assessment; ridership measurement. Integrated fare structures: integrated ticketing systems; fare structures; fare setting. System maintenance: asset management; vehicle fleet

and rolling stock maintenance and refurbishment. DP requirements: Students are required to pass class exercises during the course week.

DP requirements: None

Assessment: Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5073W TRANSPORT POLICY AND PLANNING CASE STUDY

25 NQF credits at HEQSF level 9

Convener: Associate Professor R Behrens

Course entry requirements: None

Course outline:

The aim of this course is to offer students an opportunity to undertake a case study research project in which they are able to develop or deepen skills in transport policy and planning processes. The research would involve undertaking a critical investigation of the requirement for, the process of preparing and implementing, the content and the impacts of a selected transport policy, plan, strategy or project.

DP requirements: None

Assessment: Project report 100%.

CIV5100Z PLATE & SHELL STRUCTURES PART A

16 NQF credits at HEQSF level 9

Convener: Professor A Zingoni

Course entry requirements: BScEng

Course outline:

This course aims to be a comprehensive treatment of plate and shell theories, and their application to the solution of various problems in structural engineering. Plate and Shell Structures part A will cover plates subjected to bending and twisting (slope, curvature, twist, bending moments, transverse shears and twisting moments); the derivation of the bending equation for transversally loaded plates (rectangular and polar co-ordinates), solutions for rectangular plates and circular plates, practical applications, introduction to shell structures; the membrane hypothesis for shells; the membrane theory of axisymmetrically loaded shells of revolution.

DP requirements: None

Assessment: Examination 100%.

CIV5104S PLATE & SHELL STRUCTURES PART B

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Professor A Zingoni

Course entry requirements: CIV5100Z

Course outline:

This course aims to be a comprehensive treatment of plate and shell theories, and their application to the solution of various problems in structural engineering. Plate and Shell Structures I will cover plates subjected to bending and twisting (slope, curvature, twist, bending moments, transverse shears and twisting moments); the derivation of the bending equation for transversally loaded plates (rectangular and polar co-ordinates), solutions for rectangular plates and circular plates, practical applications, introduction to shell structures; the membrane hypothesis for shells; the membrane theory of axisymmetrically loaded shells of revolution.

DP requirements: None

Assessment: Examination 100%.

CIV5107Z INTEGRATED URBAN WATER MANAGEMENT

20 NQF credits at HEQSF level 9; .

Convener: Professor NP Armitage

Course entry requirements: Any suitable four-year degree.

Course outline:

The aim of this course is to introduce students to integrated urban water management (IUWM). This includes: social imperatives; environmental considerations; politics and water service delivery. Planning for water in the City of Cape Town; servicing the informal settlements of Cape Town. Water supply: key considerations for water reticulation systems; water supply options; household management of water; water demand management; public health considerations. Sanitation: options; managing sanitation in informal settlements. Stormwater: managing stormwater in the City of Cape Town; rehabilitating urban rivers; groundwater issues; Sustainable Drainage Systems (SuDS); catchment litter management. Water Sensitive Urban Design (WSUD); water management systems; sustainability indicators.

Lecture times: 40 hours (1 week block lectures).

DP requirements: Complete all assignments.

Assessment: Oral presentations 20%, two major assignments 80%.

CIV5108Z ADVANCED MECHANICS OF MATERIALS

16 NQF credits at HEQSF level 9

Convener: Associate Professor S Skatulla

Course entry requirements: BScEng or equivalent

Course outline:

This advanced course in the mechanics of materials aims to introduce students to the following topics: physical mechanisms of deformation of common construction materials; continuum mechanics and its main mathematical tool, tensor analysis; non-linear continuum material behaviour, including visco-elasticity, plasticity, and modelling; failure and fracture characteristics and modelling of these effects. An introduction to computational mechanics is also included.

DP requirements: 40% Subminimum in class tests.

Assessment: Examination 60%, coursework 40%.

CIV5109Z DISSERTATION PREPARATION

Prerequisite for CIV5000Z and CIV5134W

0 NQF credits at HEQSF level 9

Convener: As per programme requirement.

Course outline:

The aim of this course is to allow a student to undertake preparatory work for the master's dissertation. Work required includes literature searches and reviews; identification of the research problem, objectives and hypothesis; consideration of research methodology; planning for the active research phase; and ensuring that research infrastructure (e.g. apparatus etc.) is or will be in place. The student should maintain regular contact with his/her supervisor in order to show evidence of suitable progress towards these aims. The supervisor must indicate satisfactory fulfilment of the course aims prior to the student proceeding to the dissertation.

DP requirements: None

Assessment: None

CIV5110Z LABORATORY & FIELD TECHNIQUES

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to develop an advanced understanding of laboratory and field techniques. Topics include: Laboratory methods: role and scope of laboratory tests; fundamentals of stress-strain and strength measurements; stresses, pore pressures and strains; transducers and control systems; practical applications. The theoretical and practical aspects of in situ tests in geotechnical engineering. Tests discussed include: dynamic cone penetrometer standard penetration test, field vane, piezocone, dilatometer, pressuremeter etc. Geophysical methods are also included. Emphasis on use of in situ test results for determining engineering properties of soil for design. Field instrumentation; settlement gauges; extensometers; inclinometers; piezometers; geotechnical data correlation charts; measurements of in-situ stresses and permeability's; etc. are also covered.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: 40% Coursework, project 60%.

CIV5111Z GROUND IMPROVEMENT TECHNIQUES

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field

Course outline:

This course aims to introduce students to the concepts underpinning a range of ground improvements and soil remediation techniques and an appreciation of how these techniques are applied in practice. The course covers important design and construction aspects associated with ground improvement techniques including: Mechanical methods (compaction, vibrotechniques), Hydraulic methods (groundwater lowering, preloading, vertical drains, electro-osmosis), Physical/chemical methods (admixtures, grouting, deep soil mixing, ground freezing), Inclusions (rigid inclusions, soil reinforcements) and contaminated land and remediation.

Lecture times: 40 hours (1 week block lectures)

DP requirements: None

Assessment: Course work 50%, Project 50%

CIV5112Z STABILITY & DESIGN OF STEEL STRUCTURES

16 NQF credits at HEQSF level 9

Convener: Associate Professor S Skatulla

Course entry requirements: BScEng

Course outline:

This course aims to treat advanced topics in constructional steel work. The topics include elastic and inelastic buckling behaviour; plate buckling; non-linear instability behaviour of thin-walled structures, design for fatigue, design of steel-concrete composites, hybrid steel structures, steel connections plate girders, and the behaviour of steel structures under fire. Applications in industrial buildings and crane supporting structures are also addressed.

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5113Z STRUCTURAL DYNAMICS WITH APPLICATIONS

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Professor P Moyo

Course entry requirements: BScEng

Course outline:

This course aims to introduce the concepts of structural dynamics and its applications in structural engineering. Topics covered include dynamic equilibrium of structures. Response of a single degree

144 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

of freedom system to dynamic excitation: free vibration, harmonic loads, impulse loading and general loading Response of multi-degree-of-freedom systems. Free vibrations: mass, damping, and stiffness matrices. Rayleigh damping. Forced vibrations: modal superposition and step by step methods. Continuous systems. Applications to seismic design of structures, blast and impact effects on structures and wind engineering

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5114Z FOUNDATION DESIGN

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to furnish participants with the necessary knowledge and design skills required to ensure stability of both the ground, and any structure built in or on the ground. It will introduce participants to the application of theories of soil mechanics, applied mathematics and physics to provide solutions to the serviceability and ultimate limit states of geotechnical structures. Topics include: review of soil mechanics; working stress approach, limit state design; analysis and design of shallow and deep foundations; determination of settlement of structures; use of foundation design standards such as Eurocodes, SANS 10160; etc.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, project 50%.

CIV5115Z BRIDGE MANAGEMENT & MAINTENANCE

Not offered in 2019

10 NQF credits at HEQSF level 9

Convener: Professor P Moyo

Course entry requirements: BScEng

Course outline:

This course aims to introduce the principles of bridge management and maintenance. The focus is on both highway bridges and railway bridges. The course provides the basic philosophies behind bridge management systems, the structure of a bridge management system, and the implementation of bridge management system. Life cycle cost analysis of bridges are introduced. Linkages between bridge management, maintenance and rehabilitation of bridges is discussed. Key to this course are practical bridge inspections and case studies.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5118Z SAFETY OF SPECIAL STRUCTURES

Not offered in 2019

10 NQF credits at HEQSF level 9

Convener: Professor P Moyo

Course entry requirements: BScEng

Course outline:

The course introduces students to the governance and management of special structures. The procedures employed for safety evaluation are generally not specified in codes of practice. Probabilistic based risk analysis and surveillance techniques for the evaluation of loading and consequences of failure will be introduced. Case studies are used to demonstrate the principles.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5119Z STRUCTURAL PERFORMANCE ASSESSMENT & MONITORING

20 NQF credits at HEQSF level 9

Convener: Professor P Moyo

Course entry requirements: CIV5113Z

Course outline:

This aims to introduce concepts of structural health monitoring of civil infrastructure. The course covers: philosophy of structural performance assessment, performance indicators, strategies for structural performance assessment, introduction to theoretical modal analysis, experimental modal analysis, instrumentation, data acquisition, data quality assurance, modal parameter estimation and validation, introduction to model updating, model updating methods, structural modifications, correlation between tests and FEM models, structural monitoring, measurement of live load strains/stresses, probabilistic data analysis, material performance assessment, performance assessment, and estimation of remaining life.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5121Z DESIGN & MODELLING OF WATER DISTRIBUTION SYSTEMS

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: TBC

Course entry requirements: None

Course outline:

The aim of this course is to provide a structured and practical introduction to the design and modelling of water distribution systems. Topics include: Components of water transport and distribution systems. Water Demand: categories, patterns, calculation, forecasting. Hydraulics of Pipe Flow: basic equations, single pipe calculation, branched and looped networks, system-and pump characteristics and pressure dependent demand. Hydraulics of storage and pumps. Main components of Hydraulic Design: design parameters, choice of supply scheme and network layouts. Engineering design: choice of pipe materials, valves and other equipment. Pumps: review of pump types and their applications, design of pumping stations, power requirements and energy consumption, auxiliary equipment. Hydraulic modelling of distribution systems.

DP requirements: None

Assessment: Design assignment 100%.

CIV5122Z ADVANCED SOIL MECHANICS

16 NQF credits at HEQSF level 9

Convener: FC Chebet

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to provide extensive insight and depth to students' understanding of the theoretical background involved in the design of geotechnical systems in order to facilitate critical thinking in geotechnical analyses. It covers advanced concepts and theories in soil mechanics fundamental to geotechnical engineering such as; shear strength of soils; stress-strain behaviour; drained and undrained shear strength; stress paths; critical state soil mechanics, failure criteria; constitutive models soil deformation analysis; stress distribution in soil; settlement of soil; and consolidation theory.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

146 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Assessment: Coursework 30%, examination 70%.

CIV5123Z CONTAMINATED LAND AND REMEDIATION

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to create awareness of the occurrence of and risks posed by contaminants in contaminated sites and remediation issues, and to develop basic engineering skills and knowledge required to identify appropriate remediation methods for contaminated land and waste disposal activities. It covers the problems associated with contaminated lands that arise from the unmanaged release of contaminants into the environment. Selected topics include: contaminated land definition; legal framework governing contaminated lands; contaminant types and transportation mechanisms, risk assessment procedures related to contaminated lands, site investigation and monitoring related to contaminated lands and remediation, and waste disposal methods.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 30%, examination 70%.

CIV5124Z GEOSYNTHETICS ENGINEERING

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to introduce advanced students to geosynthetics and their applications in the built environment and covers important considerations in the use of geosynthetics to solve civil engineering problems. It includes methods of analysis, design, construction and field monitoring of structures constructed with geosynthetics. Topics include the behaviour and interaction of these materials in filtration, drainage, separation, reinforcement, erosion control and barrier functions.

DP requirements: None

Assessment: Coursework 30%, examination 70%.

CIV5125Z LATERAL EARTH SUPPORTS

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to introduce students to the analysis of lateral earth pressures, various earth retention systems and its applicability, limitations and design. The course provides knowledge and tools for design and analyses of earth structures and earth retention systems. The selection, design and performance of earth retention structures used for support of fills and excavations will be covered as well as theory related to earth pressures and soil reinforcement.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5126Z SLOPE STABILITY

Not offered in 2019

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: Suitable undergraduate degree qualification in an engineering, geosciences or geological field.

Course outline:

This course aims to demonstrate the application of concepts, principles and theories of slopes and to understand the different slope stabilization techniques and its applicability and limitations. The course focuses on stability of natural slopes and stability considerations related to man-made cuts and fills. Emphasis will be on the conditions up to and until the slip is initiated. Students will be introduced to different slide mechanisms, the conditions of their occurrence, and the theories and principles governing stability of slopes. The course will also include other important aspects such as: field investigations to obtain input for slope stability analysis; slope stability analysis programmes; slope monitoring techniques and slope stabilisation methods.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 50%, examination 50%.

CIV5128Z LOSSES AND PRESSURE MANAGEMENT IN WATER DISTRIBUTION SYSTEMS

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: TBC

Course entry requirements: None

Course outline:

This course aims to teach theory and application of water losses and pressure management in water distribution systems. Topics include: water loss components and methods, pressure and leakage, impact of pressure on other network parameters, soil-leak interaction, pressure management zones, pressure control, night flow analysis and pressure-leakage parameter estimation.

DP requirements: Attend all contact activities and submit all assignments on time.

Assessment: Coursework 50%, examination 50%.

CIV5129W GEOTECHNICAL ENGINEERING PROJECT

45 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course entry requirements: None

Course outline:

The aim of the course is to offer students an opportunity to undertake a case study project in which they are able to develop skills in analysing and providing solutions to typical geotechnical engineering problems encountered in the field. The project is intended to provide a platform for the students to put into practice the methodological and technical competencies acquired during the taught course work component of the programme. A statement of objectives of the geotechnical engineering project will be agreed upon, and the course of study will be guided by the supervisor. The programme will involve the student in about 450 hours of work, and a written output in the form of a report is submitted.

DP requirements: None

Assessment: Project report 100%.

CIV5131Z RESEARCH DESIGN AND METHODOLOGY FOR CIVIL ENGINEERS

16 NQF credits at HEQSF level 9

Convener: Professor M Zuidgeest

Course entry requirements: None

Course outline:

This course aims to develop conceptual skills for conducting research at the master's level. Topics include: the scientific method, induction and deduction, inference, statistical thinking and ethics, as well as technical skills which include technical writing, searching and interpretation of scientific literature, proper use of citations, and communication of research outputs.

Lecture times: 40 hours (1 week block lectures).

DP requirements: None

Assessment: Coursework 100%.

CIV5132Z TRANSPORT DEMAND ANALYSIS AND PROJECT ASSESSMENT

20 NQF credits at HEQSF level 9

Convener: Professor M Vanderschuren

Course entry requirements: None

Course outline:

This course aims to develop an understanding of transport demand analysis and project assessment. Topics include: travel data collection and survey design; data processing and analysis; the link between methodological approaches to transport analysis and the analytical questions raised by different policy environments; theoretical and philosophical backgrounds of assessment and evaluation methods; and techniques for the assessment and evaluation of urban transport proposals.

DP requirements: None

Assessment: Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5133Z TRANSPORT MODELLING

20 NQF credits at HEQSF level 9

Convener: Professor M Zuidgeest

Course entry requirements: First year course in statistical methods or mathematics.

Course outline:

This course aims to develop an advanced understanding of transport modelling principles and skills in working with these models. Topics include: transport modelling types and scales; theory of travel demand modelling, including the four-step transport model (i.e. trip generation, trip distribution, mode choice and traffic assignment); output analysis; land use – transport interaction models, as well as theory of traffic flow dynamics, including capacity assessment, LOS assessment, shockwave analysis, dynamic traffic management and elementary traffic control design. The course ends with a discussion about the link between models and the analytical questions raised by different policy environments.

DP requirements: None

Assessment: Preparatory Assignments 15%; group assignment 10%; major assignment 50% and course test 25%.

CIV5134W MASTERS DISSERTATION TRANSPORT STUDIES

120 NQF credits at HEQSF level 9

Convener: As per programme requirement.

Course outline:

The dissertation should incorporate any or all of the following: a research project of a theoretical or practical nature; a critical review of a specified topic based upon a comprehensive search of the literature or available data; development of an item of equipment or a technique involving novel features or advanced design; or any other study acceptable to the Faculty.

Assessment: 100% written work

CIV5135W TRANSPORT PLANNING AND ENGINEERING METHODS
PROJECT

25 NQF credits at HEQSF level 9

Convener: Professor M Zuidgeest

Course entry requirements: None

Course outline:

This course aims to offer students an opportunity to undertake a research project in which students are able to develop and enhance skills in a selected area of professional practice. The research would involve undertaking a critical investigation of the origins, rationale, and debates surrounding the particular professional practice, and the necessary activities associated with applying the practice and reflecting on how it might be improved.

DP requirements: None

Assessment: Project report 100%

CIV5138Z DETERIORATION AND CONDITION ASSESSMENT OF CONCRETE
STRUCTURES

20 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: None

Course outline:

This advanced course aims to develop an understanding of durability aspects, service life design, and non-destructive testing of concrete structures. Topics include: concrete deterioration mechanisms (physical, mechanical and chemical deterioration); reinforcement corrosion (principles, mechanisms, modelling, assessment, prevention); Alkali Silica Reaction (ASR); chemical attack; cracking of concrete structures; fire damage to structures; prevention of concrete deterioration through material selection, mix design and construction; service-life modelling (principles, deterioration models, service life models, normative guidelines); impact of loads on concrete structures; on-site evaluation techniques; visual assessment of concrete structures; principles, planning and execution of assessments; test methods (types, application and limitations, interpretation of results, case studies); non-destructive test methods (NDT): classical NDT (rebound hammer, cover depth, half-cell potential), advanced NDT (radar, sonic methods, impact echo), imaging and interpretation of results; diagnostic investigations and laboratory testing. The course is based on lectures and projects and may include case studies, laboratory sessions, and site visits.

DP requirements: Minimum average mark of 50% for Assignments 1 and 2, attendance at lab and practical sessions (80% attendance required).

Assessment: Assignments 50%; Exam 50%

CIV5139Z REPAIR AND REHABILITATION OF CONCRETE STRUCTURES

Not offered in 2019

20 NQF credits at HEQSF level 9

Convener: Professor H Beushausen

Course entry requirements: None

Course outline:

This course deals with the repair and rehabilitation of concrete structures and covers the following topics: introduction to the assessment of deterioration of concrete structures; repair materials and strategies; compatibility aspects; durability and repair audits; service life predictions; economics of repair and life-cycle costing; practical and contractual aspects; repair methods and materials; reinforcement corrosion repair; repair of ASR-damaged structures; crack injection; bonded overlays and patch repairs; electrochemical repair techniques; surface coatings and durability extension; repair of fire damaged structures; repair materials for chemical resistance against acid and sulphate attack; maintenance planning.

DP requirements: Minimum average mark of 50% for Assignments 1 and 2, attendance at lab and practical sessions (80% attendance required).

150 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

Assessment: Assignments 50%; Exam 50%

CIIV5140Z STRENGTHENING AND RETROFITTING OF CONCRETE STRUCTURES

20 NQF credits at HEQSF level 9

Convener: Professor P Moyo

Course entry requirements: None

Course outline:

This course deals with the strengthening and retrofitting of concrete structures and covers the following topics: introduction to structural condition surveys and assessment of concrete structures; materials and strategies for structural strengthening; compatibility aspects; structural requirements and procedures for rehabilitation; practical and contractual aspects; strengthening systems; FRP design and application; strengthening for shear, bending and torsion; bonded steel plates; external prestressing systems; design procedures; analysis of strengthened concrete structures.

DP requirements: Minimum average mark of 50% for Assignments 1 and 2, attendance at lab and practical sessions (80% attendance required).

Assessment: Assignments 50%; Exam 50%

CIIV5141Z CONDITION ASSESSMENT AND REMEDIAL ACTION ON STEEL STRUCTURES

20 NQF credits at HEQSF level 9

Convener: Professor P Moyo

Course outline:

The course aims to develop an understanding of durability aspects, service life design, condition assessment and non-destructive testing of steel structures. Topics include: basics of steel material science; material characteristics and properties; structural behaviour of steel; advantages of steel structures in industrial application; fire resistance of steel structures; deterioration of steel structures; fundamentals of steel corrosion; corrosion detection techniques; in-situ assessment of steel structures; protection of steel structures; coatings; cathodic protection; fatigue behaviour; strengthening and repair of steel structures.

CIIV5142Z FINITE ELEMENT MODELLING IN STRUCTURAL ANALYSIS

16 NQF credits at HEQSF level 9

Convener: Associate Professor S Skatulla

Course entry requirements: None

Course outline:

The course aims to introduce advanced students to finite element modelling theory, typical applications in structural engineering and recommendations. The topics include fundamental approaches and solution strategies in finite element modelling; linear and non-linear structural problems; different types of non-linearity in structural engineering; implication of the various mesh types including truss, beam, plate and shell elements; the effects of h and p mesh refinements and mesh quality; different types of structural supports including rigid supports, elastic bedding, kinematic constraint supports, the influence on stress distribution and recommendations of suitable application; different treatment of concentrated loads and distributed loads and the effect of mesh resolution.

DP requirements: Submission and satisfactory performance in all assignments.

Assessment: 50% take-home major assignment and 50% final written examination.

CIV5143Z ROCK MECHANICS*Not offered in 2019*

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba**Course entry requirements:** Suitable undergraduate degree qualification in an engineering, geosciences or geological field.**Course outline:**

This course provides an introduction to the theory of rock mechanics and its applications in construction and mine operations. Students are presented with the fundamental concepts of stress and strain in isotropic and anisotropic rocks and conduct stress analyses using data collected in the laboratory and the field. Rock mass structures and classification schemes are introduced, and students learn how these govern rock slope stability and underground rock excavation methods in a given stress environment. Rock control and support systems utilized in underground and surface excavations and their related safety requirements are discussed. Rock mechanics topics surrounding blasting and the stability of impoundment dams and tailings dumps are also presented.

DP requirements: None**Assessment:** Coursework 50%, examination 50%.

CIV5144Z ADVANCED INTRODUCTION TO WASTEWATER TREATMENT*Not offered in 2019*

10 NQF credits at HEQSF level 9

Convener: Dr D Ikumi**Course outline:**

This course aims to introduce master's level students to modern municipal wastewater treatment from the perspective of it being a water and resource recovery facility (WRRF). Technical but non-specialist, it can be taken by any postgraduate science and engineering graduate who is admitted to master's level (NQF9). It aims to give instruction on the tests and measurement methods used for design and operation of WWTPs. By following a virtual tour of a modern WWTP, the purpose, principles, processes (physical, chemical and biological) and performance of the different unit operations involved in primary, secondary and sludge treatment that make up a WRRF are described. This will give qualitative insight into the implications of primary settling, biological N and P removal and different sludge treatment options on WWTP size, power consumption, effluent water quality, energy and phosphorus recovery and operational complexity.

CIV5145Z MASTER OF WATER ENGINEERING PROJECT

45 NQF credits at HEQSF level 9

Course outline:

The statement of objectives for the MWE project will be agreed upon between the supervisor and student. To successfully complete the 45cr research project, it is necessary to undertake in the region of 450 hours of study. The hours are made up of research and contact time between the student and supervisor.

CIV5146Z SUSTAINABLE DRAINAGE SYSTEMS*Not offered in 2019*

20 NQF credits at HEQSF level 9

Convener: Professor N Armitage**Course outline:**

This course aims to explore the philosophy behind the Sustainable Drainage Systems (SuDS) approach; the modelling of urban drainage systems using SWMM / PCSWMM; the selection of an appropriate SuDS treatment train; the design of selected SuDS Stormwater Control Measures (SCMs); the planning of an appropriate Operation and Maintenance (O&M) programme; the determination of the Total Lifecycle Costs (TLCs) for the proposed SuDS treatment train.

152 DEPARTMENTS IN THE FACULTY AND COURSES OFFERED

CIV5150Z SOIL MODELLING AND NUMERICAL METHODS

16 NQF credits at HEQSF level 9

Convener: Associate Professor D Kalumba

Course outline:

In this course participants will be introduced to: a) models used in describing soil behaviour and their use in numerical modelling; b) the advantages and limitations of different constitutive models describing soil behaviour; and c) the basic knowledge of how soil constitutive models are used in finite element analysis. They will be provided with an understanding of how to select the appropriate soil parameters. By the end of the course, they will consequently have a good grasp of soil modelling for different geotechnical applications. Topics will include: Elastic models; Basic elasto-plastic models; Cam-clay and Critical State based models; Stress paths; and Elasto-plastic Finite element method.

CIV6000W PHD IN CIVIL ENGINEERING

360 NQF credits at HEQSF level 10

Course outline:

A PhD thesis is required to be an original, coherent and consistent body of work which reflects the candidate's own efforts. The thesis may not be more than 80 000 words. A candidate will undertake research, and such advanced coursework as may be required, under the guidance of a supervisor or supervisors appointed by Senate.

DP requirements: None

Assessment: Written work counts 100%.

CIV9000Z INTERNATIONAL AFFILIATE 2 MONTHS

0 NQF credits at HEQSF level 0

CIV9001Z INTERNATIONAL AFFILIATE 2-4 MONTHS

0 NQF credits at HEQSF level 0

CIV9002Z INTERNATIONAL AFFILIATE 4-6 MONTHS

0 NQF credits at HEQSF level 0

CIV9003Z INTERNATIONAL AFFILIATE 6-12 MONTHS

0 NQF credits at HEQSF level 0

CIV9004Z POSTDOCTORAL FELLOW

0 NQF credits at HEQSF level 0

END5050X MASTERS JOURNAL PAPER REQUIREMENT

0 NQF credits at HEQSF level 9

Course outline:

The aim of submitting a research paper for the masters' degree is to develop an understanding of what is required for the publication of research findings. To this end a candidate shall submit a summary of the key aspects of the dissertation, presented in the form of a paper which is, potentially, of publishable standard, approved by a Panel of Assessors. This is a requirement for candidates submitting either a 180 or 120 credit dissertation for the following degrees: MSc in Construction Economics and Management, MSc(Eng), MSc(ProjMan), MPhil, MSc in Property Studies. Refer to the appropriate degree rules.

DP requirements: None

CIV5127Z DISCRETE CHOICE MODELLING AND STATED CHOICE SURVEY DESIGN

20 NQF credits at HEQSF level 9

Convener: Professor M Zuidgeest

Course entry requirements: No prior knowledge of discrete choice models is needed. Basic topics are covered early in the week, while more advanced topics are covered later. It is however assumed that participants have a basic knowledge of statistical methods, including linear regression models. Hence, first year university mathematics and statistics will be required.

Course outline:

This course will study the specification, estimation, and application of discrete choice models as well as the design of stated choice experiments. Day 1: Introduction to choice modelling and multinomial logit, Data & estimation, Analysis of results and specification testing, Estimation of logit models (Exercise). Day 2: Nested logit & other GEV models, Estimation of GEV models (Exercise), Latent class, mixed logit & simulation based estimation, Estimation of latent class & mixed logit (Exercise). Day 3: Model applications: sampling, forecasting and appraisal, Model fitting exercise (Exercise), Alternative models and examples, Case studies in South Africa I. Day 4: Stated choice surveys, Generating a design (Exercise), Drawbacks of orthogonal designs. Day 5: Efficient designs, Generating efficient designs (Exercise), Case studies in South Africa II.

DP requirements: None

Assessment: Coursework 100%