UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

DEPARTMENT OF CHEMICAL ENGINEERING

POSTGRADUATE STUDIES

INFORMATION BROCHURE

2014

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CONTENTS

1. INTRODUCTION

The Department of Chemical Engineering offers several postgraduate options to prepare graduates with a first degree to specialise in focus areas that are both relevant from a research perspective and also caters for requirements in an industrial environment where professional capabilities are required. To this end, it is important to provide some background to assist prospective students in making the correct choice of modules.

The UP School of Engineering requires all candidates who plan to register for postgraduate studies after a first degree, to complete the Honours degree, which is a formally recognised, postgraduate qualification and which should not be confused with terminology often used to rate level of performance of a qualification (e.g. 'honours' or 'first class honours'). Depending on the first degree, students will be able to register for either the BEng(Hons)-degree, following after a BEng-degree or equivalent, or for the BSc(Hons)(App.Sci.)-degree, following after an alternative first qualification.

To register for a BEng(Hons)-degree, a BEng degree or equivalent qualification is required. An equivalent qualification is regarded as one which ECSA (Engineering Council of South-Africa) regards as acceptable for registration as Candidate Engineer and for eventual registration as Professional Engineer. Students who earned a degree in Engineering at a university outside South Africa, which has not been accredited by ECSA, or which was not granted by an institution that is a co-signatory of the Washington Accord, will be allowed to register for the BSc(Hons)(App.Sci)-degree.

For BSc(Hons)(App.Sci) study, a BSc degree is required, with the further requirement that a full year of Mathematics, Physics and Chemistry must have been passed at least at first year level. Modules entitled "Introductory", "Elementary" or "Basic" will not be regarded as acceptable. In the case of module selection in the field of Control, it is required that Chemistry and Physics must have been passed at first year level and that Mathematics must have been passed at least at second year level. Should there be any uncertainty regarding modules to be taken, the intended programme for the BSc(Hons)(Applied Science) must be discussed and arranged with the Head of Department.

Candidates with an appropriate BTech qualification, i.e. one offered by a Department of Chemical Engineering at a university of technology, will also be allowed to register for the BSc(Hons)(App.Sci). Only candidates who did not fail any BTech-modules **and** who have achieved a weighted average of above 65% for the modules of the BTech, will however be considered. Students with a BTech who comply with the above requirements, may in addition be required to register for a number of selected modules from the fourth year of the BEng (undergraduate) programmes, which must be chosen in consultation with the Head of Department.

The following Honours-degree programmes are available:

CANDIDATES WITH A BEng DEGREE OR EQUIVALENT	CANDIDATES WITHOUT A BEng DEGREE OR EQUIVALENT
BEng(Hons) Chemical Engineering, with specialisation in:	**BScHons (Applied Science) (Chemical Technology), with specialisation in:**
Carbon, Fluorine and Polymer Materials Science Bioreaction engineering, Bioprocessing and Biotechnology	Carbon, Fluorine and Polymer Materials Science Bioreaction Engineering, Bioprocessing and Biotechnology
BEng(Hons) Control Engineering	**BScHons (Applied Science) (Control)**
BEng(Hons) Environmental Engineering	**BScHons (Applied Science) (Environmental Technology)**
BEng(Hons) Water Utilisation Engineering	**BScHons (Applied Science) (Water Utilisation)**

Only after successful completion of the relevant Honours degree can a student register for the appropriate master's degree. Registration can only take place once a suitable research proposal has been submitted to a research supervisor, who is a current departmental staff member. Only once the proposal has been accepted by the supervisor and the Departmental Postgraduate Committee, can a student register for the Master's or PhD, as required.

For entry to master's-degree study, as well as for entry to PhD study, applicants may have to submit proof of their knowledge in the area of research methodology. Students with qualifications from other South African universities must note General Regulation G.62. Students with qualifications from foreign universities will be judged on merit.

2. POSTGRADUATE POLICY AND PROCEDURES

The procedures contained in this document do not in any way replace the official regulations of the university. Students should study these official regulations and procedures, as contained in the relevant official year-books of the university, namely that of the Faculty of Engineering, Built Environment and Information Technology and also the General Regulations of the University of Pretoria. Students should also take cognisance of official dates on the academic calendar, for example the last date of registration, Regulations regarding discontinuation of study and submission of dissertations and theses.

Postgraduate lectures are presented in English. Should all class members prefer, lectures can be presented in Afrikaans. Examinations, assignments, projects, dissertations and theses may be submitted in Afrikaans or English.

International students should take note of the prerequisite competency in English, which is necessary for admission to postgraduate studies (International Information Guide) If, in his/her final year of schooling, an applicant did not comply with the admission requirements of the University of Pretoria in terms of full or foreign exemption in English, Mathematics or another subject, an applicant may be required to write the:

- SAT1 Test: The minimum requirement for the SAT1 Test is Mathematics 550, Critical Reading 500 and Writing 500. (www.collegeboard.com/splash)
- TOEFL Test: The minimum requirement for the TOEFL is Written 22, Verbal 23, Reading 21, Listening 17 with a total of 83. (www.ets.org/toefl)
- IELTS Test: The minimum requirement for the IELTS Test is 6. (www.IELTS.org)

and/or

- University of Pretoria Institutional Proficiency Test

2.1. Degrees

The postgraduate degrees offered in the Department are set out in the table below, together with a reference to the relevant regulations. The regulations determine, among other things, admission requirements and requirements for the degree.

DEGREE	ENTRY REQUIREMENTS
BEng(Hons) Chemical Engineering BEng(Hons) Control Engineering BEng(Hons) Environmental Engineering BEng(Hons) Water Utilisation Engineering	A BEng degree from the University of Pretoria or equivalent.
BSc(Hons)(Applied Science)	An appropriate BSc degree or an appropriate BTech
MEng Chemical Engineering MEng Control Engineering MEng Environmental Engineering MEng Water Utilisation Engineering	A BEng(Hons) degree from the University of Pretoria or equivalent.
MSc (Applied Science)	A BSc(Hons)(Applied Science) degree from the University of Pretoria or equivalent.
PhD	A Master's Degree from the University of Pretoria or equivalent
PhD (Eng)	A Master's Degree in Engineering from the University of Pretoria or equivalent
DEng	The degree DEng is awarded on the basis of publications. The admission requirement would normally be a PhD in Engineering or equivalent qualification.

2.1.1. Honours degrees

General Regulations G.16 to G.29 as well as Regulations Eng.19 to Eng.24 apply, where relevant. Students must pass 128 credits of course work, part of which is prescribed. For details see paragraph 3.2.

2.1.2. Master's degrees

General Regulations G.30 to G.44 as well as Regulations Eng.19 to Eng.24 apply where relevant. A student must be in possession of the relevant honours degree and must then register for the master's degree and complete a dissertation.

2.1.3. Doctoral degrees (See General Regulations G.45 to G.62)

The PhD-degree is awarded after successful completion of a thesis which shows that the candidate possesses a deep and comprehensive knowledge of the science involved, that he or she is schooled in scientific thought and method and that he/she has proved by independent research that scientific methods can be applied in a scientific study to make an independent contribution to the knowledge in the field of research. Regulations Eng.25 and Eng.26 apply.

The DEng degree is awarded on strength of publications. The degree is awarded to a candidate who commands international recognition on account of top quality comprehensive research work. In the School of Engineering this is interpreted to mean that, because of his/her research contributions, a candidate is internationally accepted as a leader in his/her field. The Department of Chemical Engineering will normally require the DEng candidate to compile the relevant papers in the form of a thesis and if necessary provide a table of contents and additional editorial comment. Rule Eng.27 applies.

2.2. Admission

All prospective postgraduate students must in the first instance obtain admission to the School of Engineering. Application forms are available at the Client Service Centre (CSC) or via e-mail from CSC@up.ac.za or via the University of Pretoria webpage (http://www.up.ac.za). This document, as well as other relevant information on the Department can be accessed via the Departmental webpage: (http://www.up.ac.za/chemeng)

2.2.1. Qualifications

The UP School of Engineering requires all candidates who plan to register for postgraduate studies after a first degree, to complete the Honours degree. Depending on the first degree, students will be able to register for either the BEng(Hons)-degree, following after a BEng-degree or equivalent, or for the BSc(Hons)(App.Sci.)-degree, following after an alternative first qualification.

To register for a BEng(Hons)-degree, a BEng degree or equivalent qualification is required. An equivalent qualification is regarded as one which ECSA (Engineering Council of South-Africa) regards as acceptable for registration as Professional Engineer. Students who earned a degree in Engineering at a university outside South Africa, which has not been accredited by ECSA, or which was not granted by an institution that is a co-signatory of the Washington Accord, will be allowed to register for the BSc(Hons)(App.Sci)-degree. If such students show, by their performance in the coursework modules of this program, that their background in engineering is sufficient, they will be allowed to register for the MEng when they continue their studies after the honours degree.

For BSc(Hons)(App.Sci) study, a BSc degree is required, with the further requirement that a full year of Mathematics, Physics and Chemistry must have been passed at least at first year level. In the case of module selection in the field of Control, it is required that Chemistry and Physics must have been passed at first year level and that Mathematics must have been passed at least at second year level. Modules entitled "Introductory", "Elementary" or "Basic" will not be regarded as acceptable. The intended programme for the BSc(Hons)(Applied Science) and, where applicable, the MSc(Applied

Science), must be discussed and arranged with the Head of Department.

Candidates with an appropriate BTech qualification, i.e. one offered by a Department of Chemical Engineering at a university of technology, will be allowed to register for the BSc(Hons)(App.Sci) in certain areas of specialisation. Only candidates who did not fail any BTech-modules **and** who have achieved a weighted average of at **least 65%** for the modules of the BTech, will be considered. Students with a BTech who are registered for BSc(Hons)(Applied Science) are allowed to, or may be required to register for a number of selected modules from the fourth year of the BEng (undergraduate) programmes, which must be chosen in consultation with the Head of Department.

For entry to certain research master's degrees, as well as for entry to PhD study, applicants may have to submit proof of their knowledge in the area of research methodology. Students with qualifications from other South African universities must note Rule G.62. Students with qualifications from foreign universities will be judged on merit.

2.2.2. Selection

The Department reserves the right to select prospective students. Selection will be done on the basis of the student's academic record and the available opportunities for postgraduate study in the Department. Due to a large number of applications, it is not possible to enter into any correspondence with an applicant whose application for postgraduate studies has not been successful.

2.3. Application for Admission and Registration

Applications from persons who are registering for post-graduate study for the first time should be submitted on the prescribed form obtainable from the Client Service Centre, at http://www.csc.up.ac.za or the University's web page http://www.up.ac.za/apply by **31 October 2013**. Applications for International students close on 31st August 2013.

Official registration for postgraduate study takes place annually on the day selected for this purpose, usually a Saturday morning in January. All new postgraduate students must report on that day for registration. **In 2014 this date will be: Saturday 25th January, 08:00, Engineering III Building.** The specific venue will be made available in due course. Please take note that first-time applicants, who have never studied previously at UP, cannot apply for admission to UP on this day.

It is also important to take note of the fact that the academic year starts with the first semester in January and that most second semester modules follow on first semester modules. A candidate must therefore commence his/her studies in the first semester of any year.

Postgraduate students who continue their studies must renew their registration every year before a specific date. All students who wish to follow postgraduate courses in any year must report on the day of registration as mentioned above. Students who will not be doing course work, i.e. those who will be registered for a dissertation or a thesis only, need not report on the day of registration (although this is preferable). Such students will have their registration forms mailed to them.

Students should ensure that they are aware of the times of lecture blocks of the different specialisation groups. This information is normally published on the Departmental website (http://www.up.ac.za/chemeng). In case of doubt, the relevant divisional heads should be contacted in good time.

2.4. Registration Fees

Please refer to the "Guide for Student Fees", which gives details regarding tuition fees and payment. The fees for 2014 will be announced towards the end of 2013.

A deposit or registration fee is payable at registration. It is, however, permissible to pay the remainder of the tuition fees in two instalments, namely a deposit at registration and one subsequent payment.

The applicable initial payment that is due before or during registration is as follows:

- Post-graduate students who are registering for the first time for a particular field of study will be required to pay an amount of R4 600 towards their tuition fees before or during registration.
- Post-graduate students who are renewing their registration will be required to pay an amount of R3 000 towards their tuition fees before or during registration.
- Post-graduate students who need to renew their registration in order to submit a dissertation/thesis for examination will, subject to the examination being completed before 30 March, be required to pay an administration levy of approximately R1 000. If the examination extends beyond 30 March the full re-registration amount, in the order of R3 000 must be paid.

2.5. Study fees

The exact fees payable for each module can be ascertained from the Student Administration Offices; but would be in the order of R6 600 per 32 SAQA credits in 2014.

Fees for the first year of registration for a Master's degree or PhD is approximately R26 000. Consult to the "Guide for Student Fees".

The student's registration must be renewed annually until such time as the degree requirements have been complied with. Candidates who fail to renew their registration or who interrupt their studies are liable for the full tuition fees when the study is resumed. For the second and any subsequent years of study for a research master's and PhD a re-registration fee of R3 000 is payable.

International students Non-South African students are, for the duration of their studies, required to annually pay an international administration levy (Approximately R3 000 for 2014). If an international student studies for a non-research based degree, the fees are

in the majority of instances double those mentioned above.

2.6. Recognition of modules

Postgraduate modules completed in another department or at another university may be recognised for postgraduate study in the Department on condition that such modules complement the student's proposed area of study and on condition that the stipulations of General Regulation G.23 are adhered to. Application for recognition of modules must be made on the prescribed form.

2.7. Appointment of supervisor

Before a student can register for a degree at M- or D-level, a member of staff in the Department must agree to act as the student's supervisor. Normally a supervisor will have at least the same degree as the one he/she supervises.

The choice of supervisor must be approved by the Head of Department. He takes into account the student's research proposal and the proposed study program and also the qualifications, experience and research record of the member of staff. The subject of the student's dissertation/thesis as well as his supervisor/co-supervisor and external examiner(s) are also subject to the approval of the Head of Department and the Postgraduate Committee of the Faculty.

2.8. Duration of study

Students must note Regulations Eng.19(f), Eng. 20(h) Eng 22(f) and Eng 23(e) about duration of study; and also Regulation Eng.19(f) stipulating that a student may repeat a postgraduate module once only.

2.9. Address changes and discontinuation of study

All students must notify the university forthwith of address changes. This is done by reporting the address change in writing to the Student Administration (contact email addresses: See the last page of this brochure).

Students who discontinue the study of specific subject modules do so on 6th Floor, Engineering I Building. Discontinuiation of degree studies must be done at the Client Service Centre. Repayment of tuition fees, if any, is processed by the Client Service Centre.

2.10. Financial assistance and study agreement

University bursaries and loans are available for postgraduate study. (UP Study Financing information). More information is available from the UP website. Application forms are available at the Client Services Centre (CSC), or can be downloaded from the CSC-website. For study in specific fields, financial assistance from industry may be available in the Department of Chemical Engineering, depending on current agreements with industrial partners. Students are advised to contact the appropriate division heads in the Department. Bursaries for master's and doctoral study are also available from the National Research Foundation and prospective students are advised to apply directly to the NRF for these bursaries.

If a student receives a bursary from the university or a grant from industry, which was organised by the Department, the student will enter into a contract with the university. This contract will determine, inter alia, that if a student does not meet all his commitments regarding research application, dissertation or thesis, the money paid out to the student, will have to be repaid by the student.

Any study agreement with a postgraduate student implies that a student will spend at least 40 hours per week on campus working on his/her postgraduate modules and research projects and that he/she will be absent from campus during normal office hours, only in exceptional cases, with the approval of his/her supervisor. Each student has to complete a suitable study agreement with his/her supervisor.

2.11. Postgraduate committee

The Department has the responsibility of ensuring that students follow meaningful, coherent and balanced study programs, which contain deepening as well as broadening elements. The final decision in this regard rests with the Department's Postgraduate Committee which, inter alia, also advises the Department about research areas.

2.12. Performance monitoring

Students who do research at postgraduate level must, at the end of each semester, submit a short progress report to the postgraduate committee, via his/her supervisor. The postgraduate committee also has the task of monitoring students' progress on the ground of exam results. Should a student not perform adequately, or does not submit a satisfactory progress report, his/her studies may be terminated.

3. HONOURS STUDY

The University of Pretoria's School of Engineering has a unique way of offering postgraduate qualifications. The qualification **BEng(Hons)**, is a postgraduate degree, following after the four-year **BEng**- or **BSc(Eng)**-degree. Please note that it has nothing to do with the practice of awarding a Bachelors-degree with honours or first-class honours, as is the custom at some universities and which is associated with an average mark attained towards that degree.

In order to accommodate many graduates with a science background and who find themselves in an engineering environment, a parallel qualification was established, namely the **BSc(Hons)(Applied Science)**

Students with **BTech**-qualifications are, under certain conditions, allowed to register for the **BSc(Hons)(Applied Science)**-degree.

Successful completion of the **BEng(Hons)**- or the **BSc(Hons)(Applied Science)**-degree is a prerequisite before a student may register for respectively a **MEng**- or a **MSc(Applied Science)**-degree. Since many students need specialist knowledge when pursuing professional careers, they graduate with a sought-after, rounded-off qualification. For those students who are interested in obtaining a more focused research-based qualification, the honours-degree serves as necessary preparation towards the master's degree.

Regulations Eng.21 and Eng.24 apply to honours study in the Department. To obtain an Honours degree, a student must pass modules to the value of at least 128 credits. This rule refers to the weight credits awarded to postgraduate modules. As a broad guideline, the following norm is set for the determination of credits allocated to postgraduate modules:

A module which involves about 320 notional hours (notional hours is the combination of contact hours and study hours), is awarded 32 course credits. Some postgraduate modules are, however, not formally taught. In all cases the guideline above applies to qualify for 32 postgraduate weight credits. A similar reasoning applies for modules with other credits.

The different focus groups in the Department each has its own policy with regard to the presentation of postgraduate modules. Postgraduate modules are presented in one of three ways i.e.

- in blocks, by presenting lectures in announced blocks of one week (or in some cases mini blocks of shorter duration)
- by presenting lectures after hours; and
- by allowing the student to master the module on a self study basis under the supervision of a lecturing staff member.

All postgraduate modules are moderated by external examiners who are experts in the field and are not associated with the University of Pretoria.

3.1. Honours modules

The modules which are presented in the Department at postgraduate level appear in section 7.1 of this document. In all cases those modules with code numbers ending on 7 are reserved for non-BEng(Hons) students. Some modules with code numbers ending on 0 or 2 may also be followed by non-BEng(Hons) students, with special permission from the Head of Department.

3.2. Module combinations

Depending on the field of specialisation chosen by the student, certain module combinations will be prescribed in most instances. The modules are described in section 7 of this document. Note that not all the modules are presented every year.

3.2.1. BEng(Hons) Chemical Engineering

To obtain the BEng(Hons) in Chemical Engineering, at least half of the required 128 credits must be completed in the Department of Chemical Engineering. It is strongly advised that students select modules that will lead to specialist knowledge in a selected focus area of Chemical Engineering. Modules selected outside the Department, should enhance the selected focus area. Course credits required for completion of the degree are chosen by the candidate in consultation with the Head of Department.

Please note that the area of specialisation mentioned in 3.2.1.1, 3.2.1.2, 3.2.1.3 and 3.2.1.4 below is not indicated on the degree certificate for the BEng(Hons)(Chemical Engineering). Also note that candidates registered for BEng(Hons)(Control Engineering), BEng(Hons)(Water Utilisation Engineering) and BEng(Hons)(Environmental Engineering), have to comply with the relevant prescribed modules as set out in 3.2.2, 3.2.3 and 3.2.4 below.

3.2.1.1. Specialisation in Process Design

Specialisation in process design is possible by taking the following:

Prescribed modules: (Any **two** of the following modules, for 64 credits)

(CPO 732)	Product Design 732	32 credits
(CIP 732)	Process Integration 732	32 credits
(CSK 732)	Separation Technology 732	32 credits
(CSP 732)	Process Control System Development 732	32 credits

Elective modules: (64 credits)

A variety of modules are offered in the Department that will complement the prescribed modules.

Candidates who wish to enroll for other modules in this or other departments to complete the required 128 credits for the Honours programme, should consult the postgraduate brochures of those departments and make a choice in consultation with the Head of Department.

3.2.1.2. Specialisation in Carbon, Fluorine and Polymer Materials Science

Specialisation in Carbon and Polymer Materials Science and Chemical Product Design is possible by taking a minimum of 96 credits of the following:

(CPP 732)	Polymer Processing 732	32 credits (2nd semester)
(CPW 732)	Polymer Materials Science 732	32 credits (1st semester)
(CSK 732)	Separation Technology 732	32 credits (2nd semester)
(CYM 732)	Additive Technology 732	32credits (1st semester)
(CPO 732)	Product Design 732	32 credits (1st semester)
(CIR 702)	Chemical Engineering 702	32 credits (1st / 2nd semester)
(CMS 732)	Carbon Materials Science and Technology 732	32 credits (2nd semester)
(CFT 732)	Fluoro-materials Science and Technology 732	32 credits (2nd semester)

The other course credits required for completion of the degree are chosen by the candidate in consultation with the Head of Department.

3.2.1.3. Specialisation in Bioreaction Engineering

Specialisation in Bioreaction Engineering is possible by taking the following:

(CRH 732)	Bioreaction Engineering 732	32 credits (1st semester)
(CBP732)	Bioprocessing 732	32 credits (1st semester)
(CRO 700)	Research Orientation 700	32 credits (2nd semester)
(CIR 702)	Chemical Engineering 702	32 credits (2nd semester)

3.2.1.4. Specialisation in Bioprocessing and Biotechnology

Specialisation in Bioprocessing and Biotechnology is possible by taking the following:

The following module is prescribed:

(CBP 732)	Bioprocessing 732	32 credits (1st semester)

The remaining 96 credits may be taken by selecting three of the following relevant modules:

(CPO 732)	Product Design 732	32 credits (1st semester)
(CRH 732)	Bioreaction Engineering 732	32 credits (1st semester)
(CSK 732)	Separation Technology 732	32 credits (2nd semester)
(WBW 780)	Biological Water Treatment 780	32 credits (2nd semester)

3.2.2. BEng(Hons) Water Utilisation Engineering

The following modules (96 credits) are prescribed:

(WCW 780)	Chemical Water Treatment 780	32 credits (1st semester)
(WQB 780)	Water Quality Management 780	32 credits(1st semester)
(WBW 780)	Biological Water Treatment 780	32 credits (2nd semester)

The remaining 32 credits may be taken by selecting one of the following relevant modules:

(WAI 780)	Industrial Waste Engineering 780	32 credits (2nd semester)
(CIP 732)	Process Integration 732	32 credits (2nd semester)
(CEM 780)	Principles of Environmental Engineering 780	32 credits (1st semester)

Relevant modules from the Department of Civil Engineering may also be taken after consultation with the Head of Department.

3.2.3. BEng(Hons) Environmental Engineering

The following 128 course credits are prescribed.

(CEM 780)	Principles of Environmental Engineering 780	32 credits (1st semester)
(CAM 780)	Air Quality Control 780	32 credits (2nd semester)
(WQB 780)	Water Quality Management 780	32 credits (1st semester)
(WAI 780)	Industrial Waste Engineering 780	32 credits (2nd semester)

3.2.4. BEng(Hons) Control Engineering

The following 128 course credits are prescribed.

(CBT 700)	Multivariable Control System Theory 700	32 credits (1st semester)
(CBO700)*	Multivariable Control System Design 700	32 credits (2nd semester)
(CML 732)	Model-based Control Laboratory 732	32 credits (2nd semester)
(CSP 732)	Process Control System Development 732	32 credits (1st semester)

*CBT700 is a prerequisite for CBO700

3.2.5. BSc (Hons) (Applied Science)

Students who do not have the appropriate qualification to allow them to register for the **BEng(Hons)**, may register for a **BSc(Hons)(Applied Science) within a chosen field of specialisation**, as set out below. In certain instances modules of the fourth year of the undergraduate curriculum may be allowed/prescribed/recommended. Please note that students will have to complete the required modules **within a chosen field of specialisation** in order to conform to degree requirements.

The following fields of specialisation are available:

3.2.5.1. Specialisation in Carbon, Fluorine and Polymer Materials Science (BSc (Hons)(Appl.Sci.): Chemical Technology)

Specialisation in this area is possible by selecting 128 credits from the following:

(CPW 732)	Polymer Materials Science 732	32 credits (1st semester)
(CPP 732)	Polymer Processing 732	32 credits (2nd semester)
(CSK 732)	Separation Technology 732	32 credits (2nd semester)
(CPO 732)	Product Design 732	32 credits (1st semester)
(CIR 707)	Chemical Engineering 707	32 credits (1st / 2nd semester)
(CMS 732)	Carbon Materials Science and Technology 732	32 credits (2nd semester)
(CFT 732)	Fluoro-materials Science and Technology 732	32 credits (2nd semester)

3.2.5.2. Specialisation in Water Utilisation (BSc (Hons)(Appl.Sci.): Water Utilisation)

The following modules (128 credits) are prescribed:

(WCW 787)	Chemical Water Treatment 787	32 credits (1st semester)
(WQB 780)	Water Quality Management 787	32 credits (1st semester)
(WBW 787)	Biological Water Treatment 787	32 credits (2nd semester)
(WAI 787)	Industrial Waste Engineering 787	32 credits (2nd semester)

3.2.5.3. Specialisation in Environmental Technology (BSc (Hons)(Appl.Sci.): Environmental Technology)

The following basic modules (128 credits) are prescribed:

(CEM 787)	Principles of Environmental Engineering 787	32 credits (1st semester)
(WQB 787)	Water Quality Management 787	32 credits (1st semester)
(CAM 787)	Air Quality Control 787	32 credits (2nd semester)
(WAI 787)	Industrial Waste Engineering 787	32 credits (2nd semester)

3.2.5.4. Specialisation in Control (BSc (Hons)(Appl.Sci.)(Control):

NOTE: Before this option is considered, it is strongly recommended that students who intend to pursue this area of specialisation, register for and successfully complete, **for non-degree purposes**, the following undergraduate modules:

In the first semester of their studies: MPR 213 Programming & Information Technology 213.
In the second semester of their studies: CPN 321 Process Dynamics 321.

Specialisation in Control is possible by registering for the following modules: (Please note that a candidate selecting this option will not be allowed to register for any modules at level 7** before the modules of the first semester at level 4** had been completed successfully.

Year 1:

The following first semester module:

CPB 410 Process Control 410	16 credits	semester 1

as well as one of the following:

CBI 410 Biotechnology 410	16 credits	semester 1
CRO 410 Reactor design 410	16 credits	semester 1

The following second semester modules:

** CSS 420 Specialisation 420	16 credits	semester 2
CIR 787 Chemical Engineering 787	16 credits	semester 2

** Note: Only the Optimisation-option may be taken

Year 2:

CSP 732 Process Control System Development 732	32 credits	semester 1

and one of the following modules:

CSK732 Separation Technology 732	32 credits	semester 2

CIP 732	Process Integration 732	32 credits	semester 2

The modules CPB 410, CBI 410, CRO 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

CPB 410	Process Control 410	Prof P de Vaal	012-420-2475
CRO 410	Reactor Design 410	Mrs E du Toit	012 420-3641
CIR 412	Chemical Engineering 412	Mr B du Plesiss	012-420-3740
CSS 420	Specialisation (Optimisation)	Mr C Sandrock	012-420-2197

3.2.5.5. Specialisation in Process Technology (BSc (Hons)(Appl.Sci.): Chemical Technology

NOTE: Before this option is considered, it is strongly recommended that students who intend to pursue this area of specialisation, register for and successfully complete, **for non-degree purposes**, the following undergraduate modules:

In the first semester of their studies: MPR 213 Programming & Information Technology 213.
In the second semester of their studies:
CKN 321 Reaction Kinetics 321, if CRO 410 Reactor Design 410 is to be taken, as below.
or
CPN 321 Process Dynamics 321, if CPB 410 Process Control 410 is to be taken, as below

Specialisation in Process Technology is possible by registering for the following modules: (Please note that a candidate selecting this option will not be allowed to register for any modules at level 7** before the modules of the first semester at level 4** had been completed successfully.

Year 1:

Two (2) of the following **first semester modules:**

CBI 410	Biotechnology 410	16 credits	semester 1
CPB 410	Process Control 410	16 credits	semester 1
CRO 410	Reactor Design 410	16 credits	semester 1

The following **second semester modules:**

CSS 420	Specialisation 420	16 credits	semester 2

Note: Any of the options may be taken

CIR 787	Chemical Engineering 787	16 credits	semester 2

Year 2:

CPO 732	Product Design 732	32 credits	semester 1

and one of the following modules:

CSK732	Separation Technology 732	32 credits	semester 2
CIP 732	Process Integration 732	32 credits	semester 2

The modules CPB 410, CBI 410, CRO 410 and CSS 420 do not form part of the postgraduate block presentations. Individual arrangements have to be made with the relevant lecturer regarding attendance of lectures, study material, tests and assignments.

CPB 410	Process Control 410	Prof P de Vaal	012-420-2475
CRO 410	Reactor Design 410	Mrs E du Toit	012 420-3641
CIR 412	Chemical Engineering 412	Mr B du Plesiss	012-420-3740
CSS 420	Specialisation (Optimisation)	Mr C Sandrock	012-420-2197

3.3. Study guides

A study guide exists for every postgraduate module. This guide describes procedures, study aims and details about examinations, assignments etc. Study guides are made available during the lecture sessions of a particular module.

3.4. Examination policy

The honours degrees are awarded based on the results of assignments, projects and examinations. All the courses taken must be passed individually. A candidate passes with distinction if he/she obtains a weighted average of at least 75% in all the modules.

Please take note:

- A postgraduate module may only be repeated once.
- No supplementary exams are available for postgraduate modules.

4. MASTER'S STUDY

No student can register for a master's degree unless he/she has successfully completed the relevant Honours degree. A master's degree is awarded on strength of a research dissertation. A candidate conforming to the entry requirements may register for the applicable master's degree once a suitable research topic has been approved and a study supervisor allocated.

4.1. Master's degree dissertation

A student in possession of an appropriate BEng(Hons) or BSc(Hons)(App.Sci.) degree will be considered for registration for the MEng or MSc (App.Sci.) degree (as applicable). The master's degree is awarded on strength of a dissertation as well as an oral examination in the field of the dissertation. In certain cases, coursework modules relevant to the dissertation topic may be prescribed in addition to the research topic. Please take note of the entry requirements as stated in paragraph 1.2.1.

The MEng and MSc (App.Sci.) degrees are awarded in the following areas:

MEng (Chemical Engineering), MEng (Control Engineering), MEng (Environmental Engineering) and MEng (Water Utilisation Engineering)

Students register for: CVD 800 Dissertation 800 128 credits

MSc(App.Sci.) Chemical Technology*, MSc (Appl.Sci.)(Control), MSc (Appl.Sci.)(Environmental Technology), MSc (Appl.Sci.)(Water Utilisation)
*With specialisation in Carbon, Fluorine and Polymer Materials Science

Students register for: CVD 807 Dissertation 807 128 credits

The dissertation can cover any acceptable aspect of chemical engineering or chemical technology. When any of the specialisation fields as indicated above is chosen, the dissertation must cover an acceptable aspect of the relevant field in consultation with the Head of Department.

4.2. Examination policy

A candidate passes the dissertation if the internal and external examiners both award a mark of at least 50% to the dissertation and if a suitable publication on the dissertation or an aspect of the dissertation is presented and accepted by the internal examiner as suitable for publication. An oral exam after examination of the dissertation is a standard requirement in the School of Engineering.

It is the policy of the School that dissertations may not be classified or confidential. An exception to this rule will be considered only in exceptional circumstances, if approved by the Postgraduate Committee on recommendation of the Head of Department. If a student wishes to submit a classified dissertation the Postgraduate Committee's permission must be obtained **before** the student registers for the degree. In such a case the student must still submit a draft article for publication (see 4.3).

4.3. Publications

Regulations G.43 and G.61 determine that, unless the Senate should decide otherwise, a candidate for a MEng or PhD degree must submit proof that at least one draft article has been submitted and received for publication by a recognised journal. The draft article must be based on the research for the degree and must be acceptable to the supervisor. The article can only be submitted for publication to an appropriate journal with the aproval of the supervisor.

Students must note that in order to get the correct recognition for any publication which results from research done as part of the study, the name of the supervisor(s) must be mentioned as co-author(s) of the publication. To indicate clearly that the work was done in the Department, the address of all the authors must be given as the address of the Department and the University.

4.4. Upgrading of Master's to PhD

It is the policy of the Faculty that students who are enrolled for master's degrees may not upgrade their registration to the doctoral level. In exceptional cases where this upgrading of studies may be considered, the student involved must submit a report (which must be on the standard of a master's dissertation) about the research which has been concluded to date as well as copies of published peer-reviewed journal articles on the the topic of research by the student as well as a document clearly explaining the proposed additional work to comply with the requirements of the PhD thesis. The Head of Department will use these documents as basis for his motivation to the Postgraduate Committee and the Faculty Board. This procedure will be considered only during the first two years of master's study. Take note of admission requirements as stated in paragraph 1.2.1.

5. DOCTORAL STUDY

5.1. PhD and PhD(Eng)

Except as allowed for in Regulations G.45 and G.62, a master's degree is required for admission to the PhD study. Students with an acceptable MSc degree are admitted to PhD study and students with an acceptable MEng degree are admitted to the study of PhD(Eng). Both PhD degrees are awarded on the basis of a thesis and except if the Faculty Board decides otherwise, an examination in the field of the thesis. An oral exam after examination of the thesis is a standard requirement in the School of Engineering. Note admission requirements as stated in paragraph 1.2.1. Students with a MSc (App.Sci.) degree may also apply for PhD studies.

5.2. DEng

The degree DEng is awarded on publications. Refer to general rule G.56.

5.3. Examination policy

A candidate passes the thesis if the internal and two external examiners agree that the thesis meets with all examination and other criteria and the thesis or an appreciable part thereof is suitable for publication. The same requirements regarding publications, as applicable to master's dissertations mentioned above, also apply. The PhD and DEng degrees are not awarded with distinction.

6. SYMPOSIA

The Department organises research colloquia, symposia and open days from time to time. Postgraduate research students are required to attend these meetings and to participate as required.

7. TEACHING STAFF

▪	**De Vaal, P.L.**	PrEng BEng(Hons) MEng(Pret) PhD(Pret) FSAIChE MSAIT MSTLE	Professor (Head of Department)
	Room 8-21	Engineering I Building	Tel 420-2475
▪	**Badenhorst, H.**	PrEng BEng(Hons) PhD(Pret)	Senior Lecturer
	Room 1-36	Building 2, South Campus	Tel: 012 420 4989
▪	**Chirwa, E.M.N.**	P.E.(MD-USA) MSc(UKY) PhD(UKY) MASCE MAWWA MWISA MMIE(MW)	Associate Professor
	Room 1-28	Water Utilisation Engineering South Campus	Tel: 420-3824
▪	**Crouse, P.L.**	PhD (UP), MSc (UCT) BSc (Hons) (UCT) BSc (UCT); HED (UKZN); BA (Unisa)	Professor (DST Chair: Fluoro-Materials)
	Room 8-13	Engineering I Building	Tel: 420-2856
▪	**Du Plessis B.J.G.W.**	Pr Eng MEng(Pret) MDP(Unisa) MSAIChE	Senior Lecturer
	Room 8-16	Engineering I Building	Tel: 420-3740
▪	**Du Toit, E.L.**	PrEng BEng(Hons)(Pret) MEng(Pret) MSAIChE	Senior Lecturer
	Room 8-15	Engineering I Building	Tel.: 420-3641
▪	**Focke, W.W.**,	BEng(Hons) MEng(Pret) Dip Data(Unisa) PhD(MIT) MSAIChE	Professor
	Room 1-45	Chemistry Building	Tel: 420-2588
▪	**Fourie, W.J**	BEng(Chem)(Pret), MS(Univ.Alaska) PhD (Univ Alsaka)	Senior Lecturer
	Room 1-26.2		Tel: 012 420-3571 /
▪	**Grimsehl, U.H.J.**	PrEng BEng(Hons) DEng(Pret) FSAIChE	Professor
	Room 8-26(b)	Engineering I Building	Tel: 420-3568
▪	**Heydenrych, M.D.**	PrEng, C.Eng., MSc(Eng)(Wits) PhD(Twente) MDP(Unisa) FSAIChE, FIChemE	Associate Professor
	Room 8-18	Engineering I Building	Tel 420-2199
▪	**Labuschagne, FJWJ**	BEng(Hons)(Pret) MEng(Pret) PhD(Pret) MSAIChE	Senior Lecturer
	Room 8-14	Engineering I Building	Tel: 420-3020
▪	**Kornelius, G**	PrEng BEng(Hons)(Pret) MBA (Pret) PhD (Pret) FSAIChE	Senior Researcher
	Room 1-18	Building 2, South Campus	Tel: 012 420 6409
▪	**Manyala, N**	PhD	Associate Professor (Deputy Chair Cabon Techn.)
	Room 1-36	Building 2, South Campus	Tel 420-4173
▪	**Nicol, W.**	PrEng BEng(Pret) PhD(Wits) MSAIChE	Associate Professor
	Room 8-17	Engineering I Building	Tel.: 420-3796
▪	**Rand, B.**	MSc (Durham) PhD (Newcastle) FIM	Professor (DST Chair: Carbon Techn.)
	Room 1-36	Building 2, South Campus	Tel: 420-4173
▪	**Rolfes, H.**	PrEng BEng MSc(UMIST) PhD(UMIST) MSAIChE	Senior Lecturer
	Room 8-12	Engineering I Building	Tel: 420-4903
▪	**Vacant**		Senior Lecturer
	Room 1-26	Building 2, South Campus	Tel: 012-420-3571
▪	**Sandrock, C.**	MEng(Control)(Pretoria) MSAIChE	Senior Lecturer
	Room 8-19	Engineering I Building	Tel 420-2197

8. MODULE DESCRIPTIONS

The subject modules described below are not all presented every year. Consult the appropriate divisional head for details.

(CAM 780/787) AIR QUALITY CONTROL 780/787 32 credits Semester: 2

Air quality awareness and impacts of air pollutants.South African air pollution legislation. Meteorology and dispersion modelling. Measurement of air pollution - sampling and analysis. Air quality management systems. Greenhouse gas emissions and control thereof. Equipment design of settling chambers and cyclones. Venturis and other wet cleaning equipment. Bag filters. Electrostatic precipitators. Incinerators, adsorption and absorption equipment.

(CBO 700/707) MULTIVARIABLE CONTROL SYSTEM DESIGN 700/707 32 credits Semester: 2

Design of multivariable controllers using various design techniques. Application of criteria for achieving satisfactory performance, reduction of interaction, maintaining stability and obtaining robust controllers. Design techniques: Sequential loop closure, use of interaction analysis and the RGA; Frequency domain techniques: Inverse Nyquist Array (INA)-, Characteristic Loci (C.L) -.and LACEY-techniques; Model-based approaches: Model-Predictive Control (MPC), Internal Model Control (IMC) and Dynamic Matrix Control (DMC); Optimal Controller Design Techniques: LQG, μ-synthesis and $H^{\infty;}$ Neural networks and Fuzzy Logic Controllers.

(CBP 732) BIOPROCESSING 732 32 credits Semester 1

Description of industrial biotechnology in a process engineering environment. Focus on specific applications in the mining, agricultural, paper and pulp, medical, pharmaseutical, veterinary, brewing and food industries. Principles including implications of bio-prospecting, bio-safety, inoculum production, aseptic growth, quality control and product formulation as applicable to bio-processes. Fermentation with various microbial groups, bio-leaching, gene transfer, solid-substrate fermentation, enzymatic catalysis and immunology. Bioreactors, batch and continuous processing. Bio-remediation.

(CBT 700/707) MULTIVARIABLE CONTROL SYSTEM THEORY 700/707 32 credits Semester: 1

Overview of single loop feedback principles; Matrices and matrix operations; Singular values; State-space description of systems; Extension to multivariable systems; Properties of multivariable systems: Interaction, Stability, Performance, Robustness, Uncertainty. Norms and relationships between single and multiple loop criteria. Criteria for control system specification.

(CEM 780/787) PRINCIPLES OF ENVIRONMENTAL ENGINEERING 780/787 32 credits Semester: 1

Environmental awareness. South African environmental legislation. Environmental management models, the Blue model, Responsible Care, USEPA. Environmental standards, ISO 14001. Environmental impact assessments. Life cycle assessment and engineering. Environmental auditing. Environmental economics. Public participation.

(CFT 732) FLUORO-MATERIALS SCIENCE AND TECHNOLOGY 732 32 credits Semester 2

A historical review of the development of fluorine chemistry. Health and safety aspects of fluorochemicals: the interaction of hydrogen fluoride, fluorine, and fluorides with biological tissue, safe practice, emergencies, exposure limits. Production of hydrogen fluoride. Electrolytic production of fluorine gas: basics of fluorine cell technology, contaminants, purification. Inorganic fluorides: synthesis, properties, reactivities, and industrial uses. Comparison of inorganic fluorides with other halides. Noble gas fluorides. The nuclear fuel cycle. The use of hydrofluoric acid in hydro-metallurgy. Introduction to organic fluorine chemistry: properties of fluoro-organics and preparation methods. Direct fluorination. Electrochemical fluorination. A selection of high-temperature synthesis techniques. Organic fluorides as etchants in plasma and semiconductor technologies. Excimer lasers. Fluoro-polymers: properties, applications, and markets. Preparation of important industrial fluoro-monomers. Polymerisation and manipulation of physical properties. Fluoro-polymer characterisation methods. PTFE processing technologies. Refrigerants. Fluorine-containing pharmaceuticals. Proton emission tomography. Fluoride glasses. The role of fluorine chemistry in Li-ion batteries: electrolytes, solvents, intercalated graphite and CFx materials

(CIP732) PROCESS INTEGRATION 732 32 credits Semester: 2

Heat integration: targeting for minimum use of utilities, selection and optimal placing of utilities, role of minimum temperature difference, design for maximum energy recovery, placement of heat engines and heat pumps, capital-energy trade-offs, heat integration of reactors, heat integration of distillation columns, total site analysis; Mass integration: modelling of mass exchange units, synthesis of mass exchanger networks, mathematical optimization techniques for mass integration, wastewater minimization using the WaterPinch; Batch process integration: types and operational philosophies of batch processes, heat integration using time average models, wastewater minimisation in batch processes, scheduling techniques of batch processes, design and synthesis of batch processes

(CIR 780/787) CHEMICAL ENGINEERING 780/787 16 credits Semester: 1,2

A self-study module, the content of which is discussed with the relevant lecturer.

(CIR 702/707) CHEMICAL ENGINEERING 702/708 32 credits Semester: 1,2

A self-study module, the content of which is discussed with the relevant lecturer.

(CMS 732) CARBON MATERIALS SCIENCE AND TECHNOLOGY 732 32 credits Semester: 2

Materials science of carbon and graphite materials: Pitch, mesophase, cokes, synthetic carbons, bulk carbon and graphite, carbon fibres and matrices, sintered carbon, carbon/carbon composites and nuclear graphite. Carbon nanotechnology. Characterization of carbon materials: crystallography (Powder X-ray Diffraction), thermogravimetric and differential scanning calorimetry, thermo-mechanical analysis, infrared and Raman spectroscopy. Processing of carbon materials.

(CPP 732) POLYMER PROCESSING 732 32 credits Semester: 2

Unit processes in polymer processing. Analysis of complex processes. Description in terms of elementary processing steps. Transport phenomena: Transport equations, rheology, mixing processes. Elementary process steps: Particle technology, melting, pumping, pressure elevation, mixing, modelling of processes. Forming: Extrusion, calendering, injection moulding, film blowing. Reactive processing: Thermo-set materials, reaction kinetics.

(CPW 732) POLYMER MATERIALS SCIENCE 732 32 credits Semester: 1

The solid state properties of polymer materials and their applications: Major applications of polymers (plastics, rubbers, adhesives, binders coatings etc.) Polymer phases: Liquid, glass and crystalline states. Phase transitions: Glass transition, crystallization and spinodal decomposition. Multi-component systems: Morphology, thermodynamics of polymer mixtures, block copolymers, compatibilisation, interfaces. Mechanical properties and failure of polymers

(CPO 732) PRODUCT DESIGN 732 32 credits Semester: 1

The methodology to develop chemical products involves assessing needs, generating ideas, sorting and screening ideas, development of good ideas, and assessment of manufacturing methods. Engineering principles must be used to estimate whether the performance of the product will meet requirements, and involves the application of eg. thermodynamics of mixing, phase equilibrium, solutions, surface chemistry, diffusion and transport properties,. Students will choose a need for suitable chemical product, and implement the product design process and techniques to arrive at a unique product that meets the need. Students will present their projects both orally and as a written report.

(CRH 732) BIOREACTION ENGINEERING 732 32 credits Semester: 1

Fundamental aspects of fermentation, detailed study of the microbial production of primary metabolites. Main themes include: the chemistry of the primary metabolic pathways; the stoichiometry of bioreactions; metabolic modelling and flux analysis; biokinetics; bioreactor design and optimization. A Chemical engineering background as well as sound programming skills are required.

(CRO700) RESEARCH ORIENTATION 700 32 credits Semester: 2

Design, construction and testing of experimental setup. Initial test experiments, calibrations and modifications. Preliminary results. Experimental plan and schedule for the research dissertation. Detailed predictions on anticipated measurements. Directly relevant literature (core essentials taken from CIR702).

(CSK 732) SEPARATION TECHNOLOGY 732 32 credits Semester: 2

Characterisation and classification of particulate solids, bulk and single particle properties (flowability, rheology, density, etc.), preparation of particles and powders, separation of particles from liquid, gas and solid- solid separation, unit operations involving solids (fluidisation, ion exchange, pneumatic transport, hopper design, etc.) behaviour of multi-component and multiphase systems. The concepts of particles and powders. The specification and control of powder particles. Powder fundamentals: particle size; surface structure, energy and activity; surface properties: wetting, adsorption and catalytic action. Surface improvement and mechano-chemistry. Preparation of powders: Theory and practice of grinding and comminution; thermal decomposition, precipitation and crystallisation processes. Hydrothermal and vapour phase reactions. Sintering and solid state reactions. Characterisation of powders.

(CSP 732) PROCESS CONTROL SYSTEM DEVELOPMENT 732 32 credits Semester: 1

Process control computers, interfaces and data-transfer. Controllability analysis. Specific application of control principles to selected processes like distillation columns, heat exchangers, boilers, reactors, biological systems, control of batch processes, pH-control. Identification of opportunities for advanced control. Optimisation. Cost benefits analysis (CBA). Development and implementation of advanced control systems. Plantwide control vs control of individual processing units. Control philosophy. Development of a control strategy. Base layer control: Inventory control, maintaining a mass and energy balance. Control of production quality and production rate. Design diagrams. Design documentation. Flowsheet development and optimisation. Hazard control. Role of the control engineer as member of the design team.

(CYM 732) ADDITIVE TECHNOLOGY 732 32 credits Semester 1

Property modification through reactive processing and additive compounding. Colorants and optical modifiers (pigments, dyes, absorbers and opacifiers), fillers and reinforcements; Stabilisers (anti-oxidants, light stabilisers, flame retardants); Surfactants (antistatic, antifog, antiblock); Functional additives (gas absorbers, biocides, foaming agents, barrier additives and cross-linkers); Viscosity modifiers. Optimisation of formulations using statistical methods: Taguchi experimental designs and triangular formulation designs. Overview of surface science: Surfaces and interfaces; surface activity and surface tension. Surfactant structure-property relationships. Phase diagrams: Solubilisation, micellation and complexation. Wetting, adsorption, dispersion and thickening. Formulation principles for foams, emulsions, micro-emulsions and particle suspensions. Applications in detergency and soil removal, suspension of solids in liquids, emulsions, textiles, paper industry and agriculture.

(WAI 780/787) INDUSTRIAL WASTE ENGINEERING 780/787 32 credits Semester: 2

Identification of 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 and risk characterisation. Minimum requirements for the handling, classification and disposal of hazardous waste. Minimum requirements for waste disposal by landfill. Minimum requirements for water monitoring at waste management facilities. Recycling and resource management. Waste prevention, minimisation and optimisation.

(WBW 780/787) BIOLOGICAL WATER TREATMENT780/787 32 credits Semester: 2

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. Sequential batch processes. Anaerobic digestion with industrial applications. Compulsory site visit.

(WCW 780/787) CHEMICAL WATER TREATMENT 780/787 32 credits Semester: 1

Basic water chemistry, Water quality and treatment objectives; Treatment approaches, multi-barrier approach, linking of processes, design philosophies; Conventional drinking water treatment: coagulation-flotation, sedimentation, 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, detoxification, ion exchange. Case studies

(WQB 780) WATER QUALITY MANAGEMENT 780 32 credits Semester: 1

Regulatory aspects including all relevant legislation. Integrated environmental management, integrated pollution control. Procedures to assess effluent discharge impacts. Storm water management. Water quality management policies and procedures, role of catchment management agencies, catchment management plans. Environmental economics, cost-benefit analysis.

CERTAIN MODULES FROM THE CURRICULA OF OTHER DEPARTMENTS MAY, WITH THE APPROVAL OF THE DIVISIONAL HEAD, BE INCLUDED IN POSTGRADUATE PROGRAMS OF THE DEPARTMENT OF CHEMICAL ENGINEERING.

9. RESEARCH AREAS OF THE DEPARTMENT

The most important research areas of the Department are the following.

Bioreaction Engineering
The group focuses on the effi cient production of biobased platform chemicals in continuous fermenter systems. Using plant material as feed and micro-organisms as catalyst we help to develop the biorefinery of tomorrow. The group specialises in biofilm reactors where microbial attachment is utilised to enhance process productivity.

Biotechnology & Bioprocessing
Biotechnology is generally regarded as an area where Chemical Engineering is making an increasingly large contribution. Combined with the increasing emphasis on renewable resources and the focus on reducing effluents and minimising pollution, biotechnology finds application in almost every area of Chemical Engineering.

Water Utilisation
Water purification and treatment, improving water purification technology. Production of useful products from effluent. Biological and physical-chemical treatment of domestic and industrial wastewater. Membrane processes in wastewater treatment.

Air Pollution Control
The removal of dust from gas streams to limit pollution. The design of equipment.

Process Control
Process control for the chemical industry. Multivariable control and process identification. Development of dynamic models of unit operations for application to model-based control systems.

Process Synthesis
Process development in mining and minerals processing; Modelling of complex reaction systems; Process Integration, advanced scheduling and product design

Carbon and Polymer Materials Science and Chemical Product Design
Polymers and polymer additives, reactive ceramics and nuclear grade carbons from coal. Design of chemical products.

Tribology
Relationships between lubrication and wear prevention properties of different lubricants and their composition. Performance evaluation of lubricants. Fuel characterisation.

Research Chairs in the Department:

DST Chair in Fluoro-materials and Process Integration:

This Chair was established in September 2007 and focuses on converting the large fluorine-containing mineral deposits in South Africa into commercially feasible products.

DST Chair in Carbon Technology and Materials:

The Chair was established in 2006 and is located in the Institute of Applied Materials, which resides jointly under the Faculty of Engineering, Built Environment and Information Technology and the Faculty of Natural and Agricultural Sciences. The Chair provides post graduate training and research services in Carbon Materials relevant to the PBMR initiative and other local carbon industries.

FOR INFORMATION ABOUT SPECIFIC AREAS OF STUDY PLEASE CONSULT:

Prof P L de Vaal (420-2475)	●	Chemical Engineering, Control Engineering and Tribology
Prof E Chirwa (420-5894)	●	Environmental & Water Utilisation Engineering
Prof W Focke (420-2588)	●	Carbon, Fluorine and Polymer Materials Science
Prof W Nicol (420-3796)	●	Bioreaction Engineering
Prof Brian Rand (420-2588) / Dr Ncholu Manyala (421-4173)	●	DST Chair in Carbon Technology and Materials
Prof Philip Crouse (420-2856)	●	DST Chair in Fluoro-materials and Process Integration

FOR INFORMATION ABOUT ADMINISTRATIVE MATTERS (ADMISSION, REGISTRATION, FEES) PLEASE CONSULT:

Honours: Mr Joseph Makhasa 012 420 2142 (joseph.makhasa@up.ac.za)
Master's & Doctoral: Ms S Steenberg (012-420-5315) (stefanie.steenberg@up.ac.za)

DEPARTMENTAL WEBSITE: http://www.up.ac.za/chemeng