Message from the Head of Department

Welcome to the post-graduate programme in the Department of Civil Engineering at the University of Pretoria. We are fortunate in having the critical mass of teaching staff and associates in the profession to be able to offer doctoral, masters and honours programmes in five engineering disciplines; namely Construction Materials, Geotechnical, Structural, Transportation and Water Resources Engineering. We do not only cater for civil engineering graduates, but past students have also included graduates from other disciplines (e.g., engineering geologists, as well as BTech graduates from the Universities of Technology, former Technikons).

During the last ten years, over 450 post-graduate students have graduated through this department and are held in high esteem in the industry.

The post-graduate degree programmes of the School of Engineering meet the requirements of the Department of Education and Higher Education and Training. All students who want to study towards a Master's degree must first complete the honours degree which is the course component for the Master's but also serves as a separate degree exit. The South African Qualifications Authority (SAQA) credits for the honours degree are calculated separately from that of the Master's degree. Credits cannot be transferred between the two degrees. Following the completion of the course work based honours degree the Master's degree can be done as a research degree.

The flexible learning mode used in the offering of these post-graduate modules includes block-week presentations of course work. This format enables short course presentation of selected courses in these various areas of specialisation and can be taken for non-degree purposes for Continued Professional Development (CPD) points.

This brochure provides all the information on course selection required for electronic registration, which will open on 8 January 2020, and will close on 31 January 2020, with the proviso that if a module you wish to take is offered before this closing date, then you must be registered to access the study material. Late registrations will not be possible. Students writing final examinations at year-end must apply by 30 October 2019 and submit final exam results by 10 December 2019 for study in 2020.

Please note in Annexure B the different programmes and modules offered and taken by the different disciplines before registering if accepted for study in the Department.

Further information in the following aspects of the studies are available as indicated in the table.

Item	**Website address**
Admission requirements	https://www.up.ac.za/programmes/year/2020/type/pg/faculty/F3
Application and registration	https://www.up.ac.za/online-application
Fees and funding	https://www.up.ac.za/article/2749200/fees-and-funding
Policies and regulations	https://www.up.ac.za/article/2754069/up-policies-and-other-important-documents
Location and maps	https://www.up.ac.za/article/2749435/campuses-maps-directions
EBIT Post graduate studies general	https://www.up.ac.za/ebit-postgraduate

I look forward to welcoming you to the Department of Civil Engineering as a postgraduate student.

Prof Wynand Steyn
Head of Department

Contents

Overview

The University and the Department of Civil Engineering

The University is located in Hillcrest Pretoria, 6 km from the CBD of Pretoria and 50 km from the Oliver Tambo International Airport (Johannesburg). Within walking distance is the Hatfield commercial complex with its many shops, restaurants, entertainment venues and of course bookshops, and the Hatfield Gautrain station.

The University was established in 1908 as the Transvaal University College (that is why it is commonly referred to as TUKKIES). In October 1930, the independent University of Pretoria came into being. Since then it has grown to have a resident student population in excess of 50 000, the largest student population of any residential university in South Africa. This student population is made up of over 40 000 undergraduate students and more than 10 000 post-graduate students.

The School of Engineering, which forms part of the Faculty of Engineering, Built Environment and Information Technology, has a student population of more than 11 000, of whom 3 200 are post-graduate students.

The Department of Civil Engineering, has a teaching staff of 19, and in 2019 had a student population in excess of 1 100 students, of which more than 200 were post-graduate students.

During the last 10 years, the University of Pretoria has conferred over 1 000 undergraduate degrees and over 450 post-graduate degrees in the Department of Civil Engineering.

The department is housed in the Engineering 1 Building (often referred to as the Engineering Tower Building) on the main Hatfield Campus.

The Disciplines

The Department of Civil Engineering offers post-graduate courses in five disciplines. These are shown below together with the name and contact details of the person responsible for each discipline.

- **Head of Department of Civil Engineering**
  Prof WJvdM Steyn
  Room 11-7 Eng 1 Tel: (012) 420 2429
  e-mail: wynand.steyn@up.ac.za
- **Construction Materials**
  Prof Billy Boshoff
  Room 12-05 Eng 1 Tel: (012) 420 2746
  email: billy.boshoff@up.ac.za
  Prof Elsabe Kearsley
  Room 11-16 Eng 1 Tel: (012) 420 2176
  email elsabe.kearsley@up.ac.za
- **Geotechnical Engineering**
  Prof G Heymann
  Room 11-18 Eng 1 Tel: (012) 420 3627
  e-mail: gerhard.heymann@up.ac.za
- **Structural Engineering**
  Prof CP Roth
  Room 12-15 Eng 1 Tel: (012) 420 2185
  e-mail: chris.roth@up.ac.za
- **Transportation Engineering**
  Prof C Venter
  Room 13-9 Eng 1 Tel: (012) 420 2184
  e-mail christo.venter@up.ac.za
  Prof WJvdM Steyn
  Room 11-7 Eng 1 Tel: (012) 420 2171
  e-mail: wynand.steyn@up.ac.za
- **Water Resources Engineering**
  Mr M van Dijk
  Room 12-18 Eng 1 Tel: (012) 420 3176
  e-mail: marco.vandijk@up.ac.za

IMPORTANT DATES

Closing date for **application for admission** for study in the following year by students registering for the first time as Honours post-graduate students or who did not study in is 30 November 2019. Students who are writing final examinations at year-end must apply before 30 November 2019, and the final outstanding marks must be submitted by 10 December 2019 to permit processing of the application.

CLOSING DATES FOR REGISTRATION OF HONOURS STUDENTS

31 January 2020.

BLOCK WEEKS FOR MODULES OFFERED BY DEPT OF CIVIL ENGINEERING IN 2020

9 to 13 March 2020, 20 to 24 April 2020, 17 to 21 August 2020 and 28 September to 2 October 2020
Final examinations 1 to 5 June 2020 and 9 to 20 November 2020

DATES OF MODULES OUTSIDE OF THE BLOCK WEEKS

Geotechnical Engineering Modules

Theoretical Soil Mechanics SGS 788	20 January to 3 February 2020
Analytical Soil Mechanics SGS 787	20 January to 3 February 2020
Specialised Geotechnical Testing SGS 789	20 January to 3 February 2020

Water Engineering Modules

Pipeline design SHC795	17 February to 21 February 2020
Flood hydrology SHC792	2 March to 6 March 2020
Concrete Technology SGC 794	4 to 5 February, 4 to 5 March and 27 to 28 May 2020

Transportation Engineering Modules

Traffic Engineering SVC 792	11 to 15 May 2020 (To be confirmed)

BLOCK WEEKS FOR MODULES OFFERED BY OTHER DEPARTMENTS

Block weeks and examination dates to be obtained from the relevant department

Postgraduate Programmes

This section briefly describes each of the disciplines within the Department of Civil Engineering in which post-graduate programmes are offered and the modules that make up the post-graduate programmes.

CONSTRUCTION MATERIALS

The Discipline

This discipline is a sub-discipline of Structural Engineering and Pavement Engineering and covers a wide range of construction materials, with a focus on the microscopic behaviour to structural design. Most of the work is done in the field of cement-based materials.

The discipline is staffed by:

Prof Billy Boshoff	Tel: (012) 420 2746	e-mail: billy.boshoff@up.ac.za
Prof Elsabe Kearsley	Tel: (012) 420 2176	e-mail: elsabe.kearsley@up.ac.za
Ms Phia Smit	Tel: (012) 420 2179	e-mail: phia.smit@up.ac.za

At present the research of the discipline is focused on:

- Concrete Roads
- Ultra High Performance Concrete
- Fibre reinforced concrete
- Fresh and green concrete behaviour
- Sustainability of construction materials

This research group has published a large number of international papers and regularly presents their latest works at international conferences. The group members' Google Scholar and Scopus profiles can be visited for more information on recent publications.

To enrol for postgraduate studies in Construction Materials, either Structural Engineering or Transport Engineering discipline has to be chosen, whichever is more appropriate. Contact the Construction Material group's members for more information.

- **BEng (Hons)**
  Students who have obtained an engineering degree or equivalent may apply for admission to this post-graduate programme.

  The required modules for Construction Materials will be the same as for Structural Engineering or Transport Engineering, with the exception that an additional compulsory module needs to be taken. This is Concrete Technology 794 (SGC 794 24 Credits). Please refer to the disciplines of Structural Engineering and Transport Engineering for more details.

- **MEng**
  A student who has obtained a BEng (Hons) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme. Note that Construction Materials is a sub-field of either Structural Engineering or Transport Engineering therefore prospective students should apply for a MEng in one of those two disciplines.

- **Doctoral Studies**

  See web links.

GEOTECHNICAL ENGINEERING

The Discipline

Geotechnical Engineering is a specialist field of research and application within the larger framework of Civil Engineering. All engineering aspects of soil and rock fall within this discipline. The courses presented cover the highly specialized theoretical Soil Mechanics and Geotechnical Engineering as well as the specialist fields of laboratory and in situ testing.

The discipline is staffed by:

Prof G Heymann Tel: (012) 420 3627 e-mail: gerhard.heymann@up.ac.za
Prof SW Jacobsz Tel: (012) 420 3124 e-mail: sw.jacobsz@up.ac.za
Dr T da Silva Tel: (012) 420 6864 e-mail: u04409507@up.ac.za

Specialists in the field of geotechnical engineering that assist the discipline include Prof E Rust and Prof CRI Clayton (Southampton).

At present the research in the discipline is focused on centrifuge modelling, advanced geotechnical laboratory testing, geotechnical, geo-environmental and in-situ testing.

The descriptions of the curricula for each of the modules are outlined in Annexure A.

Three modules (SGS 787, SGS 788 and SGS 789) will be presented as short courses in the beginning of the year and will be open to persons from industry to attend for non-degree purposes. Students enrolled for a degree will be required attend the short course(s) as well as submit assignments and write exams in June and November. The relevant courses for each module are shown in the table below. In addition to registering for these post graduate modules in the normal way, students must also enrol for the courses through Enterprises University of Pretoria (http://www.ce.up.ac.za/).

Module	Short course
Analytical Soil Mechanics 787	Analytical Methods in Geotechnical Engineering (2 day course) Reliability Methods in Geotechnical Engineering (1 day course)
Theoretical Soil Mechanics 788	Theoretical Soil Mechanics (3 day course)
Specialized geotechnical testing 789	In-situ Geotechnical Testing (2 day course) Geotechnical Laboratory Testing (1 day course)

- **BEng (Hons)(Geotechnical Engineering)(12240215)**

  Students who have obtained a BEng degree or equivalent and comply with the requirements in Table 1 may apply for admission to this post-graduate programme.

  To obtain this degree, students will be required to obtain a minimum 128 SAQA credits from the list below. Core modules are compulsory.

Core Modules	Code	Credits
Civil Research 780	SSC 780	32
Analytical Soil Mechanics 787	SGS 787	24
Theoretical Soil Mechanics 788	SGS 788	24
Specialized geotechnical testing 789	SGS 789	24
Applied Statistical Methods and Optimisation 798 OR Numerical Methods and Finite Element Applications for Civil Engineers 790	SHC 798 SIK 790	24 24

- **BSc(Hons)(Applied Science) (12243005)**
  Specialization in **Geotechnics**
  Students who have obtained a relevant three-year university degree or BTech degree and comply with the admission requirements may apply for admission to this post-graduate programme. To obtain this degree, students will be required to obtain a minimum 128 SAQA credits from the list below. Core modules are compulsory.

Core Modules	Code	Credits
Civil Research 780	SSC 780	32
Basic Statistical Methods 797	SHC 797	24
Analytical Soil Mechanics 787	SGS 787	24
Theoretical Soil Mechanics 788	SGS 788	24
Specialized geotechnical testing 789	SGS 789	24

  Students with a BTech degree must attend the undergraduate lectures and complete the examination for Soil Mechanics SGM311 and Geotechnical Engineering SGM323 before enrolment for the other geotechnical modules will be approved.

- **MEng (Geotechnical Engineering)(12250212)**
  A student who has obtained a BEng (Hons) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme. A total of 128 SAQA credits must be obtained:

Module Name	Code	Credits
Dissertation 890	SGI 890	128

- **MSc (Applied Sciences) (12253019)**
  Specialization in **Geotechnics**
  A total of 128 SAQA credits must be obtained. A student who has obtained a BSc (Hons) (Applied Science) degree with an average of at least 65% may apply for admission to this post-graduate programme.

Module Name	Code	Credits
Dissertation 890	SST 890	128

- **Doctoral Studies**

  See web links.

STRUCTURAL ENGINEERING
The Discipline

A wide spectrum of modules is presented, including more analytical subjects such as structural analysis and structural mechanics as well as design courses in reinforced concrete, steel and timber.

The discipline is staffed by:

Prof C.P. Roth	Tel: (012) 420 2185	e-mail: chris.roth@up.ac.za
Dr A. Roux	Tel: (012) 420 2186	e-mail: anneke.roux@up.ac.za
Ms S. Skorpen	Tel: (012) 420 2196	e-mail: sarah.skorpen@up.ac.za
Prof George Markou	Tel: (012) 420 4529	e-mail: george.markou@up.ac.za

At present the research of the discipline is focused on:

- Advanced structural analysis and structural reliability
- Reinforced concrete
- Structural steel
- Structural timber

Recent examples of research output include papers in recognised local and international journals and presentations at international conferences.

The requirements for the degrees that are obtainable in this discipline are described in the following sections. The descriptions of the curricula for each of the modules are outlined in Annexure A.

- **BEng (Hons)(Structural Engineering) (12240122)**
  Students who have obtained an engineering degree or equivalent may apply for admission to this post-graduate programme.
  To obtain this degree, students will be required to obtain a minimum of 128 SAQA credits from the following modules:

Core Modules	Code	Credits	Prerequisite *
Civil Research 780	SSC 780	32	
Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24	
Electives *(remainder of the credits from the following*			
Prestressed Concrete Design 791	SIN 791	24	SIC 793
Reinforced Concrete Design 778	SIN 778	24	SIC 793
Steel Design 776	SIN 776	24	SIC 793
Structural Analysis 790	SIN 790	24	SIC 790
Structural Mechanics 777	SIN 777	24	SIC 790
Timber Design 779	SIN 779	24	
Concrete Technology 794	SGC 794	24	**
Infrastructure Management 790	SSI 790	24	
Approved module from Dept of Mathematics and Applied Mathematics			
Approved module from Dept of Mechanical Eng.			

* Applies to Applied Science students
** Not for Applied Science students

- **BSc (Hons)(Applied Science) (12243034)**
  Specialization in **Structures**

  Students who have obtained a relevant three-year university degree or BTech degree may apply for admission to this post-graduate programme. As for the other Honours degrees, a minimum 128 SAQA credits are required. The modules to select from are as follows:

Core Modules	Code	Credits
Civil Research 780	SSC 780	32
Basic Structural Analysis 790	SIC 790	24
Basic Structural Design 793	SIC 793	24

  and the remainder of the credits chosen from the elective modules for the BEng(Hons)(Structural Engineering) programme, as approved by the Head of the Department, and after completion of the appropriate Basic modules from the list above.

- **MEng (Structural Engineering) (12250121)**
  A student who has obtained a BEng (Hons) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme.

Module Name	Code	Credits
Dissertation: Structural Engineering 890	SIN 890	128

- **MSc (Applied Science) (12253036)**
  Specialization in **Structural Technology**
  A student who has obtained a BSc (Hons) (Applied Science) degree with an average of at least 65% may apply for admission to this post-graduate programme:

Module Name	Code	Credits
Dissertation 890	SST 890	128

- **Doctoral Studies**
- See web links.

TRANSPORTATION ENGINEERING

The Discipline

The postgraduate programme in Transportation Engineering offers three focus areas around which teaching and research activities are organised:

Focus Area	Responsible staff member
Pavement Engineering	Prof WJ vdM Steyn Tel: (012) 420 2171 e-mail wynand.steyn@up.ac.za Prof James Maina Tel: (012) 420 6608 e-mail james.maina@up.ac.za
Transport Planning and Traffic Engineering	Prof C Venter Tel: (012) 420 2184 e-mail christo.venter@up.ac.za
Railway Engineering	Prof PJ Gräbe Tel: (012) 420 4723 e-mail hannes.grabe@up.ac.za

Specialists in the field of transportation engineering that assist the discipline include Dr L Roodt, Dr P Pretorius, Prof G Jordaan, Mr G Hayes and Dr H Ribbens.

Most of the research being conducted in the transportation engineering field falls under the Centre for Transport Development (CTD), a collaborative faculty-wide entity coordinating funding and research within this area. For further information on the CTD's research activities and opportunities for future research, please visit https://www.up.ac.za/centre-for-transport-development.

The requirements for the degrees that are obtainable in this discipline are described in the following sections. Note that the selection of modules would be based on the particular focus area as described above.

The descriptions of the curricula for each of the modules are outlined in Annexure A.

- **BEng (Hons)(Transportation Engineering) (12240112)**

  Students who have obtained an engineering degree or equivalent may apply for admission to this post-graduate programme.

  A minimum of 128 SAQA Credits must be obtained from the following:

Core Modules (Compulsory)	Code	Credits
Civil Research 780	SSC 780	32
Applied Statistical Methods and Optimisation 798	SHC 798	24
Electives	**Code**	**Credits**
Concrete Technology 794	SGC 794	24
Transportation Studies 790	SVC 790	24
Geometric Design and Safety 791	SVV 791	24
Infrastructure Management 790	SSI 790	24

Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24
Multimodal Transport 788	SVV 788	24
Pavement Design 793	SGC 793	24
Road Rehabilitation Technology 797	SGC 797	24
Traffic Engineering 792	SVC 792	24
Transportation Special 791	SVC 791	24

It is strongly recommended that students identify one of the three focus areas within Transportation Engineering before commencing their studies. Within each focus area, the following course combinations are typical. Well-motivated requests for deviations from these combinations will be considered on an ad hoc basis.

Focus Area:	Transport Planning & Traffic Engineering	Pavement Engineering	Railway Engineering
Core modules	▪ Civil Research 780 ▪ Applied Statistical Methods and Optimisation 798	▪ Civil Research 780 ▪ Applied Statistical Methods and Optimisation 798	▪ Civil Research 780 ▪ Applied Statistical Methods and Optimisation 798
Electives: Any 3 of:	▪ Geometric Design and Safety 791 ▪ Multimodal Transport 788 ▪ Traffic Engineering 792 ▪ Transportation Studies 790 ▪ Infrastructure Management 790 ▪ Transportation Special 791	▪ Pavement Design 793 ▪ Road Rehabilitation Technology 797 ▪ Concrete Technology 794 ▪ Transportation Special 791 ▪ Infrastructure Management 790 ▪ Numerical Methods and Finite Element Applications for Civil Engineers 790 ▪ Geometric Design and Safety 791	▪ Transportation Special 791* ▪ Numerical Methods and Finite Element Applications for Civil Engineers 790 ▪ Infrastructure Management 790 ▪ Pavement Design 793 ▪ Concrete Technology 794

* See Short courses in Railway Engineering on Page 24

- **BSc (Hons) (Applied Science) (12243009)**
  Specialization in **Transportation Planning**

  Students who have obtained a relevant three-year university degree or B Tech degree may apply for admission to this post-graduate programme. As for the other Honours degrees, a minimum of 128 SAQA credits are required from the following:

Core Modules	Code	Credits
Civil Research 780	SSC 780	32
Basic Statistical Methods 797	SHC 797	24
Basic Pavements and Transportation 787	SGM 787	24

  and the remainder of the credits chosen from the modules prescribed for the BEng(Hons)(Transportation Engineering) programme, see lists below, as approved by the Head of the Department. The Basic courses must be taken before proceeding to the other modules.

It is strongly recommended that students identify one of the three focus areas within Transportation Engineering before commencing their studies. Within each focus area, the following course combinations are recommended. Well-motivated requests for deviations from these combinations will be considered on an ad hoc basis.

Focus Area:	Transport Planning & Traffic Engineering	Pavement Engineering	Railway Engineering
Core modules	▪ Civil Research 780 ▪ Basic Statistical Methods 797 ▪ Basic Pavements and Transportation 787	▪ Civil Research 780 ▪ Basic Statistical Methods 797 ▪ Basic Pavements and Transportation 787	▪ Civil Research 780 ▪ Basic Statistical Methods 797 ▪ Basic Pavements and Transportation 787
Electives: Any 2 of:	▪ Geometric Design and Safety 791 ▪ Multimodal Transport 788 ▪ Traffic Engineering 792 ▪ Transportation Studies 790 ▪ Infrastructure Management 790	▪ Pavement Design 793 ▪ Transportation Special 791* ▪ Infrastructure Management 790 ▪ Geometric Design and Safety 791	▪ Transportation Special 791* ▪ Infrastructure Management 790 ▪ Pavement Design 793

* See Short courses in Railway Engineering on Page 16

- **MEng (Transportation Engineering) (12250111)**

  A student who has obtained a BEng (Hons) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme. A total of 128 SAQA credits must be obtained.

Module Name	Code	Credits
Dissertation 890	SVI 890	128

- **MSc (Applied Science) (12253028)**
  Specialization in **Transportation Planning**

  Students who have obtained a BSc (Hons) (Applied Science) (Transportation Technology) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme. A total of 128 SAQA credits must be obtained.

Module Name	Code	Credits
Dissertation 890	SST 890	128

- **Doctoral studies**
- See web links.

Financial support for studies and research

Apart from general support for postgraduate studies (see http://www.up.ac.za/fees-and-funding/), specific sources of financial support in the transportation sector include:

- The South African Road Federation (SARF) – www.sarf.org.za
- Southern African Transportation Conference (SATC) – www.satc.org.za
- University of Pretoria (UP) – http://www.up.ac.za/en/eece/article/1972338/postgraduate-bursaries
- Transnet Freight Rail (TFR) Chair in Railway Engineering – Contact Prof. PJ Gräbe for further information – www.up.ac.za/chair-in-railway-engineering
- Railway Safety Regulator (RSR) Chair in Railway Safety – Contact Prof. PJ Gräbe for further information – www.up.ac.za/chair-in-railway-engineering
- Research Scholarships awarded by the Centre for Transport Development - see http://www.up.ac.za/centre-for-transport-development

WATER RESOURCES ENGINEERING
The Discipline

Water Resources Engineering encompasses various elements of the natural and man-made water cycle. Civil engineers' input in creating sustainable development that requires safe water supply to all consumers and protect the natural resources is based on an understanding of the natural hydrological cycle, physical principles and the effect of human interference with these fields.

The subjects that are presented are aimed at broadening the understanding of different aspects of hydrological and hydraulic phenomena and the application thereof in the design of pipelines, pump stations, open channels, hydraulic structures and the assessment of the yield from surface water resources. The lecture material is presented in such a format that it enhances the skills of the student to undertake real problems.

The discipline is headed by:
Mr M van Dijk Tel: (012) 420 3176 e-mail: marco.vandijk@up.ac.za
He is supported by:
Ms I Loots Tel: (012) 420 5484 e-mail: ione.loots@up.ac.za
Mr RT Seabi Tel: (012) 420 2175 e-mail: rt.seabi@up.ac.za
Ms CM Niebuhr Tel: (012) 420 2439 e-mail: chantel.niebuhr@up.ac.za
Prof SJ van Vuuren e-mail: fanie.van.vuuren51@gmail.com

The research focus of the group is on the evaluation of the prevention of cavitation in control valves, operating conditions on the roughness in pipelines, the application of Genetic Algorithms in the optimisation of water systems, energy generation (hydropower), CFD modelling of hydrokinetic turbines, urban drainage and flood hydrology.

Recent publications and research projects include:

- *"Waterborne sanitation design guide". WRC Report TT481/11 and "Waterborne sanitation, operation and maintenance guide". WRC Report TT482/11*
- *"Determination of the change in hydraulic capacity in pipelines". WRC K5/1820*
- *"Energy generation from water distribution systems". WRC Reports TT596/14 and TT597/14*
- *"The development of small-scale hydropower for rural electrification".*
- *"Design flood estimation in urban areas in South Africa".*

Books and journal papers:

Kruger, E.J. (Editor), Rooseboom, A. Van Vuuren, S.J., Van Dijk, M., Jansen van Vuuren, A.M., Pienaar, W.J., Pienaar, P.A., James, G.M., Maastrecht, J. and Stipp, D.W. (2013). *Drainage Manual*. 6th Edition. The South African National Roads Agency SOC Ltd (SANRAL).

Loots, I., Van Dijk, M., Van Vuuren, S.J., Bhagwan, J.N. and Kurtz, A. (2014). *Conduit-hydropower potential in the City of Tshwane water distribution system.* South African Journal of Civil Engineers. Vol 58. October 2014.

Loots, I., Van Dijk, M., Barta, B., Van Vuuren, S.J. and Bhagwan, J.N. (2015). *A review of low head hydropower technologies and applications in a South African context.* Renewable and Sustainable Energy Reviews. Elsevier. pp 1254-1268.

Scharfetter, B.G. & Van Dijk, M. (2017). *Legislation governing the implementation of small-scale hydropower projects for rural electrification in South Africa*. Journal of Energy in Southern Africa. 28(2): pp 14–28.

Niebuhr, C.M., Van Dijk, M., Neary, V.C. and Bhagwan, J.N. (). *A review of hydrokinetic turbines and enhancement techniques for canal installations: Technology, applicability and potential*. Renewable and Sustainable Energy Reviews. Vol. 13.

Focus areas applicable for a masters' degree, dissertation or project report.

- Spillway design.
- Hydraulic capacity of pipelines.
- Energy generation from water distribution systems.
- Low head hydro-power installations.
- Rural electrification using small-scale hydropower.
- Pico hydropower turbine development.
- Kinetic hydropower, physical and numerical modelling with CFD.
- Urban hydrology.

The requirements for the degrees that are obtainable in this discipline are described in the following sections. The descriptions of the curricula for each of the modules are outlined in Annexure A. Most of the Water Resources Engineering courses will be presented as short courses in the beginning of the year open to persons from industry to attend for non-degree purposes. Students enrolled for a degree will be required to submit assignments and write an exam at the end of the year. Feedback sessions will be organized before the end of the year, where students can discuss any problems with the lecturer, and obtain feedback on their assignments.

- **BEng (Hons)(Water Resources Engineering) (12240162)**

  Students who have obtained an engineering degree or equivalent may apply for admission to this post-graduate programme. To obtain this degree, students will be required to obtain a minimum of 128 SAQA credits of the following modules:

Core Modules	Code	Credits
Civil Research 780	SSC 780	32
***at least 72** of the credits from the following:*	Code	Credits
Flood Hydrology 792	SHC 792	24
Free Surface Flow 794	SHC 794	24
Pipe Flow 795	SHC 795	24
Pump Systems 785	SHW 785	24
Applied Statistical Methods and Optimisation 798 OR Numerical Methods and Finite Element Applications for Civil Engineers 790	SHC 798 SIK 790	24 24
***and** the remainder, if needed, from the following:*	Code	Credits
Hydraulic Design 793[#]	SHC 793	24
Water Resource Analysis and Management 796[#]	SHC 796	24
Infrastructure Management 790	SSI 790	24
Concrete Technology 794	SGC 794	24
Modules offered by the Department of Chemical Engineering (See page 18)		

[#] Only presented when numbers warrant in collaboration with industry

BSc (Hons) (Applied Science) (12243033)
Specialization in **Water Resources**

Students who have obtained a relevant three-year university degree or BTech degree may apply for admission to this post-graduate programme. A minimum of 128 SAQA credits need to be obtained from the following modules:

Core Modules	Code	Credits
Civil Research 780	SSC 780	32
Basic Hydraulics 788	SHW 788	24
Basic Statistical Methods 797	SHC 797	24
***and** the remainder of the credits from the following:*		
Hydraulic Design 793#	SHC 793	24
Water Resource Analysis and Management 796#	SHC 796	24
Flood Hydrology 792	SHC 792	24
Free Surface Flow 794	SHC 794	24
Pipe Flow 795	SHC 795	24
Pump Systems 785	SHW 785	24
Infrastructure Management 790	SSI 790	24

Only presented when numbers warrant in collaboration with industry

- **MEng (Water Resources Engineering) (12250161)**

A student who has obtained a BEng (Hons) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme.

Module Name	Code	Credits
Dissertation: Water Resources Engineering 890	WBK 890	128

- **MSc (Applied Science) (12253031)**
Specialization in **Water Resources**

Students who have obtained a BSc (Hons)(Applied Science) degree or equivalent with an average of at least 65% may apply for admission to this post-graduate programme

Module Name	Code	Credits
Dissertation 890	SST 890	128

- **Doctoral Studies**
- See web links.

SHORT COURSES IN RAILWAY ENGINEERING

General Information

The department is privileged to have the Transnet Freight Rail (TFR) Chair in Railway Engineering as well as the Railway Safety Regulator (RSR) Chair in Railway Safety. Various short courses are offered to industry and students can include these courses into their study programmes as credit bearing post-graduate modules. Modules in Railway Engineering are offered as full day blocks (usually 5 days) as detailed below. The necessary credits and assessment criteria will be identified per individual course.

Students who have chosen Railway Engineering as their focus area should select two courses from the list below and need to register these under the module SVC 791 (Transportation Special). The course "Introduction to Multi-Disciplinary Concepts in Railway Engineering" is a pre-requisite for doing any of the other Railway Engineering courses and should therefore be one of the two courses that are elected. Civil Engineering students are encouraged to do "Geotechnical Aspects of Railway Engineering" as their second course.

For enquiries and course dates contact Prof Hannes Gräbe Tel: (012) 420 4723
e-mail: hannes.grabe@up.ac.za
website: www.up.ac.za/chair-in-railway-engineering

- **Short Courses**

  Introduction to Multi-Disciplinary Concepts in Railway Engineering
  Brief description: The course provides an introduction to the multi-disciplinary aspects of railway engineering. **Outline of course:** It covers the principles applicable to each railway engineering field as well as a general background on how a railway transport system operates. **Learning outcomes:** An appreciation for the complexities of and multi-disciplinary inter relationships of the railway system.

- **Geotechnical Aspects for Railway Engineering**
  Brief description: The course provides an introduction to railway track substructure fundamentals. **Outline of course:** It covers the principles and functions of the layered track foundation system, its drainage and failure modes and how it relates to track performance. Various case studies are included. **Learning outcomes**: An appreciation for the railway track substructure fundamentals and problems and solutions related to its interaction with the track.

- **Railway Infrastructure Maintenance Management**
  Brief description: The course provides an introduction to the general principles of railway asset management. **Outline of course:** It covers the key facets of the management of a railway asset having a life cycle and the relationship between railway asset management as part of a system and of the business plan. **Learning outcomes:** An understanding of the appropriateness of the design of the railway system as related to the prevailing and future business needs and coupled to the development of life cycle maintenance plans and the ability to adapt it to changing business circumstances.

- **Best Practice for Wheel and Rail Management**
  Brief description: The course provides an understanding of the interaction between wheel and rail. **Outline of course:** It is based on the manual published by the International Heavy Haul Association (IHHA) in 2001. It draws on information presented at 16 international IHHA conferences and technical sessions between 1978 and 2000. **Learning outcomes:** An understanding of the

wheel/rail system and the root causes of wheel and rail damage. A systems approach to wheel and rail management is provided.

- **Locomotive Systems, Performance and Maintenance (LSPM)**
- **Management of Continuously Welded Rails (MCWR)**
- **Introduction to Railway Projects and Processes (IRPP)**
- **Railway Safety Investigation (RSI)**
- **Railway Asset Management (RAM)**
- **Transnet Freight Rail Operations (TFRO)**
- **Rolling Stock Technology (RST)**
- **Law, Risk, Economics and the Environment (LREE)**
- **Railway Safety Audits, Investigations and Reporting (RSAIR)**
- **Technical Writing and Presentation Skills (TWPS)**
- **Train Movement Control Systems (TMCS)**
- **Railway Technology for Executives (RTE)**

The courses listed above are presented throughout the year and specific dates can be obtained from Prof. Gräbe or on the departmental website under Railway Engineering (www.up.ac.za/chair-in-railway-engineering). As the courses start early in the year, and are open to industry, students should contact Nocwaka Combo (nocwaka.combo@up.ac.za, 012 420 2183) during November of the preceding year to ensure a place on the course. Part-time students in the department of Civil Engineering will receive a 50% discount when registering for the short courses while full-time students in Railway Engineering (with financial support from the Department of Civil Engineering) will register free of charge provided that they are on campus full-time and part of the Railway Engineering research group.

MODULES OFFERED BY OTHER DEPARTMENTS

Department of Chemical Engineering – Water Utilisation and Environmental Engineering

Mrs E. Otto Tel: (012) 420 3824 e-mail: elmarie.otto@up.ac.za
South Campus: Building 2, Room1-26.

2020 - First Semester – for modules and dates enquire at the department (details will be available on the website of the Department of Chemical Engineering, www.up.ac.za/chemeng)

Core Modules	Code	Credits
Chemical Water Treatment	WCW 780	32 SAQA credits
Water Quality Management	WQB 780	32 SAQA credits

2020 - Second Semester – for dates enquire at the department

Core Modules	Code	Credits
Biological Water Treatment	WBW 780	32 SAQA credits
Industrial Waste Engineering	WAI 780	32 SAQA credits

Department of Mathematics and Applied Mathematics

Enquire at this Department.

Department of Mechanical and Aeronautical Engineering

Prof N J Theron Tel: (012) 420 3309 e-mail: nico.theron@up.ac.za

Core Modules	Code	Credits
Advanced Finite Element Methods	MEE 781	16 SAQA credits
Fatigue	MSV 780	16 SAQA credits

Annexure A: Curricula for Postgraduate Modules

A1 PREREQUISITES:

For certain modules prerequisites are indicated. The system of coding is as follows:

AAAnnn: An ordinary module code means that the module should previously have been passed.

(AAAnnn): A module code in parentheses means that lecture attendance should have been satisfactory.

AAAnnn: Underlining means that at least simultaneous enrolment will be required. Satisfactory attendance as well as a pass will therefore also be acceptable.

A2 MODULES PRESENTED WITHIN THE DEPARTMENT OF CIVIL ENGINEERING

Analytical Soil Mechanics SGS 787 24 SAQA credits
Introduction to elasticity and plasticity theory in geomechanics. Solution of confined and unconfined seepage problems using the method of fragments, finite differences and finite elements. Numerical solutions of consolidation problems and secondary compression. Slope stability analysis methods. The point estimate method. Monte Carlo simulation.

Applied Statistical Methods and Optimisation SHC 798 24 SAQA credits
The course will apply some of the basics theories and methodologies in statistics and modelling to solve common civil engineering problems. The course seeks to demonstrate the theory, applicability and use of statistical and modelling in the civil engineering field. Emphasis will be on the applications of these methods in common civil engineering practice. Some of the applications will include; demand forecasting, optimum network design, statistical sample analysis, maximum flow problems, project scheduling, queuing theory, Markov chain, Probability theory, discrete and continuous probability distribution, reliability and decision analysis, Monte Carlo simulation, etc.

Basic Hydraulics SHW 788 24 SAQA credits
This course covers the basic hydraulic principles and their application. Fluid characteristics, hydrostatics, fluid kinematics will be used to consider pipe flow phenomena, pipe network analyses and review of municipal services. An introduction to pumps and design of hydraulic structures and storm water drainage systems and culverts, the assessment of the hydrological cycle (precipitation, infiltration, and run-off) for flood estimation form part of this course.

Basic Pavements and Transportation SGM 787 24 SAQA credits
Pavements: The geological cycle and origin of road building materials, soil testing and classification systems, compaction, stabilization, bitumen, introduction to pavements, principles of pavement design and management.
Transportation: Introduction to traffic analysis techniques, capacity and level of service concepts, traffic signal design. Road geometric design. Road safety engineering.

Basic Soil Mechanics SGM 785 24 SAQA credits
Introduction to soil mechanics, classification of soil characteristics, seepage and permeability, stress and strain in saturated and partially saturated soils, Mohr's circle applications

Basic Statistical Methods SHC 797 24 SAQA credits
Basic mathematical methods. Algebra. Matrices and matrix algebra. Series expansions. Differentiation and integration. Probability theory. Graphic analysis. Discrete and continuous probability distributions. Moments and expectation. Statistical sampling and experimental design. Parameter estimation. Confidence intervals. Hypothesis testing. Regression analysis.

Basic Structural Analysis SIC 790 24 SAQA credits
Virtual work and influence lines, analysis of statically indeterminate structures (two and three-dimensional), slope-deflection, superposition, stiffness and flexibility methods, matrix and computer methods, plastic analysis of portal frames.

Basic Structural Design SIC 793 24 SAQA credits
This course comprises two sections: reinforced concrete design and structural steel design.
Reinforced concrete design covers the design of beams; behaviour and design of slabs; design of slender columns and columns subjected to bi-axial bending; design of simple and combined footings; staircase design; and an introduction to prestressed concrete.
Structural steel design covers the characteristics of steel; design of structural steel members including elements in bending, and bending combined with tension and compression; design of portal frames; composite construction and the bending resistance of composite sections, and plastic design.

Civil Research SSC 780 32 SAQA credits
The course will require all honours students to conduct research in an appropriate field of civil engineering, linked to the main discipline in which the student specializes for their honours degree.

Concrete Technology SGC 794 24 SAQA credits
Properties of concrete and concrete mixes. Characteristics of Portland cement and supplementary cementitious materials. Aggregates, admixtures and practical design of mixes. Manufacture, curing and testing, including non-destructive methods. Statistical approach to quality control. Time-dependent behaviour and durability of concrete. The principles for appropriate selection of materials and techniques for repair, maintenance and strengthening of civil engineering structures. Investigation and diagnosis. Corrosion of reinforcement. Alkali-aggregate reaction, sulphate attack. Physical degradation. Repair materials. Protective systems. Systems for repair.

Flood Hydrology SHC 792 24 SAQA credits
This course entails the calculation of design flows for different return periods, using the statistical, deterministic - and empirical methods. Dambreak analyses is included in this course as well as channel and level pool routing. The design of stormwater systems for flood events are also dealt with in this course.

Free Surface Flow SHC 794 24 SAQA credits
This course covers the theory of open channel flow as well as analytical and numerical procedures to analyse three dimensional flow conditions. Furthermore the procedures to determine flood lines and identify hydraulic controls are also covered.

Geometric Design and Traffic Safety SVV 791 24 SAQA credits Prerequisite: SGM787 or equivalent
A selection of topics from the following: Rural/Peri-urban road networks: transportation policy, standards and safety, environmental quality, capacity, design, interchanges. Urban street networks: functional classes, town planning considerations, capacities, environment, safety, standards design, evaluation of road networks.
Traffic safety in global and national content, Road Safety Engineering and the assessment and interpretation of accident information, reactive and proactive identification of remedial measures, traffic safety strategies: 3E model and Haddon matrix.

Hydraulic Design SHC 793 24 SAQA credits
This course covers the hydraulic aspects associated with the design of hydraulic structures for dams, road drainage, and other conveyance systems. The hydraulic considerations for the selection and design of energy dissipation structures are assessed in this course.

Infrastructure Management SSI 790, 24 SAQA credits
This module will cover the following topics: Asset Management principles, Maintenance Management principles, Maintenance strategies and philosophies, Condition based Maintenance, Reliability Centred Maintenance (RCM), Resource Management, Maintenance Management Systems, Total Productive Maintenance (TPM) and Risk Management. Travel demand management and Intelligent Transport Systems as management strategies. Lifecycle economic evaluation. Maintenance management of the following disciplines will be studied in detail: Road infrastructure, Railway infrastructure, Airport infrastructure, Buildings and other structures, Water resources and water supply.

Multimodal Transport SVV 788 24 SAQA credits
This course reviews aspects of the policy, planning, and operations of multimodal transport systems in cities. Topics include land use-transport relationships; the economics and financing of transport systems; equity and environmental imperatives; the characteristics, impacts and role of different modes; theory and principles of public transport network design, scheduling and operations; contemporary issues and approaches to public transport restructuring and formalisation in South Africa, including Bus Rapid Transit (BRT) and non-motorised transport.

Numerical Methods and Finite Element Applications for Civil Engineers SIK 790 24 SAQA credits
In the first part of this course, numerical procedures and some underlying theory for solving systems of equations, eigenvalue problems, integration, approximation and boundary value problems will be discussed. The second part of the course covers general finite element theory, discretization aspects related to geometry, nodes and numbering, element type and shape, interpolation functions, formulation of element characteristic matrices and vectors for elasticity problems, assembly and solution of the finite element equations, modelling procedures and results processing. The student will use Finite Element software to apply the theory that was covered in the course for solving typical Civil Engineering problems.

Pavement Design SGC 793 24 SAQA credits. For Applied Science students SGM 787 is a prerequisite
Design philosophy in First and Third World environments; characterising and use of pavement materials; drainage; systems approach to layout, geometric and pavement design; stresses and strains in pavements; mechanistic design methods and elasto-plastic behaviour; economic analysis; designing pavements for streets, gravel and paved roads, runways, and industrial areas.

Pipe Flow SHC 795 24 SAQA credits
The focus in this course will be on the practical aspects of pipeline design. The theoretical background to pipeline hydraulics will be covered and practical examples will be assessed. The following specific aspects such as pipeline hydraulics induced dynamic pressures, pipeline component selection and design, pipeline installation and the testing and operation of pipelines will be covered in this course

Pre-stressed Concrete Design SIN 791 24 SAQA credits Prerequisite: SIC 793 or equivalent
Material properties; prestressing systems; flexural design; losses; effects of continuity; shear; deflections; anchorage; cracking; prestressed concrete slabs and detailing

Pump Systems SHW 785 24 SAQA credits
The background theory and design practice of pumping station design will be highlighted. Various hydraulic problems associated to the inlets as well as the planning and design aspects of pump stations will be discussed. Pump selection, dimensioning of the layout to accommodate components required in a pump

station (sump design, good design practice, superstructure, lighting ventilation and control, inlet design, switch gear, pump control, surge protection and optimal scheduling of pumping) are some of the aspects that will be evaluated during the course.

Reinforced Concrete Design SIN 778 24 SAQA credits Prerequisite: SIC 793 or equivalent
Material properties. Behaviour and analysis of reinforced concrete members for flexure, axial loads, flexure plus axial load and shear. Cracking and deflection (short- and long-term) of flexural members. Plasticity in flexural members. Braced and unbraced slender columns

Road Rehabilitation Technology SGC 797 24 SAQA credits
Development of road management systems and application to existing street and road networks. Evaluation of, and measurements on existing facilities. Maintenance management. Recycling of materials. Design methods for upgrading, re-construction and strengthening of the existing road infrastructure. Prerequisite: Pavement Design SGC 793.

Specialised Geotechnical Testing SGS 789 24 SAQA credits
Theory, application and interpretation of geotechnical laboratory and in-situ tests. Laboratory instrumentation and calibration, stress and strain conditions for laboratory tests. Triaxial stress space and stress paths. Triaxial tests, Direct shear tests, Oedometer test and Rowe cell test. Standard Penetration Test (SPT), Cone Penetration Test (CPT), Piezocone (CPTU), Continuous surface wave test, Borehole seismic tests and Seismic cone test.

Steel Design SIN 776 24 SAQA credits Prerequisite: SIC 793 or equivalent
Introduction to structural reliability, tension elements, buckling of plates in compression elements, compression elements, beams and plate girders, plastic analysis and design of structures and structural elements, connections, composite design and steel-framed structures.

Structural Analysis SIN 790 24 SAQA credits Prerequisite: SIC790 or equivalent
Matrix methods: direct stiffness method for plane and three-dimensional structures. Stability: in-plane stability of beam-columns and frames; effective lengths and lateral torsional instability of beams. Dynamics: free and forced, undamped and damped framed systems and mass matrices and natural frequencies, earthquake response spectra.

Structural Mechanics SIN 777 24 SAQA credits Prerequisite SIC790 or equivalent
Elasticity theory. Failure criteria. Beams on elastic foundations. Classical and numerical (finite difference, Rayleigh-Ritz and finite element) solutions for plane and plate structures. Theory of plates and shells.

Theoretical Soil Mechanics SGS 788 24 SAQA credits
Introduction to critical state soil mechanics. Stress and strain invariants. Stress paths. State boundary surfaces including Roscoe and Hvorslev surfaces. Cam clay model. Application of geotechnical constitutive models in finite element analysis.

Timber Design SIN 779 24 SAQA credits
Timber properties, grading, treatment, structural form, element design and bracing of structures. Analysis of I-beams, composite beams, frames and connections. Research project.

Traffic Engineering SVC 792 24 SAQA credits Prerequisite: SGM787 or equivalent
Part 1: Traffic flow theory: Traffic and vehicle characteristics. Traffic flow studies. Traffic interactions. Traffic flow analysis and queuing theory. Traffic flow models. Traffic control theory. Part 2: Selected topics in Traffic studies and facility design: (e.g. Transportation and land use. Traffic impact studies. Site planning and design.

Determination of demand. Traffic control investigations. Intersection design. Internal circulation. Parking areas).

Transportation Special SVC 791 24 SAQA credits
Module specially compiled to satisfy specific needs. Not available unless cleared with Head of Department.

Transportation Studies SVC 790 24 SAQA credits
Role of transport modelling in developmental context, land use, data collection and surveys. Four step transportation model, trip generation, trip distribution, modal split, trip assignment. Introduction to simulation of transport systems, and use of simulation software. Introduction to discrete choice models, econometrics, and stated preference analysis.

Water Resources Analysis & Management SHC 796 24 SAQA credits
In this course students will be familiarized with the background and procedures used in the creation of flow records and the use of the WRSM2005 model. Surface water systems will be analysed and gross yields will be determined. In the second part of the course the theory and procedures required for the yield determination of surface water resources will be discussed.

A3 MODULES PRESENTED BY OTHER DEPARTMENTS WITHIN THE UNIVERSITY OF PRETORIA

A3.1 Department of Chemical Engineering

CHEMICAL WATER TREATMENT WCW780 32 SAQA credits

Water quality standards: drinking water quality standards (chemical), performance evaluation for drinking water treatment systems

Basic water chemistry: Acid-base and solubility equilibrium chemistry; Chemistry of the carbonate system

Conventional drinking water treatment: coagulation, flocculation; sedimentation, flotation; sand filtration; chlorination; chemical stabilisation

Advanced drinking water treatment: activated carbon adsorption; ozone and ultra-violet disinfection; enhanced coagulation; membrane processes; softening; iron and manganese removal

Industrial water treatment: chemical precipitation; neutralisation; oxidation-reduction; desalination processes; ion exchange

BIOLOGICAL WATER TREATMENT WBW780 32 SAQA credits

Composition and characterisation of sewage; Basic design principles of: Simple sewage treatment systems – night soil, pit latrines, septic tanks; Small scale sewage works – oxidation dams, biological filters and reed beds; Anaerobic digestion; Suspended – and Attached growth processes; Sludge handling and treatment. The module includes training and practice for simulation software for wastewater treatment processes.

INDUSTRIAL WASTE ENGINEERING WAI 780/787 32 SAQA credits

Identify source materials, physical and chemical properties of waste; Release and transport mechanisms from source to air, groundwater, soil; Primary pathways of contaminants including sorption, volatilisation, biotic and abiotic transformations; Toxicology: absorption, distribution, biochemical transformation, and secretion of chemicals; Acute and chronic toxicity quantification and evaluation of risk; Hazard identification, exposure assessment, toxicity assessment, risk assessment and approaches to hazardous waste minimisation, treatment and disposal; The handling, classification and disposal of hazardous waste; Disposal of waste by landfill; Water monitoring at waste management facilities; Recycling and resource management; Waste prevention, minimisation and optimisation.

WATER QUALITY MANAGEMENT WQB 780 32 SAQA credits

Water quality parameters: physical, chemical, biological, microbiological. Units of expression. Evaluation of parameters. Methods of analysis and practical laboratory analyses; Water quality interpretation, evaluation and assessment, water quality guidelines and requirements for domestic, industrial, agricultural, ecological, recreational requirements; Limnology and water quality in rivers and lakes. Ground water quality and assessment; Regulatory aspects including all relevant legislation; Integrated environmental management, integrated pollution control; Procedures to assess effluent discharge impacts; Water quality management; policies and procedures, role of catchment management agencies, catchment management plans.

Annexure B: Study Programme Planner

The pages in this annexure are provided to assist the student in planning his/her study programme.

The next page (page B2) is primarily administrative in that it records the study direction and degree code for which the student is registered.

Page B3 shows the modules that are compulsory for each specific discipline. Those shown as ‘B’ are compulsory for BSc (Hons)(Applied Science) and MSc(Applied Science) students and those shown as ‘C’ are compulsory for all honours and masters students. The years in which the module will be presented are also shown. If the module is presented in the block week it is shown with ‘X’ in the year A ‘D’ symbol is shown that the module is presented as a “block day” module (‘1’ following the ‘D’ indicates a first semester module and a ‘2’ indicates a second semester module).

Page B4 shows the modules that are presented during the year and ‘recommended’ for each discipline.

When selecting a set of modules for a year of study, students must ensure that:

- The module is being presented in that year.
- The module times do not clash with other modules the student intends taking (Check the block week time table (pg B6) and the calendar (Annexure C)).
- Modules being selected take into account the requirements of the discipline in respect of the “compulsory” and “recommended” module.
- If specified, the prerequisite course has already been passed.

Programme codes

DESCRIPTION	STUDY CODE	DESCRIPTION	STUDY CODE
GEOTECHNICAL		TRANSPORTATION	
BEng(Hons) (Geotechnical)	12240215	BEng(Hons) (Transp'n Engin'ng)	12240112
BSc(Hons)(Applied Sc)(Geotech)	12243005	BSc(Hons)(Appl Sc)(Transp Plan'g)	12243009
MEng (Geotechnical Engineering)	12250212	MEng (Transportation Engineering)	12250111
MSc(Applied Science) (Geotechnics)	12253019	MSc (App Sc) (Transport Planning)	12253028
STRUCTURAL		**WATER RESOURCES**	
BEng(Hons) (Structural Engineering)	12240122	BEng(Hons) (Water Res Eng'ng)	12240162
BSc(Hons)(Applied Sc)(Structures)	12243034	BSc(Hons)(App Sc) (Wat Res'ces)	12243033
MEng (Structural Engineering)	12250121	MEng (Water Res'ces Engineering)	12250161
MSc(Applied Science) (Structures)	12253036	MSc(Applied Sc) (Water Res'ces)	12253031

ALL COURSES (all modules are registered as year modules)

Module Code	Module Name	SAQA Credits	Geotechnical	Structure	Transport	Water	2020	2021	2022
SGS 787	Analytical Soil Mechanics	24	C				X	X	X
SHC 798	Applied Statistical Methods and Optimizt'n	24	X		X	X	X	X	X
SHW 788	Basic Hydraulics	24				B		W3	W3
SGM 787	Basic Pavements and Transportation	24			B		X	X	X
SHC 797	Basic Statistical Methods	24			B	B	X	X	X
SIC 790	Basic Structural Analysis	24		B				X	X
SIC 793	Basic Structural Design	24		B				X	X
WBW 780	Biological Water Treatment	32				X		S2C	
WCW 780	Chemical Water Treatment	32				X		S1C	
SSC 780	Civil Research (1st registration from 2017)	32	C	C	C	C	X	X	X
SGC 794	Concrete Technology	24		X	X	X		D1	
SHC 792	Flood Hydrology	24				X	W2		W2
SHC 794	Free Surface Flow	24				X		W2	
SVV 791	Geometric Design and Safety	24			X			D1	
SHC 793	Hydraulic Design	24				X			
SSI 790	Infrastructure Management	24			X	X	X	X	X
SVV 788	Multimodal Transport	24			X			X	
SIK 790	Numerical Methods and Finite Element Applications for Civil Engineers	24	X	X	X	X	X	X	X
SGC 793	Pavement Design	24			X		X	X	X
SHC 795	Pipe Flow	24				X	W1		W1
SIN 791	Prestressed Concrete Design	24		X			X		X
SHW 785	Pump Systems	24				X		W1	
SIN 778	Reinforced Concrete Design	24		X				X	
SGC 797	Road Rehabilitation Technology	24			X		X	X	X
SGS 789	Specialised Geotechnical Testing	24	C				X	X	X
SIN 776	Steel Design	24		X				X	
SIN 790	Structural Analysis	24		X				X	
SIN 777	Structural Mechanics	24		X			X		X
SGS 788	Theoretical Soil Mechanics	24	C				X	X	X
SIN 779	Timber Design	24		X					
SVC 792	Traffic Engineering	24			X		D1		D1
SVC 791	Transportation Special	24			X		X	X	X
SVC 790	Transportation Studies	24			X		X		X
WAI 780	Industrial Waste Engineering	32				X		S2C	
WQB 780	Water Quality Management	32				X		S1C	
SHC 796	Water Resource Analysis and Management	24				X			

X	Recommended
D1 and D2	First and second semester full day block
C	Compulsory
B	Compulsory for Applied Science students
S1C and S2C	Chemical Engineers block week, first and second semester
W	Water Resources Engineering (outside normal block week).

STUDY PROGRAMME FOR HONOURS STUDENTS IN 2020

The following tables show the combinations of modules for the different programmes. Note that part-time means students who have modules outstanding after being registered previously, or who wish to complete the course over 2 years. Civil Research 780 will be taken during the last year of honours study, remembering that not more than 72 SAQA credits can be taken part-time during any year. In the tables greyed out combinations are not permissible/available. There are no options for Applied Science students to study fulltime. In the tables X* means select outstanding modules. X+ must be taken.

Geotechnical

			BEng(Hons)			BSc(Hons) Applied Sciences	
		Credits	Fulltime	Part-time First year	Part-time Second yr	Part-time First year	Part-time Second yr
Civil Research 780	SSC 780	32	X		X		X
Analytical Soil Mechanics 787	SGS 787	24	X	X	X*	X	X*
Theoretical Soil Mechanics 788	SGS 788	24	X	X	X*	X	X*
Specialized geotechnical testing 789	SGS 789	24	X	X	X*	X	X*
Applied Statistical Methods and Optimisation 798	SHC 798	24	X*		X*		
Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24	X*		X*		
Basic Statistical Methods 797	SHC 797	24					X+

Structures

			BEng(Hons)			BSc(Hons) Applied Sciences	
		Credits	Fulltime	Part-time First year	Part-time Second yr	Part-time First year	Part-time Second yr
Civil Research 780	SSC 780	32	X		X		X
Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24	X	X	X*		
Concrete Technology 794	SGC 794	24	X	X	X*		
Prestressed Concrete Design 791	SIN 791	24	X	X	X*		
Reinforced Concrete Design 778	SIN 778	24					X*
Steel Design 776	SIN 776	24					X*
Structural Analysis 790	SIN 790	24					X*
Structural Mechanics 777	SIN 777	24	X	X	X*		
Timber Design 779	SIN 779	24					
Infrastructure Management 790	SSI 790	24	X	X	X*	X	X*
Basic Structural Analysis 790	SIC 790	24					
Basic Structural Design 793	SIC 793	24					

Note that Basic Structural Analysis 790 and Basic Structural Design 793 are prerequisites for a number of other Structural modules. Consult the Post-grad brochure.

Transportation

Note that Basic Pavements and Transportation 787 is a prerequisite for Pavement Design 793. Pavement Design 793 is a prerequisite for Road Rehabilitation Technology 797.

X+ must be taken and a further module from the remaining modules.

Transport Planning & Traffic Engineering

			BEng(Hons)			BSc(Hons) Applied Sciences	
		Credits	Fulltime	Part-time First year	Part-time Second yr	Part-time First year	Part-time Second yr
Civil Research 780	SSC 780	32	X		X		X
Applied Statistical Methods and Optimisation 798	SHC 798	24	X	X	X*		
Transportation Planning 789	SVC 789	24					
Geometric Design and Safety 791	SVV 791	24					
Infrastructure Management 790	SSI 790	24	X	X	X*	X	X*
Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24	X	X	X*		
Multimodal Transport 788	SVV 788	24	X	X	X	X	X
Pavement Design 793	SGC 793	24					
Road Rehabilitation Technology 797	SGC 797	24					
Traffic Engineering 792	SVC 792	24	X	X	X	X	X
Transportation Special 791	SVC 791	24					
Transportation Studies 790	SVC 790	24					
Basic Statistical Methods 797	SHC 797	24				X+	
Basic Pavements and Transportation 787	SGM 787	24				X+	

Pavement Engineering

			BEng(Hons)			BSc(Hons) Applied Sciences	
		Credits	Fulltime	Part-time First year	Part-time Second yr	Part-time First year	Part-time Second yr
Civil Research 780	SSC 780	32	X		X		X
Applied Statistical Methods and Optimisation 798	SHC 798	24	X	X	X*		
Transportation Planning 789	SVC 789	24					
Geometric Design and Safety 791	SVV 791	24					
Infrastructure Management 790	SSI 790	24	X	X	X*	X	X*
Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24	X	X	X*		
Multimodal Transport 788	SVV 788	24	X	X	X*	X	X*
Pavement Design 793	SGC 793	24	X	X	X*		X*
Road Rehabilitation Technology 797	SGC 797	24	X		X*		
Concrete Technology 794	SGC 794	24	X	X	X		
Traffic Engineering 792	SVC 792	24	X	X	X	X	X
Transportation Special 791	SVC 791	24					
Transportation Studies 790	SVC 790	24					
Basic Statistical Methods 797	SHC 797	24				X+	
Basic Pavements and Transport'ion 787	SGM 787	24				X+	

Railway Engineering

			BEng(Hons)			BSc(Hons) Applied Sciences	
		Credits	Fulltime	Part-time First year	Part-time Second yr	Part-time First year	Part-time Second yr
Civil Research 780	SSC 780	32	X		X		X
Applied Statistical Methods and Optimisation 798	SHC 798	24	X	X	X*		
Transportation Planning 789	SVC 789	24					
Geometric Design and Safety 791	SVV 791	24					
Infrastructure Management 790	SSI 790	24	X	X	X*	X	X*
Numerical Methods and Finite Element Applications for Civil Engineers 790	SIK 790	24	X	X	X*		
Multimodal Transport 788	SVV 788	24	X	X	X	X	X
Pavement Design 793	SGC 793	24	X	X	X*		X*
Road Rehabilitation Technology 797	SGC 797	24					
Concrete Technology 794	SGC 794	24	X	X	X		
Traffic Engineering 792	SVC 792	24	X	X	X	X	X
Transportation Special 791	SVC 791	24	X	X	X*	X	X*
Transportation Studies 790	SVC 790	24					
Basic Statistical Methods 797	SHC 797	24				X+	
Basic Pavements and Transport'ion 787	SGM 787	24				X+	

Water Resources
X+ must be taken and a further module from the remaining modules.

			BEng(Hons)			BSc(Hons) Applied Sciences	
		Credits	Fulltime	Part-time First year	Part-time Second yr	Part-time First year	Part-time Second yr
Civil Research 780	SSC 780	32	X		X		X
Applied Statistical Methods and Optimisation 798 OR Numerical Methods and Finite Element Applications for Civil Engineers 790	SHC 798 SIK 790	24 24	X	X	X*		
Concrete Technology 794	SGC 794	24	X	X	X		
Hydraulic Design 793	SHC 793	24					
Water Resource Analysis and Management 796	SHC 796	24					
Flood Hydrology 792	SHC 792	24	X	X	X*	X	X*
Free Surface Flow 794	SHC 794	24					
Pipe Flow 795	SHC 795	24	X	X	X*	X	X*
Pump Systems 785	SHW 785	24					
Infrastructure Management 790	SSI 790	24	X	X	X*		X*
Basic Statistical Methods 797	SHC 797	24					
Basic Hydraulics 788	SHW 788	24					

The planned block week schedule is shown below. When choosing modules, students should ensure that their choices fit in with the timetable. No clashes are allowed, as these may also affect the examination timetable.

BLOCK 1: 9 – 13 March 2020:

Time	Geotechnics	Structures	Transportation	Water
07:30 - 08:20 08:30 – 09:20	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics
09:30 - 10:20 10:30 - 11:20			SSI790 Infrastr Mgmt	
11:30 - 12:20 12:30 – 13:20	SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE	SGM787 Basic Pavt & Transp SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE
13:30 - 14:20 14:30 - 15:20		SIN791 Prestressed Conc Des	SGC797 Road Rehab (2 hours per day) SGC793 Pavt Design* SVC790 Transportation Studies**	
15:30 - 16:20 16:30 - 17:20		SIN777 Structural Mechanics		

*SGC793 Monday and Tuesday 4 hours, Wednesday 2 hours; ** SVC790 Wednesday 2 hours, Thursday and Friday 4 hours

BLOCK 2: 20 – 24 April 2020:

Time	Geotechnics	Structures	Transportation	Water
07:30 - 08:20 08:30 – 09:20	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics
09:30 - 10:20 10:30 - 11:20			SSI790 Infrastr Mgmt	
11:30 - 12:20 12:30 – 13:20	SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE	SGM787 Basic Pavt & Transp SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE
13:30 - 14:20 14:30 - 15:20		SIN791 Prestressed Conc Des	SGC797 Road Rehab (2 hours per day) SGC793 Pavt Design* SVC790 Transportation Studies**	
15:30 - 16:20 16:30 - 17:20		SIN777 Structural Mechanics		

*SGC793 Monday and Tuesday 4 hours, Wednesday 2 hours; ** SVC790 Wednesday 2 hours, Thursday and Friday 4 hours

BLOCK 3: 17 – 21 August 2020:

Time	Geotechnics	Structures	Transportation	Water
07:30 - 08:20	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics
08:30 – 09:20				
09:30 - 10:20			SSI790 Infrastr Mgmt	
10:30 - 11:20				
11:30 - 12:20	SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE	SGM787 Basic Pavt & Transp SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE
12:30 – 13:20				
13:30 - 14:20		SIN791 Prestressed Conc Des	SGC797 Road Rehab (2 hours per day) SGC793 Pavt Design* SVC790 Transportation Studies**	
14:30 - 15:20				
15:30 - 16:20		SIN777 Structural Mechanics		
16:30 - 17:20				

*SGC793 Monday and Tuesday 4 hours, Wednesday 2 hours; ** SVC790 Wednesday 2 hours, Thursday and Friday 4 hours

BLOCK 4: 28 September – 2 October 2020:

Time	Geotechnics	Structures	Transportation	Water
07:30 - 08:20	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats SHC797 Basic Statistics
08:30 – 09:20				
09:30 - 10:20			SSI790 Infrastr Mgmt	
10:30 - 11:20				
11:30 - 12:20	SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE	SGM787 Basic Pavt & Transp SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE
12:30 – 13:20				
13:30 - 14:20		SIN791 Prestressed Conc Des	SGC797 Road Rehab (2 hours per day) SGC793 Pavt Design* SVC790 Transportation Studies**	
14:30 - 15:20				
15:30 - 16:20		SIN777 Structural Mechanics		
16:30 - 17:20				

*SGC793 Monday and Tuesday 4 hours, Wednesday 2 hours; ** SVC790 Wednesday 2 hours, Thursday and Friday 4 hours

GEOTECHNICAL ENGINEERING SHORT COURSES

20 January – 22 January 2020
Short course - Theoretical Soil Mechanics

23 January – 24 January 2020
Short course - Analytical Methods in Geotechnical Engineering

27 January – 28 January 2020
Short course - In-situ Geotechnical Testing

29 January 2020
Short course - Geotechnical Laboratory Testing

3 February 2020
Short course - Reliability Methods in Geotechnical Engineering

The allocation of lecture halls as well as examination timetable is provided on the departmental website at the start of a particular block week.

OUTSIDE NORMAL BLOCK WEEKS

BLOCK WEEKS IN 2020 FOR MODULES OFFERED BY DEPT OF CIVIL ENGINEERING

9 – 13 March, 20 – 24 April, 17 - 21 August and 28 September - 2 October 2020
Final examinations 1 – 5 June and 9 - 20 November 2020

DATES OF MODULES OUTSIDE OF THE BLOCK WEEKS

Geotechnical Engineering Modules

Theoretical Soil Mechanics SGS 788	20 January – 3 February 2020
Analytical Soil Mechanics SGS 787	20 January – 3 February 2020
Specialised Geotechnical Testing SGS 789	20 January – 3 February 2020

Water Engineering Modules

Pipeline design SHC795	17 February – 21 February 2020
Flood hydrology SHC792	2 March - 6 March 2020
Concrete Technology SGC 794	4 - 5 February, 4 - 5 March and 27 - 28 May 2020

Transportation Engineering Modules

Traffic Engineering SVC 792	11 – 15 May 2020 (To be confirmed)

BLOCK WEEKS FOR MODULES OFFERED BY OTHER DEPARTMENTS

Block weeks and examination dates to be obtained from the relevant department

Scheduled Examination Dates (2020)

Date	Geotechnics	Structures	Transportation	Water
1 June	Theoretical Soil Mechanics			
5 June	Specialised Geotechnical Testing			
22 June (tbc)		SGC794 Concrete Technology	SGC794 Concrete Technology	
9 Nov	SHC798 Applied Stats	SHC798 Applied Stats	SHC798 Applied Stats SHC797 Basic Statistics	SHC798 Applied Stats
11 Nov			SSI790 Infrastr Mgmt	
13 Nov	SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE	SGM787 Basic Pavt & Transp SIK790 Numerical Methods & FE	SIK790 Numerical Methods & FE
16 Nov	SGS787 Analytical Soil Mechanics	SIN791 Prestressed Conc Des	SGC793 Pavt Design SGC797 Road Rehab	SHC795 Pipe Flow
18 Nov		SIN777 Structural Mechanics	SVC790 Transportation Studies	SHC792 Flood Hydrology
20 Nov			SVC791 Transportation Special SVC791 Traffic Engineering	SHW788 Basic Hydraulics

Annexure C: Calendar 2020

	January	February	March	April	May	June
Wed	1 New Year					
Thu	2					
Fri	3				1 Workers Day	
Sat	4	1			2	
Sun	5	2	1		3	
Mon	6	3	2		4	1
Tues	7	4	3		5	2
Wed	8	5	4	1	6	3
Thurs	9	6	5	2	7	4
Fri	10	7	6	3	8	5
Sat	11	8	7	4	9	6
Sun	12	9	8	5	10	7
Mon	13	10	9	6	11	8
Tues	14	11	10	7	12	9
Wed	15	12	11	8	13	10
Thurs	16	13	12	9	14	11
Fri	17	14	13	10 Good Friday	15	12
Sat	18	15	14	11	16	13
Sun	19	16	15	12	17	14
Mon	20	17	16	13 Family Day	18	15 No lectures
Tues	21	18	17	14	19	16 Youth Day
Wed	22	19	18	15	20	17
Thurs	23	20	19	16	21	18
Fri	24	21	20	17	22	19
Sat	25	22	21 Human rights	18	23	20
Sun	26	23	22	19	24	21
Mon	27	24	23	20	25	22
Tues	28	25	24	21	26	23
Wed	29	26	25	22	27	24
Thurs	30	27	26	23	28	25
Fri	31	28	27	24	29	26
Sat		29	28	25	30	27
Sun			29	26	31	28
Mon			30	27 Freedom Day		29
Tues			31	28		30
Wed				29		
Thurs				30		

Water week 2

Post Grad block

Traffic Engng

Water week 1

Post Grad block

	July	August	September	October	November	December
Tues			1			1
Wed	1		2			2
Thurs	2		3	1		3
Fri	3		4	2		4
Sat	4	1	5	3		5
Sun	5	2	6	4	1	6
Mon	6	3	7	5	2	7
Tues	7	4	8	6	3	8
Wed	8	5	9	7	4	9
Thurs	9	6	10	8	5	10
Fri	10	7	11	9	6	11
Sat	11	8	12	10	7	12
Sun	12	9 Women's Day	13	11	8	13
Mon	13	10 Public Holiday	14	12	9	14
Tues	14	11	15	13	10	15
Wed	15	12	16	14	11	16 Day of Reconc
Thurs	16	13	17	15	12	17
Fri	17	14	18	16	13	18
Sat	18	15	19	17	14	19
Sun	19	16	20	18	15	20
Mon	20	17	21	19	16	21
Tues	21	18	22	20	17	22
Wed	22	19	23	21	18	23
Thurs	23	20	24 Heritage Day	22	19	24
Fri	24	21	25	23	20	25 Christmas Day
Sat	25	22	26	24	21	26 Goodwill Day
Sun	26	23	27	25	22	27
Mon	27	24	28	26	23	28
Tues	28	25	29	27	24	29
Wed	29	26	30	28	25	30
Thurs	30	27	1	29	26	31
Fri	31	28	2	30	27	
Sat		29		31	28	
Sun		30			29	
Mon		31			30	
Tues						
Wed						

Post Grad block

Post Grad block

Final exam week

Final exam week

Annexure D: Preparation of Reports, Dissertations and Theses

Students registering for Masters degrees are required to have identified a suitable research topic in consultation with the head of discipline prior to registration.

Before starting their research, Masters students are required to prepare a planning report, which covers the following aspects:

- Proposed title of the project report
- Introduction and background to the study
- Problem statement
- Objectives of the study
- Scope and extent of the study
- Provisional format of the report in the form of an index
- Detailed work program, including a bar chart.

In the case of doctoral students, the planning report must also have a section discussing the contribution that the research will make to the state of knowledge on the topic and be accompanied by a 3-page CV of the student, (including a list of previous publications and experience) and a copy of the student's Master's dissertation or research report. These are submitted by the Head of Division to the Department's Review Committee in support of the student's application for admission to the doctoral programme.

All students must prepare their project reports, dissertations or theses in accordance with the "*Guidelines for reports, dissertations and theses*" prepared by the department, which is available on http://www.up.ac.za/en/civil-engineering/article/21923/student-information and the latest version is also on ClickUp.