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Faculty of Engineering, Built Environment and Information Technology
Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

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Department of Chemical Engineering

General Module Guide

(Undergraduate Degree Programme)

Why Choose Chemical Engineering?

2024

Table of Contents

List of Tables

1 DEPARTMENT OF CHEMICAL ENGINEERING

The vision of the Department is to be a chemical engineering department that grows professionals to contribute towards African development. We achieve this vision by being excellent, innovative and sustainable in teaching, research and human empowerment. Therefore, the educational objectives of the BEng (Chem. Eng.) degree programme speak to the vision, mission and strategic goals of the department and also may be considered to cover three general areas which relate to the overall objective of the School of Engineering and the University, and also the University's commitment to supporting the initiatives and requirements of ECSA. In actualising these objectives, the Department has 4 objectives indicated below:

(a) The provision of a graduate-level whole qualification which engenders understanding, creativity, life-long learning and applied competence in the broad field of engineering. *Engineering* is the profession in which a knowledge of mathematical and natural sciences gained by study, experience and practice is applied with judgement to develop ways to utilise, economically, the materials and forces of nature for the benefit of mankind.

(b) The provision of specific knowledge and applied competence in *chemical engineering* in the context of the specific needs of the South African chemical and process industries. Chemical engineers are concerned, not only with the manufacture of chemicals on an industrial scale, but also in general with the industrial processes that convert raw materials into products with a higher economic value by physical, thermal, chemical, biochemical, or mechanical changes. In these industries chemical engineers are engaged in the design, development, operation, and research related to these processes. They must also be competent in the management of the people, the processes, and the production facilities.

(c) The provision of specific knowledge and applied competence that will equip our graduates with the critical thinking skills and ability to apply fundamental concepts of sustainable chemical engineering practices to eliminate or minimise the negative ecological footprints of unsustainable chemical engineering activities. Sustainable Chemical Engineering Practices (SCEPs) could be considered as the application of knowledge gained by study, experience, and practice to develop economic ways of using materials and energy for responsible resource production and consumption in a way that preserves ecological footprint by closing the material cycles and creating value-added commodities from waste products from chemical and process industries.

(d) The content of the programme must satisfy the academic requirements for registration as a *Professional Engineer*, as set out in E-02-PE Rev 4 of the Engineering Council of South Africa (ECSA), which also endeavours to meet internationally accepted engineering accreditation standards.

2 GENERAL ADMINISTRATION ON TEACHING & LEARNING

2.1 Departmental administration

The department is to be well organized, communicate regulations and policies in a clear and courteous manner, and afford grievances the proper attention.

2.2 Campus and university facilities

1. The University is to ensure that buildings are in good condition while being clean and neat.
2. Students and staff should take pride in helping to keep the university facilities neat and in good condition.

2.3 Course-related information and formal communication

Facilities have been provided for all chemical engineering courses on the World Wide Web. It is to be used as the platform for obtaining course-related information as well as effecting formal communication. The following sites/facilities have been developed exclusively for this purpose:

- Chemical Engineering website: https://www.up.ac.za/chemical-engineering/article/1821688/timetables (Current Students). Here the students may obtain information on;
  - Undergraduate Information booklet
  - Departmental General Study Guide
  - Time-tables (lectures, tests, exam)

- Student online: http://www.up.ac.za and the ClickUP platform. Here students may obtain;
  - Study guides
  - Course notes
  - Grades
  - Time-tables
  - Assignments and memoranda
  - Contact detail of the lecturer
  - Information pertaining to facilities provided for student-lecturer communication

E-mail may be used for the following modes of written communication: lecturer to all students, lecturer to a specific student and student to lecturer.

In all electronic communication (e-mail and web-based), the following etiquette is to be followed:

- Use the subject line correctly: descriptive title followed by the date by which a response is required.
- For students, please observe the rule of thumb, which states: *Ask three then ask me*. This is not because the staff is unfriendly or does not encourage student-lecturer communication! It is to establish a culture of professional electronic communication.

2.4 Laboratory use and safety measures

All students and staff are bound by the Occupational Health and Safety Act when using the laboratories and workshops for practical sessions and CSC projects. Please carefully read the regulations and rules in your “RED FILES” and those ones made available for CLB 321.

2.5 COVID-19 related information

Some of the material in this guide may be superseded by communication made via official University channels and information shared via ClickUP for specific modules regarding the national lockdown level and access control.

2.6 Professionalism and integrity

To study or work at a tertiary educational institution is a privilege and is to be valued. Professionalism and integrity should be the hallmark of all dealings. Following are clear guidelines in this regard.

2.6.1 General interpersonal behaviour**:**

It is expected from students in the department to be professional in all their communication and relationships with each other and staff members. This implies:

1. Honesty, courtesy, respect and integrity in dealings with fellow students as well as lecturers during and outside of lectures.
2. We greet each other.
3. Students are to make a point of being on time for class as well as to hand in assignments and projects by the expected date.
4. Lecturers are to be well prepared, punctual and to behave fairly toward all students. Furthermore, they are to be good communicators and strive to high standards in terms of their own research as well as toward offering high quality education.
5. It is expected that all staff and students similarly conduct themselves in a professional manner outside of the university, as we are all ambassadors of the University of Pretoria.
6. Read your e-mail every day. Your e-mail will be sent to your University’s e-mail address (no other address).

2.6.2 Plagiarism

Plagiarism is a serious form of academic misconduct. It involves both appropriating someone else’s work and passing it off as one’s own work afterwards. Thus, you commit plagiarism when you present someone else's written or creative work (words, images, ideas, opinions, discoveries, artwork, music, recordings, computer-generated work, etc.) as your own. Only hand in your own original work. Indicate precisely and accurately when you have used information provided by someone else. Referencing must be done in accordance with a recognised system. Indicate whether you have downloaded information from the Internet.

You commit plagiarism when you copy the work word-by-word (verbatim); or submit someone else’s work in a slightly altered form (such as changing a word with one meaning to another word with the same meaning); and you do not acknowledge the source in a way that shows from whom or where you took the words, ideas or reasoning.

You must provide references whenever you quote (use the exact words), paraphrase (use the ideas of another person, in your own words) or summarize (use the main points of another's opinions, theories or data).

It does not matter how much of the other person's work you use (whether it is one sentence or a whole paragraph), or whether you do it unintentionally or on purpose. If you present the work as your own without acknowledging the source, you are committing theft. Because of this, plagiarism is regarded as a very serious contravention of the University's rules, which can lead to expulsion from the University.

Even if another student gives you permission to use one of his or her past assignments or other research, to hand in as you own, you are not allowed to do it. It is another form of plagiarism. You are also not allowed to let anybody copy your work with the intention of passing it on as his/her work.

While academic staff is responsible for educating students about various appropriate systems of referencing, as well as how to avoid plagiarism, students need to take responsibility for their own academic career. Speak to your lecturer if you are at any stage uncertain as to what is required.

For more details, visit the library's website: http://www.library.up.ac.za/plagiarism/index.htm

2.6.3 Department cover pages

For each assignment (group or individual) and each practical report (group or individual), the appropriate cover page with anti-plagiarism checks (available on this site) must be completed and attached. To ensure that students are aware of the implications of plagiarism, the faculty has prepared a cover page for all assignments.

2.6.4 Grievance procedures

All issues should be reported in writing, providing details of the complaint or issue. First consult the lecturer concerned about the complaint or issue. If the matter is, however, not resolved, you should consult the class representative (the primary function of the class representative is to serve as a two-way communication channel between the class and the lecturer.) If the matter remains unresolved you should consult the Year Advisor (or module coordinator in the case of large module classes with multiple lecturers). Where the Year Advisor or module coordinator is unable to or fails to resolve the matter, you should consult the Head of Department. Should the matter remain unresolved, you may approach the Dean of the Faculty.

2.6.5 Class representative duties

The class representative is responsible for:

- The advancement of a healthy and constructive morale in the class. This includes the handling and solution of problems in the class and nurturing of a professional ethos.
- Liaise with the relevant guidance lecturers on behalf of the students.
- Participating in interviews with prospective administration personnel on request of the Dean's office (only final year students).
- Expressing thanks to guest speakers on behalf of students.
- Fostering unity and discipline amongst his/her mates in the class
- Be a middleman between the lecturers and the classmates

2.6.6 Sick test guidelines

The standard practice of the Department is followed when students are absent from tests and exams:

- Students are responsible to make their own arrangements with the department for the scheduling and writing of a sick test.
- Prior to making application for a sick test, an original sickness certificate must be handed to the departmental UG administrative administrator Ms Gymaisy Kenny (gymaisy.Kenny@up.ac.za) in Eng. 1, room 8-20, within 3 working days of the test that could not be written. No arrangements for the writing of a sick test will be made with a student prior to handing in of the above sickness certificate. In addition, the module lecturer should be informed prior the writing of the test or immediately the test has been written.
- Only medical certificates issued by persons and practitioners registered with the Health Professions Council of South Africa and the Allied Health Professions Council of South Africa will be accepted.
- Only medical certificates containing the practice number, address, contact details and signature of the particular practitioner who issued the certificate will be accepted.
- The certificate must clearly identify the student and must reflect that a consultation took place and/or that the student was examined on a specific date.
- It must furthermore indicate the specific days during which the student is unfit to participate in academic activities. A medical certificate is not accepted if it merely states that the student appeared ill or declared himself/herself unfit.
- Please ensure that you, your parents, spouse, family, friends, etc., are aware of this policy and that they ensure that you visit a doctor if you are not yourself able to this. You cannot visit a doctor after the fact and still qualify.

2.6.7 Practical Training (also referred to vacation work)

Although every effort is made to place students with employers for their vacation work, the university cannot guarantee that each student will be placed. Each student therefore ultimately has the responsibility to arrange his or her own work. Note that vacation work can be performed in any vacation period. For the second and third study years (CPY 311 and CPY 411, respectively), reports must be handed in by 25 January of the following year. The format of the report is as stipulated on the relevant document at Report for Practical training (vacation work) (https://www.up.ac.za/chemical-engineering/article/1821688/timetables). Further, the report is to be accompanied by the following documentation (which may be downloaded from the site):

- Guidelines for Practical Training
- A departmental guide to writing technical reports
- Practical Training Daily Logsheet template. The student is expected to keep a daily log when doing practical training and his/her supervisor is expected to regularly, e.g. weekly, confirm the logged information
- CPY letter
- Answers to frequently asked questions about practical training
- Practical training: During the 2nd study year, 6 weeks' practical training is to be undertaken for CPY 311. This is to be followed by the submission of a TECHNICAL REPORT AND SIGNED LOGSHEET
- Practical training: During the 3rd study year, 6 weeks' vacation work is to be undertaken for CPY 411. This is to be followed by the submission of a TECHNICAL REPORT AND SIGNED LOGSHEET

2.6.8 Appeal process and adjustment of marks

After marks awarded for assignments, practical reports, class tests and semester tests are posted, students have a 14-day period within which they can appeal for an adjustment of marks due to errors in grading or other interpretation-related matters. Any adjustments will only be made at the discretion of the lecturer. After this 14-day period no marks will be altered. Because of this ruling, semester marks are

final once a student has received exam entrance. This means that semester marks cannot be adjusted after the exam to allow for borderline cases to be allowed supplementary examination or special examination entrance, or to allow for a pass with distinction.

2.6.9 University regulations

Please take note of the University's Faculty and examination regulations as documented in the yearbook.

Frequently asked information

- The following information is available from the departmental web page: (https://www.up.ac.za/chemical-engineering/article/1821688/timetables)
    - Prescribed textbooks from the UP library that are useful for the modules. Detailed information about the recommended textbooks and additional prescribed textbooks will be provided by individual module lecturers and also included in the specific module guide.
    - Time-tables: lectures, semester tests, exams, (to be made available)
    - Forms: Related to practical training, plagiarism (logsheet/submission cover page)
    - Class representatives: names and e-mail addresses (upload it)
    - Year Advisors: Name and contact detail (see Table 6)

2.6.10 Statement on Anti-Discrimination

The University of Pretoria is committed to building an inclusive, affirming and transformed institutional culture, curriculum, and campus life. It rejects and condemns racism, sexism, homophobia, transphobia, xenophobia, ethnic chauvinism, religious intolerance, unfair discrimination, hate speech, sexual harassment, gender-based violence and retaliation, and all other forms of discrimination. The University has committed itself to the eradication of these practices, and in 2019 adopted an Anti-Discrimination Policy, in order to realize procedural and substantive equality in all respects.

As the lecturers and presenters of courses in this department, we acknowledge the extreme harm that racism, sexism, xenophobia, and other forms of discrimination have inflicted and continue to inflict on our society and communities. We as lecturers commit to ensuring that there is an open dialogue between ourselves and all the students in the module on curriculum content and teaching method which may be interpreted as discriminatory or exclusive. We undertake to ensure that any such concerns are raised without fear of intimidation or recrimination. Moreover, we resolve to continuously improve the teaching of this course in a way that allows the inclusion of all the students enrolled for this course, building their self-confidence and self-efficacy, and supporting the goal of substantive equality for all persons.

The choices that we make about curriculum content and pedagogy (what and how we teach) are also choices about what kind of society we wish to build. In this declaration of intent, we resolve to be part of and give substance to the University's anti-discrimination and transformation endeavours.

3 TEACHING & LEARNING STRUCTURE IN THE DEPARTMENT

3.1 Structure of the programme

The programme is based on the general structure as described on the ECSA document E-02-PE Rev.4 and summarised in Table 1 of this document. The curriculum for the programme is set, with only one elective module in the second semester of the fourth year, CSS 420 Specialisation 420, where students may select one of three to four available modules. These modules are representative of the research focus areas in the Department and offer students more detailed exposure to the research activities of the Department.

The information shown in Table 1 can be described as follows:

All modules are presented on a semester basis.

First year is where the foundation is established, with modules offered by the Faculty of Natural and Agricultural Sciences (NAS), namely Mathematics (WTW 158, WTW 164), Physics (FSK 116) and Chemistry (CHM 171, CHM 181), while all students do a humanities and social sciences module in the first semester (HAS 110) and another one in the second semester (HAS 120) offered by the Faculty of Humanities. In the first semester Chemical Engineering students do a Graphical Communication module (MGC 110), offered by the Department of Mechanical Engineering, as well as a Chemical Engineering module (CIR 113), where elementary chemical engineering concepts, units and conversions are introduced. In the second semester a further chemical engineering module is offered (CIR 123), where focus is placed on stoichiometry, more complex mass balances and combustion calculations. A Mechanics module (SWK 122) in the second semester is offered by the Department of Civil Engineering, while a module on Electricity and Electronics (EBN 122) is offered by the Department of Electrical, Electronic and Computer Engineering (EE&C).

Second year has more Mathematics (WTW 256, WTW 258, WTW 263) and Chemistry (CHM 215, CHM 226) modules, with a further Chemical Engineering module (CIR 211), introducing students to more complex mass and energy balances, the behaviour of fluids, under ideal and non-ideal conditions. A Programming and Information Technology module (MPR 213) offered by the Department of Mechanical Engineering establishes the programming capabilities of students, while a Strength of Materials module (SWK 210) is offered by the Department of Civil Engineering. A module on Chemical Engineering Materials (CIM 210) is presented at second year level, which is followed in the second semester with a thermodynamics module (CTD 223). The Department of Electrical, Electronic and Computer Engineering (EE&C) present Electrical Engineering (EIR 221), while a Statistics module (BES 220) is offered by the Department of Industrial Engineering. A community-based project (JCP 203) is done in the recess period between semesters 1 & 2.

Third year focus is on unit operations and associated core chemical engineering principles, with Transfer Processes (COP 311), providing the theoretical foundation for the unit operations that follow, Mass Transfer (CMO 310) focusing on unit design and an assignment that contributes to preparing for the Design Project (CPJ 421) of the final year, Biochemical Engineering (CBI 310), a further Thermodynamics module (CIR 310) with emphasis on chemical thermodynamics and non-ideal systems and a Professional and Technical Communications module (CJJ 310) are presented in the first semester. An Engineering Management module (BSS 310) offered by the Department of Industrial Engineering in the first semester satisfies the complementary content. This is followed by a Chemical Engineering Design module in the second semester (CIO 320), where heat transfer equipment design and piping systems design are treated in detail, illustrating the basic concepts associated with equipment design. A design assignment comprising heat exchange equipment with accompanying pipe & pump design, is submitted

in this module, preparing students for the final year Design Project (CPJ 421). Reaction Kinetics (CKN 321) and Process Dynamics (CPN 321) also form part of the core material. A computer-based modelling assignment in the latter module establishes the ability to use self-developed computer programmes to solve complex time-dependent process models. The module Laboratory (CLB 321) forms an important part of the curriculum, bridging from the laboratory environment of a Chemistry laboratory to a laboratory and environment where experimental setups connect to the relevant third year theoretical modules and where each student is exposed to a practical environment where experiments are planned and conducted, results interpreted and analysed and reported on by submission of a written report. This provides preparation towards the final year CSC411 Research Project and provides an environment where the content of the CJJ310 Communication module is put to practice. A module on Engineering Activity and Group work (MIA 320) offered by the Department of Mechanical Engineering satisfies the requirements of the required complementary studies related to group work and engineering activity involving other disciplines.

Fourth year focus is on the combination of several systems leading to a more comprehensive design approach for processing plants and the engineering approach to such systems. Process Control (CPB 410), Particle Technology (CPA 410), Reactor Design (CRO 410), as well as Process Synthesis (CPS 410) are offered in the first semester. The purpose of the Process Synthesis module is to take the initial exposure to the ASPEN plus, flow sheeting software to the next level in order to apply process synthesis principles using computational tools in preparation for the CPJ 421 Design Project in semester 2 of the final year. The Research Project (CSC 411) is also done in the first semester. This entails exposure of each student to the scientific method, namely problem statement, literature study, planning of experimental work, setting up of experimental apparatus, conducting experiments and analysing results.

In the second semester the Design Project (CPJ 421) and continuation of the Research Project (CSC 421) are the main foci, which require intense integration of content of modules introduced earlier. In order to allow students to focus on these two modules, the other modules in this semester, namely Process Analysis (CPS 420), Specialisation (CSS 420), offering students the opportunity to select one of the available electives, the content of which is associated with the research areas in the Department and Chemical Engineering Practice (CPR 420) are completed during the first six weeks of the second semester. The latter module also covers Professionalism and ethics in Engineering.

3.2 Identification and description of the design of the core of the programme

The basic Physics module (FSK 116, 16 credits), is offered by the Natural & Agricultural Science Faculty (NAS) and is a basic module where some introductory mathematics, symbols, exponents, logarithms, angles in degrees, radial measure, goniometry, differentiation, and integration are discussed, followed by motion along a straight line (position and displacement, acceleration), vectors (adding vectors, components, multiplying vectors), motion in two and three dimensions (projectile motion, circular motion), force and motion (Newton’s Law, force, friction) kinetic energy and work (work, power, potential energy), centre of mass, linear momentum, collisions (impulse and linear momentum, elastic collisions, inelastic collisions), rotation (kinetic energy of rotation, torque), oscillations and waves (simple harmonic motion, types of waves, wavelength and frequency, interference of waves, standing waves, the Doppler effect), and finally temperature, heat and the first law of thermodynamics, are discussed.

Chemical engineering students take all the same Mathematics modules as offered by the Department of Mathematics to the School of Engineering, namely WTW 158 (16 credits), which forms the introduction to vector algebra, functions, limits and continuity, differential calculus of single variable functions, rate of change, graph sketching, applications, the mean value theorem, the rule of L'Hospital, indefinite integrals and integration forms the core of the module, WTW 164 (16 credits), comprising of vector algebra with applications to lines and planes in space, matrix algebra, systems of linear equations, determinants, complex numbers, factorisation of polynomials and conic sections. Integration techniques, improper

integrals, the definite integral, fundamental theorem of Calculus, applications of integration, elementary power series, Taylor's theorem, vector functions, space curves, arc lengths, quadratic surfaces and multivariable functions are addressed, WTW 256 (8 credits), where the theory and solution methods for linear differential equations as well as for systems of linear differential equations are discussed. This includes theory and solution methods for first order non-linear differential equations, the Laplace transform with application to differential equations and application of differential equations to modelling problems, WTW 258 (8 credits), focusing on calculus of multivariable functions, directional derivatives, extrema, multiple integrals, polar, cylindrical and spherical coordinates, line integrals and the theorem of Green, surface integrals and the theorems of Gauss and Stokes, WTW 238 (16 credits), where linear algebra, eigenvalues and eigenvectors are discussed with applications to first and second order systems of differential equations, sequences and series, convergence tests, power series with applications to ordinary differential equations with variable coefficients, Fourier series with applications to partial differential equations such as potential, heat and wave equations and WTW 263 (8 credits), comprising of numerical integration, numerical methods to approximate the solution of non-linear equations, systems of equations (linear and non-linear), differential equations and systems of differential equations and direct methods to solve linear systems of equations.

As far as Chemistry is concerned, Chemical engineering students do two 16 credit modules of General Chemistry in the first year of study, namely CHM 171, focusing on a general introduction to inorganic, analytical and physical chemistry, nomenclature of inorganic ions and compounds, stoichiometric calculations concerning chemical reactions, redox reactions, solubilities and solutions, atomic structure, periodicity, molecular structure and chemical bonding using the valence-shell, electron-pair repulsion (VSEPR)-model, the principles of reactivity, electrochemistry, energy and chemical reactions, entropy and free energy, followed by CHM 181, a 16-credit module in the second semester, where focus is on general physical-analytical chemistry, namely physical behaviour of gases, liquids and solids, intermolecular forces, solutions, chemical equilibrium, acids and bases, buffers, precipitation; organic chemistry, where structure (bonding) and functional groups, nomenclature, isomerism, introductory stereo-chemistry, introduction to chemical reactions and chemical properties of organic compounds are discussed. This followed by a 12 credit module in the first semester of the second year, CHM 215, focusing on organic chemistry, chemical properties of organic (including aromatic) compounds, functional group transformation and synthesis and one 8 credit module in the second semester of the second year, CHM 226, focusing on theory and practice of instrumental chemical analysis, integration of electronic, chemical, optical and computer principles for the construction of analytical instrumentation, detail discussion of principles and some instrumental methods from three disciplines within analytical chemistry, namely electrochemistry, spectroscopy and chromatography. This includes potentiometry, (AA) atomic absorption-, (ICP) atomic emission-, ultraviolet (UV)-, and infrared (IR) spectroscopy, potentiometric and photometric titrations, gas chromatography, liquid chromatography as well as combinations of these techniques. Since a sound foundation in Chemistry is regarded as equally important to having a sound foundation in the other basic sciences as well as the fundamental engineering sciences, this is the main reason why the number of credits in the first two years of the curriculum have not been reduced from 80 per semester to 72, as is the case in most of the other programmes.

It should be mentioned that the focus generally shifts from mathematical principles, through basic sciences in the first 2 years, leading to engineering sciences and the design and synthesis in the third and fourth years.

3.3 Identification of specialist study components of programme

In the programme provision is made for one 16 credit "Specialisation Module" presented as an elective in the second semester of the fourth year. The student can select one of several topics (currently 4), related to the areas of research specialisation in the Department and complete it in the same way a postgraduate student would – with assistance from the lecturers as required but with less formal contact

time. Specialisation topics include Polymers, Sustainable Chemical Engineering Practices, Analytical Techniques and Environmental Engineering and could (within limits) include a component (50%) of any existing 32-credit post-graduate module available. In addition to exposing students to the research focus areas of the Department, the intention of the Specialisation module is also to deepen, rather than broaden, the knowledge base of the student with respect to the chosen area. While not limiting a student who may, at a later stage decide to change focus as postgraduate student, this provides an opportunity to merge into one of the research focus areas of the Department.

4 ENGINEERING COUNCIL OF SOUTH AFRICA (ECSA) REQUIREMENTS

4.1 Knowledge Areas

The Bachelor's programme contains a coherent core of mathematics, basic sciences and fundamental engineering sciences that provides a viable platform for further studies and lifelong learning. The coherent core enables development in a traditional discipline or in an emerging field and embraces both fundamental and core elements as defined by SAQA. Table 1 shows the list of knowledge areas with the associated SAQA credits required (the ECSA credits are sourced from ECSA document E-02-PE-rev6):

Table 1. Knowledge areas with associated credits

Knowledge area	**Minimum ECSA - credits required**	**Credits in BEng (Chem)**
1. Mathematical Sciences	56	80
2. Natural Sciences	56	100
3. Engineering Sciences	180	234
4. Design and Synthesis	72	122
5. Complementary studies	56	72
Subtotal	420	
Discretionary	≥140	
Total credits	≥560	**608**

Seven complementary studies modules of eight credits each (56 credits in total) are introduced from the first semester. The complementary studies modules are spread over the first seven semesters of each programme. This knowledge area is dealt with in modules such as Humanities and Social Sciences, Professional and Technical Communication, Community-based Project, Engineering Management, Impact of Engineering Activity and Groupwork, and Engineering Professionalism. The educational philosophy behind the teaching of these complementary studies modules is that these modules must be presented on a sound fundamental basis, but within the context of the specific requirements of the engineering profession. The modules are presented by expert lecturers from the School of Engineering (e.g., from the Department of Engineering and Technology Management) and by specialists from other divisions of the University (e.g., the School of Information Technology and the Faculty of Humanities). "Type B" (previous ECSA definition) of complementary studies (broadening the student's perspective in the humanities or social sciences to support an understanding of the world), as defined in PE-61 (rev. 2), is specifically taken up in Humanities and Social Sciences, and Community-based Project.

The engineering science content for the Chemical Engineering discipline carefully chosen to include elements of Mechanical, Electrical, and Civil Engineering. This is achieved in the first year via Graphical Communication (MGC 110, 16 credits) offered by Mechanical Engineering and in the second semester Electricity (EBN 122, 16 credits) and Mechanics (SWK 122) modules offered by Electrical Engineering and Civil Engineering respectively. The 8-credit CIM 210 module addresses relevant components of Engineering Materials in line with subsequent modules in the programme. The 16-credit Strength of Materials module, SWK 210 Strength of Materials 210, which is offered by the Department of Civil

Engineering, ties in well with required knowledge related to piping system design & design of vessels – both under pressure and under vacuum, which prepares students for the 16-credit CIO 320 Chemical Engineering Design-module.

Focusing on the fundamental Chemical engineering science content of the programme, the following areas are covered:

Materials and Material processes (CIM 210), Reaction kinetics (CKN 321), Process Dynamics (CPN 321), Fluid mechanics, Heat transfer, Mass transfer and Momentum Transfer (COP 311), Separation processes (CMO 310), Particulate systems (CPA 410), Biotechnology (CBI 310), Chemical reactor theory (CRO 410), Process synthesis (CPS 410) and Process analysis (CPS 420), Process control (CPB 410), culminating in the ability to address the requirements set by the Process equipment and Plant design (CPJ 421) and Research Project (CSC 411 and CSC 421) of the final year.

While first- and second-year modules (CIR 113, CIR 123, CIR 211) include the means and computational requirements to perform design calculations for subsequent modules, preparation for design starts in the third year, semester 1, where the CMO 310 Mass Transfer module includes an assignment aiming at the design of a separator unit operation, i.e. a distillation column or absorption column. In semester 2 of the third year, the CIO 320 Chemical Engineering Design module includes an assignment to design heat exchange equipment and associated pipework and fluid drivers. The assignment for CPN 321 Process Dynamics, which is continued as a Process Control assignment in CPB 410 provides the necessary introduction to enable the required control strategy and development of the P&ID for the final year Design Project (CPJ 421).

As discussed earlier, the fourth-year modules focus on the combination of several systems leading to the design of entire processing plants and the engineering approach to such systems. The modules of the fourth year provide the remaining engineering science background required as well as enabling design and synthesis capabilities, culminating in the Design Project (CPJ 421).

The Research Project (CSC 411) is completed in the first semester. This entails exposure of each student to the scientific method, namely problem statement, literature study, planning of experimental work, setting up of experimental apparatus, conducting experiments and analysing results.

In the second semester the Design Project (CPJ 421) and continuation of the Research Project (CSC 421) are the main foci, which require intense integration of content of modules introduced earlier.

In order to allow students to focus on these two modules, the other modules in this semester, namely Process Analysis (CPS 420), Specialisation (CSS 420), offering students the opportunity to select one of the available electives, the content of which is associated with the research areas in the Department and Chemical Engineering Practice (CPR 420) are completed during the first six weeks of the second semester. The latter module also covers Professionalism and Engineering Ethics.

Students are lectured by mostly professional engineers who are full-time staff members with previous and current involvement in the industry. This process ensures that curricula are kept alive and relevant and that students are exposed to the latest developments in the various fields, after being provided with a solid foundation of the principles in each of the various disciplines.

The qualification can only be awarded once all the modules of the fixed four-year programme have been passed. With several modules, not only a pass mark is required, but also specific prescribed subminimum for practicals, GAs, etc.

4.2 Assessment of ECSA Graduate Attributes and assessment system

Assessment within the programme is focused on compliance with Questions 2.1 and 2.2 of ECSA E-14P, ensuring that all graduates satisfy each Graduate Attributes (GAs) defined in the relevant standard and that a documented set of assessment criteria and processes is used that, taken together, demonstrate that the outcomes are satisfied at the level indicated by the range statement.

The Department has taken care to ensure that all ECSA outcomes are appropriately and comprehensively assessed in modules throughout the programme and that outcomes are addressed as students are exposed to modules where the Graduate Attributes are developmental progressing to the exit level – mostly in the final year.

This topic is addressed during Departmental planning sessions (typically during the annual departmental strategic planning event and, when necessary, by the UT&LC of the Department and during regular Departmental meetings). The study guide for each module contains information on the outcomes addressed in that module with specific emphasis on those modules in which the outcomes are assessed at exit level while considering the expected GAs. The Assessment Schedule, which is compiled and submitted to the Faculty Administration Department at the beginning of each semester, contains the summarised information regarding the methods of assessment for each module and specifically with regard to sub-minima that have to be achieved in a particular module, in order to comply with a specific ECSA Graduate Attributes.

4.3 Assessment of ECSA Graduate Attributes (GAs)

In what follows below, a discussion is given per ECSA Outcome. In all cases the details regarding the assessment criteria and the method of assessment, how the outcomes are assessed via tests, assignments, practicals and written exams, the level of performance required of the student and the consequences of the student not satisfying the graduate attributes/ outcome are presented. These are also described in the relevant study guides.

GA 1: Problem solving

The competence to identify, assess, formulate, and solve convergent and divergent engineering problems creatively and innovatively is accentuated in the modules taught in the School of Engineering. The two modules in the Department, Chemical Engineering CIR 113 and CIR 123 are used for this purpose. This is taken further in Chemical Engineering CIR 211 and Thermodynamics CTD 223, through the third-year modules Transfer Processes COP 311, Mass Transfer CMO 310, Reaction Kinetics CKN 321 and Chemical Engineering Design CIO 320 to finally culminate in the exit level outcomes assessed in Process Control CPB 410, Reactor Design CRO 410 and the Design Project CPJ 421. The assessment of these modules is focused to ensure this capability, which is moderated by the external examiners of the respective modules. In each of these modules, provision is made to assess this outcome and if not attained, the student fails the module.

GA 2: Application of Scientific and Engineering Knowledge

Students are encouraged to apply knowledge of mathematics, basic science, and engineering sciences from first principles to solve engineering problems. As can be seen from **Table 3** and **Table 4,** this outcome is addressed in essentially every module of the curriculum. By the time the exit levels have to

be assessed, the required exit outcome, as assessed via the modules Process Control CPB 410, Reactor Design CRO 410, Design Project CPJ 421, Chemical Engineering Practice CPR 420 and CSS420 Specialisation, where the focus is on being confronted with various levels of problems challenging the students to apply their engineering and scientific knowledge to obtain a solution to problems which have progressively grown into open-ended problems, challenging ingenuity.

GA 3: Engineering Design

While competence to perform creative, procedural, and non-procedural design and synthesis of components, systems, engineering works, products or processes is the purpose of the engineering curriculum, students are gradually introduced to the design process via the modules with a design component, namely Mass Transfer CMO 310, Chemical Engineering Design CIO 320 and then on to the exit level outcomes assessed in CPS410, the Design Project CPJ 421, and CPR420.

GA 4: Investigations, Experiments and Data Analysis

The third year Laboratory CLB 321 is the first important opportunity where students need to plan and perform experiments, generate data, and analyse the results in order to confirm phenomena taught in modules linked to the laboratory module. The application of this to a design problem (Heat transfer equipment and associated piping systems) is assessed in Chemical Engineering Design CIO 320. In die final year the outcome is assessed at exit level in the Research Project CSC 411, where the research project is primarily focused on this outcome, while Research Project CSC 421 of the second semester focuses on ensuring that the data generated and obtained are developed and analysed in a manner where critical analysis may take place and scientific conclusions be drawn from the results.

GA 5: Engineering Methods, Skills, Tools, including Information Technology

The competence to use appropriate engineering methods, skills, and tools, including those based on information technology are core to reaching a feasible solution. In addition to the methodology to analyse a problem, and following the correct approach to enable a solution, the use of numerical methods and the ability to use appropriate computer programming skills as well as other tools (e.g., spreadsheets, design packages etc.) is regarded as very important. Programming skills are initiated in Programming and IT MPR 213, laying the foundation that is taken further in Process Dynamics CPN 321 and Kinetics CKN 321 to be assessed at exit level in the follow-up modules Process Control CPB 410, and Process Synthesis CPS 410 and finally in CPS420 Process Analysis.

GA 6: Professional and Technical Communication

The competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large is done in several modules, but specifically in Professional and Technical Communication CJJ 310, a module where special care is taken to ensure that the required capabilities of writing a technical report is instilled in the student and that the student gets ample opportunity to submit, receive feedback, improve and re-submit. In modules where assignments are handed out, the submitted reports are assessed for clarity and the required qualities of a good technical report, cf. the Laboratory CLB 321 module, where care is taken to ensure that each individual student has to write and submit a report on a laboratory experiment. The assignments of Chemical Engineering (CIR 310) and Chemical Engineering Design (CIO 320), highlight this. Oral presentation skills are instilled in the Community Based Project (JCP 203) and then finally in Research Project (CSC 411), where a short oral presentation is made to the external examiner. In Research Project (CSC 421) of the second semester, the main focus of the module is to use the available means of communication, namely report writing, writing of a concept article, writing a project proposal, making an oral presentation and presenting work by means of a poster. During the design review for Design Project (CPJ 421), where the student defends his work in an environment which is not intimidating, the ability to present work in a concise and to-the-point manner, is regarded as very important.

GA 7: Sustainability and Impact of Engineering Activity

A critical awareness of the impact of engineering activity on the social, industrial, and physical environment is the main focus of the Humanities and Social Sciences HAS 110 and HAS 120 modules of the first year. In the third year, the new module, Impact of Engineering and Group work MIA 320 puts a strong focus on the role and responsibility of the engineer in this regard. The CPR 420 module deals with the role that the engineer plays within the confines of the law and the ethics issues around large investments by developers and their need for a good return on investment, while CPJ 421 focuses on the environmental impact that a processing plant may have on the environment and how to deal with this. Students are required to make an individual submission on the sustainability and impact of engineering activity on the process plant that they have designed.

GA 8: Individual, Team and Multidisciplinary Working

The competencies of individuals at the developmental level are addressed in modules like Thermodynamics CTD 223 and Transfer Processes COP311. The module MIA 320 is specifically aimed at enabling multidisciplinary group work as an exit level, as explained in the module sheet. In CSC 421 the assessment of written assignments and preparation of oral presentations by a group of peers and finally the realities of working in a group on a large design project (CPJ 421) provide adequate opportunities to assess this graduate attribute.

GA 9: Independent Learning Ability

This competence to engage in independent learning through well-developed learning skills is the point of departure for modules right through the programme. In the senior years, the contact hours are much reduced – specifically with respect to the modules where the exit level outcome is assessed, namely Research Project CSC 411 and Specialisation CSS 420, where the assessment focuses on the ability of the student to identify the relevant components of a body of knowledge.

GA 10: Engineering Professionalism

The need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence is put to good practical use early in the curriculum, where the Professional and Technical Communication CJJ 310 module is used to instil a sense of professionalism, by enforcing into students the concept of punctuality. Other aspects of professionalism are achieved in the CLB 320 module and finally, at the exit level in Chemical Engineering Practice CPR 420 where the ethical aspects of professionalism (code of conduct) are addressed and in the Research Project CSC 411/421 modules and the Design Project CPJ 421 module where students a penalised for late submission of log books and parts of their design according to the agreed schedule of hand-ins.

GA 11: Engineering Management

The module JCP203 Community Project introduces the students to several aspects of engineering management in a practical way, which, through a group project involves the development of communications skills, planning to make deadlines and budgeting to ensure a successful outcome within available resources. The module BSS 310 Engineering Management is dedicated towards achieving this outcome at exit level. ECSA GA 11 is assessed in both the semester tests (formative), the semester project (formative) and final examination (summative). In the examination, approximately 30% of the questions are on Systems Engineering, 35% of the questions are focused on Project Management and the remaining 35% of the questions are focused on Engineering Economics. The entire examination focuses on assessing only ECSA GA 11. A student is therefore expected to score an average of at least 50% over all the questions in the examination paper in order to pass ECSA GA 11.

4.4 Progression rules

The curricula of the undergraduate programmes in the Department of Engineering form part of a fixed four-year programme that has been designed to comply with the requirements of ECSA's "knowledge areas" (Table 1) and GAs, as stated in ECSA Document E-02-PE Rev 4. A summary of the prerequisites for progression in the Department is provided in Table 2.

Table 2: Prerequisites for progression – Chemical Engineering

Note: Brackets indicate exam entrance; # indicates simultaneous registration; GS indicates a combined mark of 40-49%			
First year of study First semester			
Module		**Credits**	**Prerequisites**
CHM 171	General chemistry 171	16	
CIR 113	Chemical engineering 113	8	
FSK 116	Physics 116	16	
HAS 110	Humanities and social sciences 110	8	
MGC 110	Graphical communication 110	16	
WTW 158	Calculus 158	16	
First year of study Second semester			
CHM 181	General chemistry 181	16	CHM 171
CIR 123	Chemical engineering 123	8	CHM 171GS, CIR 113
EBN 122	Electricity and electronics 122	16	
HAS 120	Humanities and social sciences 120	8	
SWK 122	Mechanics 122	16	WTW 158
WTW 164	Mathematics 164	16	WTW 158 GS
	Total credits for first year:	**160**	
Second year of study First semester			
Module		**Credits**	**Prerequisites**
CHM 215	Chemistry 215	12	CHM 171/172, 181
CIR 211	Chemical engineering 211	12	CIR 123
CIM 210	Chemical engineering materials 210	8	CHM 181
JCP 203	Community-based project 203	8	
MPR 213	Programming and information technology	16	
SWK 210	Strength of materials 210	16	SWK122, WTW 164/WTW 161, 168
WTW 256	Differential equations 256	8	WTW 158, WTW 164/ WTW 161, 168
WTW 258	Calculus 258	8	WTW 158, WTW 164/ WTW 161, 168
Second year of study Second semester			
BES 220	Engineering statistics 220	8	
CHM 226	Chemistry 226	8	CHM 171/172, 181
CTD 223	Thermodynamics 223	16	CIR 211, MPR 212/213, (WTW 258)
EIR 221	Electrical engineering 221	16	EBN 111/122
WTW 238	Mathematics 238	16	WTW 258 GS, WTW 256
WTW 263	Numerical methods 263	8	WTW 164/WTW 161, 168
	Total credits for second year:	**160**	
Third year of study First semester			
Module		**Credits**	**Prerequisites**
BSS 310	Engineering management 310	8	
CIR 310	Chemical engineering 310	8	(CTD 223), CHM 215
CJJ 310	Professional and technical communication 310	8	CIR 123
CMO 310	Mass transfer 310	16	(CTD 223), COP 311#
COP 311	Transfer processes 311	16	WTW 238, (WTW 263)
CBI 310	Biochemical Engineering 310	16	(CIR 211), (CHM 215)
Third year of study Second semester			
CIO 320	Chemical engineering design 320	16	(CTD 223), SWK210, (COP 311)
CKN 321	Kinetics 321	16	(CTD 223)
CLB 321	Laboratory 321	16	CJJ 210/CJJ 310, CHM 226, CPN 321#, CKN 321# (CMO 320/310), CIO 320/310#
CPN 321	Process dynamics 321	16	CIO 310/320#, CKN 321#
MIA 320	Engineering activity and group work 320	8	(CJJ310), (BSS 310)
	Total credits for third year:	**160**	
Fourth year of study First semester			
Module		**Credits**	**Prerequisites**
CPA 410	Particle technology 410	16	(COP 311)
CPB 410	Process control 410	16	CPN 321 GS
CPS 410	Process synthesis 410	8	CLB 321, CIR 310 GS
CRO 410	Reactor design 410	16	CKN 321 GS
CSC 411	Research project 411	16	CLB 321, CPB 410#, CRO 410#
Fourth year of study Second semester			
CPJ 421	Design project 421	24	(CPB 410), (CRO 410), BIE 310/BSS 310, CIO320, CPS 420#, CPR 420#
CPR 420	Chemical engineering practice 420	8	CLB 321
CPS 420	Process analysis 420	8	CPS 410
CSC 421	Research project 421	16	CSC 411
CSS 420	Specialisation 420	16	CPJ 421#
	Total credits for fourth year:	**160**	
	TOTAL PROGRAMME CREDITS:	**608**	

4.5 Criteria for awarding credit

Typically, an academic semester in the School of Engineering comprises 16 weeks (12 ‘lecture ’weeks, two ‘test 'weeks with no formal classes, and two ‘final examination‘ weeks). Most of the modules in each programme carry 16 credits. However, a number of eight-credit modules are also included – for example, the complementary studies modules and certain modules offered by departments from other faculties of the university. A typical example of the module structure of an academic semester is as follows:

Math: 1 x 16-credit module:	16 credits
Nat. Sci.: 2 x 16-credit modules	32 credits
Eng. Sci.: 1 x 16-credit module	
1 x 8-credit module	24 credits
1 x 8-credit modules (complementary studies):	8 credits
Total for semester:	80 credits

Most of the programmes in the School, therefore, have eight semesters of 72 credits each, giving a total of 576 credits. In chemical Engineering, the total credits are 608.

The final mark obtained by a student in each module is composed of a semester mark and an examination mark. In terms of the policy of the School of Engineering, formative assessment should be an important component in the assessment of students. The semester mark is therefore required to be compiled from learning activities, such as assignments, practicals and group projects, as well as class tests and semester tests. For each module, the specific formula for the calculation of the semester mark and the final mark is given in the study manual. In addition, a Rules of Assessment Schedule, listing this information for all the modules presented in each department, is compiled for approval by the Head of Department and the Dean.

4.6 Promotion to the second semester of the first and second years of study

- A new first-year student who has failed all the prescribed modules of the programme at the end of the first semester is excluded from studies in the School of Engineering. A student who is registered for the ENGAGE programme and has passed only eight credits will also be excluded
- A student who complies with all the requirements of the first year of study is promoted to the second year of study.
- A student who has not passed at least 70% of the credits of the first year of study after the November examinations must reapply for admission should he or she intend to proceed with his or her studies. Application on the prescribed form must be submitted to Student Administration of the School of Engineering not later than 11 January. Late applications will only be accepted in exceptional circumstances after approval by the Dean. Should first-year students be readmitted, conditions of readmission will be determined by the Admissions Committee.
- Students who have not passed all the prescribed modules at first-year level (level 100), as well as students who are readmitted in terms of Regulation Eng. 16(c), must register for the outstanding first-year level modules.
- A student who is repeating his or her first year may, on recommendation of the relevant Head of Department and with the approval of the Dean, be permitted to enrol for modules

of the second year of study in addition to the first-year modules that he or she failed, provided that he or she complies with the prerequisites for the second-year modules and no timetable clashes occur. Students on the ENGAGE programme may, following the same procedure, be permitted to enrol for second-year modules in addition to the first-year modules that he or she failed, provided that he or she complies with the prerequisites for the modules at second-year level (level 200) and no timetable clashes occur. On recommendation of the relevant Head of Department and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits that may be approved may not exceed the normal number of credits per semester by more than 16 credits.

4.7 Promotion to the third year of study

- A student who complies with all the requirements of the second year of study is promoted to the third year of study.
- A student must pass all the prescribed modules at first-year level before he or she is admitted to any module at third-year level (level 300).
- A student who is repeating his or her second year must register for all the second-year modules still outstanding. Such a student may, on recommendation of the relevant Head of Department and with the approval of the Dean, be permitted to enrol for modules of the third year of study in addition to the second-year modules that he or she failed, provided that he or she complies with the prerequisites for the third-year modules and no timetable clashes occur. On recommendation of the relevant Head of Department and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits that may be approved may not exceed the normal number of credits per semester by more than 16 credits.

4.8 Promotion to the fourth year of study

- A student who complies with all the requirements of the third year of study is promoted to the fourth year of study. A student who does not comply with all the requirements, but who is able to register for all outstanding modules in order to complete the degree programme may, at registration, be promoted to the fourth year of study.
- A student must pass all the prescribed modules of the second year of study before he or she is admitted to any module of the fourth year of study.
- A student who has not passed all the prescribed modules of the third year of study must register for the outstanding modules. A student may be admitted by the Dean, on recommendation of the Head of Department concerned, to modules of the fourth year of study, in addition to the outstanding third-year modules, provided that he or she complies with the prerequisites of the fourth-year modules and no timetable clashes occur. The total number of credits per semester for which a student registers may not exceed the normal number of credits per semester by more than 16 credits. In exceptional cases, the Dean may, on recommendation of the relevant Head of Department, permit a student to exceed the above limit.

4.9 Criteria for graduation

In the first year of study, the administrative officials draw up a check sheet for each student, on which his or her curriculum for the specific four-year degree for which he or she is registered is set out. After the June examinations each year, each and every module passed or failed is noted on each student's check sheet. Once again, at the end of each academic year, each and every module for which a student is registered is verified with the results obtained to determine whether a student has been promoted to the following year of study or whether he or she has to repeat the current year of study. The checks are carried out to ensure that all the rules and regulations of the School and the University are upheld regarding the curriculum. During registration at the beginning of each academic year, the student draws up his or her proposed enrolment for the current year in conjunction with the relevant lecturer and Head of Department. Immediately after registration, the administrative officials do the first check of each student's registration to ensure that the student is correctly registered in accordance with the rules and regulations of the University and those of the school. In the case of final-year students, at the end of the final year of study, the administrative official once again checks all the modules to confirm that the student has complied with all the degree requirements in accordance with the fixed curriculum. The Head of Student Administration carries out a further check to ensure that the identification of finalists by the administration official is correct.

4.10 Pass with distinction

a. A student graduates with distinction if:
    i. no module of the third or fourth year of study of the four-year programme or of the fourth or fifth year of the ENGAGE programme was repeated and a weighted average of at least 75% (not rounded) was obtained in one year in all the modules of the final year of study; and
    ii. the degree programme was completed within the prescribed four years for the four-year programme and within the prescribed five years of the ENGAGE programme.
b. Exceptional cases to the above will be considered by the Dean.

5 FACILITIES & RESOURCES TO SUPPORT TEACHING & LEARNING

5.1 Laboratories for practicals and CSC projects

The Department has well-equipped laboratories for teaching and research activities. The laboratories are situated in Eng. 2 on the main campus and in Building 2 & 4 on the South Campus. In addition, for borrowed modules from NAS, dedicated laboratories are provided from practicals. A comprehensive list of the laboratories for teaching and learning are provided in Appendix 3.

5.2 Software usage at Engineering Facilities

The School of Engineering provides software licenses to the IT facilities for use in practical classes, assessments, and student projects. As some of these software packages are

extremely expensive, the licenses and license servers, as well as the software usage are tracked carefully.
Table 3 shows the key software packages and systems used by Engineering students and presents an indication of the amount of time spent using these packages in our facilities.

Table 3: List of software in EBIT

Engineering Labs

Product	Num. of Launches	Total Usage Time (min)	Ave. Usage Time (min)
7-Zip – ENG	6452	436678	67
Jupyter Notebook - ENG	9683	986200	101
MS Edge – ENG	11720	662893	56
Spyder – ENG	3769	474722	125
Aspen – ENG	5478	423358	77
Chrome – ENG	4941	330494	66
Q-GIS	1921	162374	84
MS Word – ENG	2004	156998	78
MS Excel – ENG	1602	129750	80
Adobe Reader – ENG	612	39685	64
Firefox – ENG	344	25878	75
MATLABORATORY – ENG	181	22541	124
MS PowerPoint – ENG	194	13518	69
ANSYS – ENG	155	11181	72
MS OneNote – ENG	56	4950	88
MS Visio – ENG	25	2150	86
MS Publisher – ENG	23	1637	71
EndNote – ENG	32	1571	49
Aspen OnLine Service V10	240	412	1
MS Project – ENG	10	379	37
MS Access – ENG	3	61	20
CES EduPack – ENG	1	6	6
Chrome	1	1	1
SolidWorks eDrawings – ENG	1	1	1

Mining Industry Study Centre

Product	Num. of Launches	Total Usage Time (min)	Ave. Usage Time (min)
MS Edge-MSC	17989	1095995	60
MS Word-MSC	18478	1093614	59
MS Excel-MSC	9911	714694	72
Python-MSC	5058	560924	110
ANSYS-MSC	3855	387004	100
Aspen-MSC	2011	184935	91
MS PowerPoint-MSC	2942	144642	49
MS Visio-MSC	980	74181	75
Adobe Acrobat 2017	1005	73875	73
Firefox-MSC	825	46102	55
Adobe Reader-MSC	577	36974	64
MS Access-MSC	121	8196	67
MS Project-MSC	82	4458	54
Firefox	57	1840	32
Libre Office	1	3	3
eDrawings-MSC	1	1	1

5.3 3D Printing Service – Mining Industry Study Centre

The School of Engineering instituted a 3D printing service for the Department towards the end of 2018. The service consists of three 3D printers, which allow students to design components for specific projects. All costs are carried by the School of Engineering and students have access to print the components free of charge. We implemented strict usage rules and management of the devices as the devices themselves and the associated materials are very expensive.
Students design their own components, where after the design is verified through a quality

control process performed by highly trained ITS personnel. The 3D prints and printers are carefully monitored throughout any specific printing process to minimize faults and wastage due to incomplete printing and design errors. We receive regular donations for printing materials in addition to the material provided by the Department.

5.4 Support for personal computing devices

5.4.1 General support services – student personal devices

While the 2020/2021 support focused on assisting students working from home, we instituted personal device support to students in 2015. Students who make use of personal devices at UP are assisted with accessing the Wi-Fi services, information and guidance on purchasing options, software installations, and support for malware related challenges and general maintenance and repair where possible.

First line support and access to Department specific software is available from the relevant IT facilities, while the central laptop support facility is located in the Student Centre on Hatfield Campus and can be contacted at studentithub@tuks.co.za. The team provides onsite as well as remote support to all UP students and focuses on additional support to the UP laptop project, NSFAS project, as well as the DELL Young Leaders-, MasterCard- and DELL Sikelela scholarship programmes.

5.4.2 Software available to students

All registered UP students have access to the full **Microsoft Office 365** suite to install on their personal device for the duration of their studies. There are also a number of other software packages and services available to registered students including MalwareBytes; EndNote; MatLab; The UP Google Suite; and Microsoft Cloud services.

5.5 General support services – COVID19 period

Student Computing Services implemented an online support programme from April 2020 to support the online teaching and learning directive. We provided a COVID19 remote support page to alert students that remote support to students working from home is available throughout the year, and that this support is not dependent on access to campus or onsite facility availability. COVID remote support page: https://www.up.ac.za/it-services/article/2891993/student-computing-services

The remote helpdesk services were used by thousands of students during the COVID period and as many students are still studying from home remain in use. Students registered with the school of Engineering were assisted to acquire the licensed software to continue their studies from home. Additionally, the computers in the Engineering Laboratories were configured to allow remote connections for students to use the resources from home and several practical classes were conducted this way.

5.6 Information on other services:

The UP Info Guide (previously UP Fact Finder) provides information and links to the IT service pages relating to students.

https://www.up.ac.za/media/shared/368/Faculty%20Brochures/2023/infoguide-2022-final-pdf-06.12.2021.zp213424.pdf

UP Wi-Fi:
Wi-Fi access is available in the lecture halls, IT facilities, Libraries, and communal areas on Hatfield Campus.

Residences
All UP Residences are supported by a dedicated team available at itres@up.ac.za. Each Residence makes provision for an IT facility consisting of 10 to 36 computers and a printer / copier. Residence house committees have a dedicated computer and printer unit in their office. Residences have access to the Internet through Wi-Fi or cabled network in each room as well as through Wi-Fi access in communal areas, study rooms and cafeterias.

TuksPrint Printing Service
All IT facilities have a printer / copier unit connected to the TuksPrint system. The system allows for scanning, printing (A4 and A3, colour or black & white), as well as copying. In addition, the system stores print jobs on a central server, which also allows students to print from their own device and release the printouts at any printing station.
The Student Printing function (TuksPrint) was incorporated under the Student Computing Services portfolio from 2022 and we are in the process of implementing the new contract and working on service improvements. More information is available at https://www.up.ac.za/tuks-print

UP Google Account
All registered students are issued with a UP Google account and have access to free storage space through their Google drive. The UP Gmail account is the main e-mail platform used for communication to and from the University, and students have access to the account after their studies have concluded. A range of Google applications are available for use, including Google Docs, Google Calendar, Google Meet, and the Google Drive. This guide is available to assist students with managing their UP Google accounts: https://www.up.ac.za/media/shared/373/ZP_Files/tuks-gmail-account-guide_feb-2020.zp190797.pdf
All UP campuses have been extensively mapped through Google Maps and students can make use of the Google Map application to guide them to their lecture sites on the campuses.

Training
Training sessions are offered to groups of students as required. All new scholarship students receive a device training session on receipt of their laptop, and Residence students are taken through the steps to access the network from their rooms. Training is also provided for the House committees in order to provide support to students after hours and assist the team with managing the support to the Residences. Our student IT staff receive extensive training to assist students and perform their duties. They are also registered on the LinkedIn Learning platform to access courses.

In addition to extensive computing and IT facilities available on campus and in the School of Engineering, which is accessible to individual students as well as groups, the Department has a computer laboratory with 20 PC's available for computer-based instruction of small groups. Space next to the third-year laboratory is fitted with several workstations and power points so that students can use their laptop computers to process laboratory test results. All the research laboratories, where final years do their research projects, are equipped with PC's – in most cases connected to equipment. The Department makes it a requirement that all students should have access to a specified workstation, with recommendation that a laptop should be

purchased rather than a PC. In addition, students are increasingly making use of tablets and smart phones. Computer-based instruction, use of hybrid learning models increasingly demand this, in addition to connection to the Internet. A centralised programme of WiFi hotspots throughout the campus as well as in lecture halls has gone a long way towards satisfying this need. In the spaces occupied by the Department, WiFi access is available throughout.

Table 4: List of service pages and documents

Service page and document	Link
Student Computing Services UP Page	https://www.up.ac.za/student-computing-services
Engineering Laboratories UP Page	https://www.up.ac.za/engineering-computer-labs
Help Desk	englabs.helpdesk@up.ac.za
Mining Industry Study Centre UP Page	https://www.up.ac.za/mining-industry-study-centre
CDIO Bookings	cdio.bookings@up.ac.za
Help Desk	**studycentre.helpdesk@up.ac.za**
Covid Remote Support Page	https://www.up.ac.za/it-services/article/2891993/student-computing-services
UP Info Guide 2022	https://www.up.ac.za/media/shared/368/Faculty%20Brochures/2023/infoguide-2022-final-pdf-06.12.2021.zp213424.pdf
TuksPrint Support Page	https://www.up.ac.za/tuks-print
Student Google Account Guide	https://www.up.ac.za/media/shared/373/ZP_Files/tuks-gmail-account-guide_feb-2020.zp190797.pdf
Clickup exam guide	https://www.up.ac.za/media/shared/373/ZP_Files/studentexamsupport.zp191112.pdf
UP Wi-Fi information	https://www.up.ac.za/up-wireless-network
Student Laptop Support	studentithub@tuks.co.za
Residences IT Support:	itres@up.ac.za

5.7 Required Personal Laptops/Tablets/Smart phones and Pocket Calculators

The Department of Chemical Engineering prescribes access to a laptop computer as a requirement for all students from the 2nd semester of the first year.

Since access to and use of smart phones, tablets, e-readers and laptop computers are becoming standard practice, it will be appreciated if you could consider helping your bursar(s) in the acquisition of their own device(s). At minimum the Department expects a student to have his/her own laptop computer, since this will enable access to e-books, internet, UP-based repositories, prescribed software, etc. Tablets and smart phones are great but are not very useful for projects and assignments. Typing on them is difficult and few of them can be used to run the software needed for engineering education.

Laptop:
- Preferably a 15.6" Laptop Computer with at least an Intel i5 CPU (i7 preferred)
- 802.11a/b/g/n -enabled (preferably a/b/g/n/ac) WLAN and Gbit LAN
- At least 8 GB RAM Memory (>8 GB RAM preferred)
- Disk Drive > 500 GB HDD or 512 GB SSD (preferred)
- Display resolution of 1440 x 900 or above (with VGA/HDMI video out)
- Sufficient USB ports, e.g. 3 or 4 (USB 3.0 preferred)
- DVD Multi Writer (but not essential)
- Separate mouse preferred
- Carry bag
- >= 32 GB USB Memory Stick
- Printer (Laser preferred)

Software:
- Please note that the Windows 10 operating system is current.
- Word processing, Spreadsheet & Presentation combination (e.g. MS Office or Office 365, or Office 2019. These can be downloaded for free using your student email address.). Please contact IT of UP for detailed information about it using one of the links provided in Table 4.

Pocket calculator:
For some modules of the first year, the only prescribed pocket calculator is a non-programmable calculator like the **Casio** fx-991es PLUS or fx-570es PLUS or the newer fx-991ex or fx-570ex or **SHARP** EL-W516 for use in tests and exams where programmable devices are not allowed.

With a good laptop and the advent of smart phones and tablets, a recommendation regarding programmable pocket calculators is difficult. It is recommended that students follow market trends and only purchase programmable pocket calculators and the like, once they are sure they know what they need.

5.8 Online Learning Communication Channels

In the event of online learning taking place because of external circumstances prohibiting the continuation of classes on campus, the university has established an efficient support system for the students for classes, tutorials, tests, and exams to take place as indicated on the timetable and as communicated by module lecturers. In addition to using ClickUp and the official Tuks Gmail for announcements and communication, the lecturers, assistant lecturers, and teaching assistants make use of Blackboard Collaborate live lectures, pre-recorded lectures, and social media applications such as Slack to ensure that communication lines to students remain open. Contacting lecturing staff individually during working hours or during lecture time is encouraged in the event of any uncertainty regarding module content or scheduling enquiries through any of the available communication channels. Not only can this eliminate the possibility of misunderstandings, but it can aid in developing graduate attributes such as professional communication in students.

5.9 University calendar

For university announcements please make sure to read announcements by e-mail, UP Webpage, **ClickUP** on a daily basis.

Click on the following link for more information; https://linus.up.ac.za/calendars/

5.10 Self-help guides

These guides have information on how to use university resources such as how to access the **UP Portal**, **ClickUP** and tracking your applications. Click on the following link for more information; https://www.up.ac.za/students/article/2745903/self-help-guides.
https://www.up.ac.za/student-funding
https://www.up.ac.za/article/2894107/financial-aid.

5.11 Library services

This has information on the university services such as search databases, plagiarism policies, access to e-books, journals, exam papers, printing and photocopying etc. Click on the following link for more information; http://www.library.up.ac.za/.

5.12 Yearbooks

The Yearbook is there to provide registered students with information about their degree programmes. This includes admission requirements, the curriculum, as well as specific details regarding the programme. Important information about the modules, such as credit value, contact time and prerequisites, are all listed. It also includes faculty-specific information as well as the General Regulations and Rules, which students should take note of to ensure they make a success of their studies. Click on the following link for more information; https://www.up.ac.za/yearbooks/2022/programmes/view/12130002

5.13 Chemical Engineering Department Staff

Our department, headed by Prof Michael Daramola, has a group of excellent and enthusiastic lecturers, with a passion for teaching and research (see Table 5). More detail on individual staff member is available at https://www.up.ac.za/chemical-engineering/staff profiles.

Table 5: List of academic and support staff

1	**Daramola, M.O.** Room 8-21	C.Eng BSc(Hons), MScEng (OAU) MSc (WUR) PhD(SU) PGDip (HE) (Wits) FIChemE FSAIChE MNSE REng..Eng. (COREN) MEFB MIAEng Engineering I Building	Professor (Head of Department) michael.daramola@up.ac.za Tel: 012 420 2475
2	**De Vaal, P.L.** Room 8-11	PrEng BEng(Hons) MEng(Pret) PhD(Pret) FSAIChE MSAIT MSTLE Engineering I Building	Professor Emeritus philip.devaal@up.ac.za Tel: 012 420 6748
3	**Chirwa, E.M.N.** Room 1-28	PrEng (SA), PE (MD-USA), MSc (UKY), PhD (UKY), MSAICE, MASCE, MAWWA, MWISA Water Utilisation Engineering, Building 2, South Campus	Professor (Sedibeng Water Chair) evans.chirwa@up.ac.za Tel:012 420 5894
4	**Brink, H.G.** Room R1-25	PrEng BEng(Hons)(Pret) MEng(Pret), PhD(Pret) Water Utilisation Engineering, Building 2, South Campus	Associate Professor deon.brink@up.ac.za Tel: 012 420 3569
5	**Crouse, P.L.**	PhD (UP), MSc (UCT) BSc (Hons) (UCT) BSc (UCT); HED (UKZN); BA (Unisa)	Professor Emeritus philip.crouse@up.ac.za

6	**Du Plessis B.J.G.W.** Room 8-16	Pr Eng MEng(Pret) MDP(Unisa) MSAIChE Engineering I Building	Senior Lecturer Tel: 420-3740
7	**Du Toit, E.L.** Room 8-15	PrEng BEng(Hons)(Pret) MEng(Pret) MSAIChE Engineering I Building	Senior Lecturer elizbe.dutoit@up.ac.za Tel.: 012 420 3641
8	**Focke, W.W.**, Room 8-26(a)	BEng(Hons) MEng(Pret) Dip Data(Unisa) PhD(MIT) MSAIChE Engineering I Building	Professor Emeritus walter.focke@up.ac.za Tel: 012 420 2588
9	**Heydenrych, M.D.** Room 8-18	PrEng, C.Eng., MSc(Eng)(Wits) PhD(Twente) MDP(Unisa) FSAIChE, FIChemE Engineering I Building	Associate Professor mike.heydenrych@up.ac.za Tel: 012 420-2199
10	**Labuschagne, FJWJ** Room 8-14	BEng(Hons)(Pret) MEng(Pret) PhD(Pret) MSAIChE Engineering I Building	Professor johan.labuschagne@up.ac.za Tel: 012 420 3020
11	**Kornelius, G** Room 1-26.1	PrEng BEng(Hons)(Pret) MBA (Pret) PhD (Pret) FSAIChE Building 2, South Campus	Senior Researcher gerrit.kornelius@up.ac.za Tel: 012 420 3741
12	**Merckel, R** Room 8-11	BEng, BEng(Hons), MEng, PhD (Pret.) Engineering I Building	Senior Lecturer Tel: 076 220 5069
13	**Mulaudzi, L** Room 8-10	BScEng (UCT), MEng (Chem.Eng)(Univ. Stellenbosch) Engineering I Building	Lecturer lusani.mulaudzi@up.ac.za Tel: 012 420 3048
14	**Nicol, W.** Room 8-17	PrEng BEng(Pret) PhD(Wits) MSAIChE Engineering I Building	Professor willie.nicol@up.ac.za Tel.: 012 420 3796
15	**Ramjee, S**	BEng(Chem)(Pret), MEng(Pret.), PhD (Pret.)	Senior Lecturer (Shared with Metallurgical Engineering)
16	**Tichapondwa, S** Room 1-16	BEng (NUST),BEng (Hons), MEng (Pret), PhD (Pret) Water Utilisation Engineering, Building 2, South Campus	Associate Professor shepherd.tichapondwa@up.ac.za Tel: 012 420 3741
17	**Yapi, L** Room 8-19	BEng, BEng(Hons), MEng, PhD (Pret.) Engineering I Building	Lecturer Tel: 012 420 4903 litha.yapi@up.ac.za
18	**Iwarere, S**	BSc, BEng(Hons), MEng, PhD (UKZN) Building 2, South Campus	Senior Lecturer Samuel.Iwarere@up.ac.za
19	**Sonnendecker, P** Room 8-13	BEng, BEng(Hons), MEng, Engineering I Building	Lecturer paul.sonnendecker@up.ac.za Tel: 012 420 3161
20	**Motsa, N**	MEng Engineering 1 Building	Lecturer Engineering 1
21	**Van Vuuren, DS**	BEng(Hons)(Pret) MEng(Pret) PhD(Pret) FSAIChE	Associate Professor & Research Associate dawie.vanvuuren@up.ac.za

		Engineering I Building	Tel: 012 420 3568
22	**Mrs Elmarie Otto** Room 1-26	Building 2, South Campus	Departmental Administrator (South Campus Wing) elmarie.otto@up.ac.za Tel: 012 420 3824
23	**Mrs Alette Devega** Room 1-14	Building 2, South Campus	Senior Technical Assistant alette.devega@up.ac.za Tel: 012 420 4206
24	**Dr Isbe van der Westhuizen**	PhD (Pret) Engineering 2 Building	Control Instructor/Lab Manager isbe.vanderesthuizen@up.ac.za Tel: 012 420 4206
25	**Ms Gymaisy Kenny** Room 8-20	Engineering 1 Building	Departmental Administrator (General Administration & UG Administration) Gymaisy.Kenny@up.ac.za Tel: 012 420 4206
26	**Mr Matlala, G**	Engineering 2 Building	Chief Messenger gibson.matlala@up.ac.za
27	**Ms Olga Shokane** Room 8-26(b)	Engineering 1 Building	Departmental Administrator (Finance & PG Administration) Olga.shokane@up.ac.za
28	**Mthokozisi Sibanda**	BSc,MSc, PhD	Extraordinary Senior Lecturer (Applied Materials)
29	**Randal MC Albertus**	BSc,MSc, PhD	Extraordinary Senior Lecturer (Solid waste management)
30	**Zack Khuzwayo**	BSc,MSc, PhD	Extraordinary Lecturer (Environmental and wastewater treatment)
31	**S de Vos**	BSc,MSc, PhD	Extraordinary Lecturer (Air quality)
32	**Ange Nzhihou**	BSc,MSc, PhD	Extraordinary Professor (Sustainable and Efficient Energy Processes)
33	**M.R. Riazi**	BSc,MSc, PhD	Extraordinary Professor (Sustainable and Efficient Energy Processes)
34	**A Maity**	BSc,MSc, PhD	Extraordinary Professor (Advanced and Applied Materials)
35	**Erik Dahlquist**	BSc,MSc, PhD	Extraordinary Professor (Process Control & Optimisation)
36	**Mika E.T. SILLANPÄÄ**	BSc,MSc, PhD	Extraordinary Professor (Sustainable Environment and Water Utilisation)

5.14 Contact details

To contact the University during the COVID-19 lockdown, please send an email to ssc@up.ac.za. If you would like more information on academic programmes or have any other queries, concerns or need general help and guidance, we're glad to help you. Please use the links provided in this document to help you to find the contact information you're looking for.

Some of the relevant links and contact details specific to the faculty and department are listed in Table 6.

Table 6: Contact information relevant to teaching and learning

Faculty Student Advisors	https://www.up.ac.za/faculty-of-engineering-built-environment-it/article/2951500/faculty-student-advisors
Departmental Undergraduate Administrator	Ms Gymaisy Kenny E-mail: gymaisy.kenny@up.ac.za Tel.: +27 (0)12 420 3769
Year 1-Year 4 Advisor for 2024	Information will be provided in March 2024
Chair, Departmental UG Teaching and Learning Committee	Mrs Elizabeth du Toit E-mail: elizbe.dutoit@up.ac.za Tel.:+27 (0) 12-420 3641
Head of Department	Prof Michael Daramola E-mail: Michael.Daramola@up.ac.za Tel.: +27 (0) 12 420 2475
Undergraduate Coordinator: Applications and admissions	Ms J van Rooyen, **Tel:** +27 (0) 12 420 5166 **Email:** jvr2@up.ac.za
Undergraduate Coordinator: Student Administration	Ms E Willemse, **Tel:** +27 (0)12 420 2724, **Email:** izette.willemse@up.ac.za
EBIT Administration Department:	**Tel:** +27 12 420 3011
General Enquiry Fax Number:	**Tel:** +27 12 420 5048
General Enquiry E-mail Address:	chemeng@up.ac.za

Physical Address:	**Postal Address:**
Department of Chemical Engineering Engineering I Building, Room 8-21 University of Pretoria Lynnwood Road Hatfield Pretoria	Department of Chemical Engineering University of Pretoria Private Bag X20 Hatfield Pretoria 0028 South Africa

Appendix 3: Laboratories that support the programme

Code and module	Laboratory	Description of facilities and support	Description of function	Capacity	Time availability
CHM 171 / CHM 172 General Chemistry	General	General first year chemistry laboratories. Three full-time technicians provide support, while the sessions are offered by trained postgraduate tutors under supervision of the lecturer(s).	Support of the theoretical components covered during lectures and tutorials.	324	As arranged per student's timetables.
CHM 181 General Chemistry *The course is divided into 2 parts: Physical/analytical Chemistry is covered in Q3 and Organic Chemistry is covered in Q4.*	Chemistry First year laboratories	General first year chemistry laboratories. Wet laboratory practical: Three full-time technicians provide support, while the sessions are offered by trained postgraduate tutors under supervision of the lecturer(s). Tutorial: sessions are offered by trained postgraduate tutors under supervision of the lecturer(s) in the large Chemistry Hall.	Support of the theoretical components covered during lectures and tutorials.	About 300 (Laboratory 1-40 and Laboratory 1-24); Two laboratories are utilised simultaneously to accommodate student numbers during the practical sessions; Large Chemistry Hall is used during the tutorial sessions.	1 x 3hr practical or tutorial session once a week, as arranged per student's timetables.
CHM 226 Chemistry	Chemistry second and third year laboratory	There are 5 practical sessions and students are grouped in groups E1 – E11, for each group, both Afrikaans and English students.	Three part-time trained postgraduate tutors and one full time staff member provide support, while the sessions are offered under supervision of the lecturer(s).	Formal practicals are conducted on Thursdays in one of two 3 hour time slots.	Practicals start at 10:30 or at 14:30
CHM215 Organic Chemistry	Organic Chemistry Laboratories	Organic Chemistry second year chemistry laboratories. Four full-time technicians (2 each lab) provide support, while the sessions are offered.	Support of the theoretical components covered during lectures and tutorials.	Practical sessions for each of the three groups (about 40 students each) are scheduled for Tuesdays over a period of nine weeks.	09:30 – 15:30

EBN 111/122 Electricity and Electronics	Computer Aided Education Centre (CAEC lab), Eng II building	Desktop computer and complete set of laboratory instrumentation at each of the 144 workstations. Practical sessions are supported by lecturers, assistant lecturers, instructors and student demonstrators.	Practical sessions of the introductory electric circuit modules and some more advanced modules presented by the Dept of EEC Eng are held in this lab. Circuit simulations using specialized software are performed on the computers, and physical circuits are built on proto-board and measurements taken using the laboratory instrumentation.	144 workstations, 144 seats.	07:30 – 17:30 or as arranged.
EIR 211/221 Electrical Engineering	Computer Aided Education Centre (CAEC lab), Eng II building	Desktop computer and complete set of laboratory instrumentation at each of the 144 workstations. Practical sessions are supported by lecturers, assistant lecturers, instructors, and student demonstrators.	Practical sessions of the introductory electric circuit modules and some more advanced modules presented by the Dept of EEC Eng are held in this lab. Circuit simulations using specialized software are performed on the computers, and physical circuits are built on proto-board and measurements taken using the laboratory instrumentation.	144 workstations, 144 seats.	07:30 – 17:30 or as arranged.
FSK 116 Physics	Physics First Year laboratories	Laboratory sessions illustrate the theory studied during lectures. There are 8 laboratory sessions during the semester and the equipment needs to be assembled and used in groups of 2 or 3 to illustrate a certain theoretical concept.	The 8 laboratory sessions are used during the semester to illustrate some of the theoretical concepts, and to improve the students' skills in measuring, presentation of results, and drawing conclusions based on the results.	120 – 180 students per session with 3 sessions per week. Each session is divided up into 5 or 7 groups.	8 x 1½ hour sessions are set aside on the timetable. Allocation of times is done by the Engineering faculty.

FSK 176 Physics	Physics First Year laboratories	Laboratory sessions illustrate the theory studied during lectures. There are 8 laboratory sessions during the semester and the equipment needs to be assembled and used in groups of 2 or 3 to illustrate a certain theoretical concept.	The 8 laboratory sessions are used during the semester to illustrate some of the theoretical concepts, and to improve the students' skills in measuring, presentation of results, and drawing conclusions based on the results.	120 – 180 students per session with 3 sessions per week. Each session is divided up into 5 or 7 groups.	8 x 1½ hour sessions are set aside on the timetable. Allocation of times is done by the Engineering faculty.
JPO 110 Professional Orientation	Computer laboratories NW 2 Laboratories 1,2,3 &4	Reports, tutorials and scientific documents compiled electronically. Software: MS Office, Terrapin Logo.	The course is project based and skills focussed.	196 students	7:30-17:30
JPO 113 Additional Graphical Communication	Goldfields computer labs	Computer laboratories with CAD software.	Laboratory is used as a computer facility to learn CAD software.	200 students accommodated in 4 groups of about 50 people each, over 4 separate sessions.	Arranged per student's timetables
JPO 116 Additional Mathematics	NW II Computer laboratories 1, 2, 3 & 4	Laboratory 1: 96 computers, Laboratory 2: 44 computers, Laboratory 3 & 4: 58 computers, Software used: GeoGebra (freeware supported by Google); Graphic Calculus; Support provided by laboratory assistants.	The software supports students in the development of mathematical concepts moving laterally across algebraic, verbal and graphical representations, and vice versa.	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	07:30-17:30
MIA 320 Impact of Engineering Activity and Group Work	Engineering Computer Laboratories and CDIO laboratories for group work	Desktop computers with Engineering Software such as Solid works etc. as well as document generation software as Microsoft Word and Internet Access. Specific area with conference tables etc. dedicated to support group work for students.	Students will be able to generate their semester project reports and supporting documents (such as drawings) in these labs.	Approx. 80 students/labs	07:30 – 16:00 or as arranged

MPR 213 Programming and Information Technology	NW2 Computer Laboratories 1, 2, 3, and 4	Software: Anaconda and LibreOffice	General support and assistance provided to the students. Supervision from at least 8 teaching assistants and at least 1 postgraduate.	100 to 200 students/ session	As arranged. (6 x 2-hour sessions/ week)
MPR 213 Programming and Information Technology	NW2 Computer Labs, CBT Computer Labs, Blue Computer Labs, Study Centre Computers, Other Computer Labs	Software: Anaconda and LibreOffice, Laboratory technical support, Exam conditions.	General computer laboratory facilities for use during the writing of semester tests and exams.	600+ students / session	As arranged (2 x 1.5hour sessions per semester tests and 2 x 3hour sessions per exam)
CRO 410	Computer laboratories	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers Software used: Excel Spread sheets and Python	Use of programming packages (Python specifically) to solve problems which requires numerical integration and sets of non-linear algebraic equations	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	7:30-17:30 Booked for formal contact sessions, semester tests and examination
CPS410	IT	Computer labs	Aspen Plus tutorials	100	8:30 to 9:30 Fridays
CPJ421	IT	Postgrad computer labs, study centre	Computer facilities for Design functions such as Aspen Plus and flow sheeting software	100+	All hours
CSS420 Analytical techniques	FMG, IAM South Campus, Microscopy Unit	Laboratories for microscopy, and thermal, physical & chemical analysis.	For demonstration of analytical equipment and selected had-on analyses.	<15	All hours
CSS420 Sustainable chemical engineering practices	None	None	Interactive lectures and a design-for-sustainability project	36	Scheduled lecture times
CSS420 polymer materials	None	None	Interactive lectures and a design-for-recycling project	50	Scheduled lecture times
CMO310	NW2 computer labs	Aspen Plus	Simulation	115	When needed

CPN321	Computer laboratories	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	Use of Python to solve systems of equations based on time-dependent continuity equations. Requires numerical integration and sets of non-linear algebraic equations.	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	7:30-17:30 Booked for formal contact sessions, semester tests and examination
CPB410	Computer laboratories	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	Use of Python and Modelica to solve systems of equations comprising of feedback control systems, including model-based controllers.	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	7:30-17:30 Booked for formal contact sessions, semester tests and examination
CBI310	Computer laboratories	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	Use of Python and Excel for solving linear algebraic equations and ordinary differential equations.	Laboratory 1: 96 computers Laboratory 2: 44 computers Laboratory 3 & 4: 58 computers	Booked for semester tests and examinations.
CLB321	Third year laboratory in Eng. II	General experimental laboratory with 4 duplicate experiments set up in the lab	To perform the experiments	120	Always available to us
CKN321	NW 2 Laboratories 1,2	Laboratory 1: 96 computers Laboratory 2: 44 computers Software used: Python Students use python as a calculation tool for the solution of reaction kinetic problems during the exam	Test and exams	120 students	To be arranged
CSC411	All Departmental laboratories in Eng. II and on South Campus, Building 2	In addition to common laboratories, i.e., "Third Year"-laboratory, students are allocated to smaller research laboratories, where the set up their equipment and/or use apparatus, including analytical equipment as and when required.	To perform experimental work & analyse results as required.	Various, depending on allocation. (3 - 120)	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Polymer Pilot Plant	Eng. Bld 2, 146 m²	For processing and analysis of materials and polymers on a larger than laboratory scale basis.	Approximately 10 positions for polymer and material processing equipment	Generally available 24/7, provided compliance with safety requirements after

					hours.
CSC411	Pyrotechnics Laboratory	Eng. Bld 2, R1-47 (R1-47.1), 44 + 13 m²	Development and testing of new pyrotechnic materials.	Four (4) workstations and an isolated testing area.	Restricted to trained staff and students only.
CSC411	Laser Laboratory	Eng. Bld 2, R1-54, 16 m²	Typically used for thermal analysis where rapid heating of small samples is needed.	One (1) workstation.	Restricted to trained staff and students only.
CSC411	IAM Wet Chemistry Laboratory	Eng. Bld 2, R1-58, 60 m²	Preparation area of low hazard materials used in Polymer Pilot Plant, Laser Laboratory and Pesticide Lab, as well as general wet chemistry.	Seven (7) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Pesticide Laboratory	Eng. Bld 2, R1-58.1, 16 m²	Primarily used for development of pesticides, repellents related formulations in the prevention of malaria.	Two (2) workstations.	Restricted to trained staff and students only.
CSC411	IAM Nano Technology Lab	Eng. Bld 2, R1-61, 46 m²	Investigative work in the toxicology and environmental hazards incurred from nano particles.	Six (6) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	IAM Emulsion Laboratory	Eng. Bld 2, R1-60, 38 m²	R & D on emulsion stability.	Five (5) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Precision Workshop	Eng. Bld 2, R1-66, 31 m²	Customised design and manufacturing of research equipment.	N/A	Restricted to trained staff and students only.
CSC411	Micro-Brewery	Eng. Bld 2, R1-67, 33 m²	R & D microbrewery in line with a sponsorship from SAB.	N/A	Restricted to trained staff and students only.
CSC411	Particle Technology Laboratory	Eng. Bld 2, R1-68, 145 m²	General wet chemistry related to specific material groups.	Twenty-four (24) workstations.	Generally available 24/7, provided compliance with

					safety requirements after hours.
CSC411	Double/Triple Volume Area	Eng. Bld 2, R1-77, 46 + 51 m² Level 1, R2-66, 46 + 51 m², R3-71, 46 m²	An area reserved for larger, multiple level apparatus such as separation columns, pyrolysis setups and fluidised beds.	N/A	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Tribology Laboratory	Eng. Bld 2, R1-76, 60 + 15 m²	R & D and analyses of the lubricity of fuels, lubricants and greases.	Seven (7) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Third year laboratory in Eng. II	Eng. Bld 2, R2-54, 191 m²	Workplace dedicated to experimental setups for the fundamentals of chemical engineering as well as for non-hazardous fourth year research projects.	Eleven (11) benches.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Communal Workshop	Eng. Bld 2, R2-56, 17 m²	Area used for general drilling, fitting and assembling of simple parts and apparatus.	N/A	Available on weekdays, 08:00 - 16:30
CSC411	Balance Room	Eng. Bld 2, R2-57, 12 m²	Area dedicated to housing balances of various mass ranges.	N/A	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Process Modelling and Control	Eng. Bld 2, R2-63, 106 m²	Laboratory for process modelling and control purposes.	Eight (8) workstations	Generally available 24/7, provided compliance with safety requirements after hours.

CSC411	FMG: Fluorine Laboratory	Eng. Bld 2, R3-47, 26 m²	Laboratory dedicated for experimental work involving fluorine and hydrofluoric acid.	Three (3) workstations.	Restricted to trained staff and students only.
CSC411	FMG: Plasma Laboratory	Eng. Bld 2, R3-48, 30 m²	Laboratory dedicated for experimental work involving plasma pyrolysis	Three (3) workstations.	Restricted to trained staff and students only.
CSC411	FMG: Wet Chemistry Laboratory	Eng. Bld 2, R3-49 + R3-49.1, 51 m²	Wet chemistry laboratory for experimental work involving fluorine containing compounds. NMR certificate of exemption for zirconium related work.	Three (3) workstations.	Restricted to trained staff and students only.
CSC411	Analytical Instrument Laboratory	Eng. Bld 2, R3-50 + R3-50.1, 85 + 13 m²	Area dedicated to housing analytical instruments such as ICP, TGA, FTIR, DSC etc.	Ten (10) workstations.	Restricted to trained staff and students only.
CSC411	Bio-Reaction Engineering	Eng. Bld 2, R3-61, 66 m²	R & D in bio-reactions and the production of chemicals based on bio-reactions.	Seven (7) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Bio-Reaction Engineering	Eng. Bld 2, R3-67,	R & D in bio-reactions and the production of chemicals based on bio-reactions.	Three (3) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Bio-Processing Laboratory	Eng. Bld 2, R3-66, 48 m²	R & D in processing of organic matter as alternative fuels.	Four (4) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Water Utilisation: Biotech Lab	SC, Bld 2, R1-12, 72 m²	Primarily used for water purification research involving algae.	Eight (8) workstations	Generally available 24/7, provided compliance with

					safety requirements after hours.
CSC411	Water Utilisation: Micro Lab	SC, Bld 2, R1-13, 20 m²	Growth of microbial organisms and related work.	Four (4) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Water Utilisation: Analytical Lab	SC, Bld 2, R1-15, 30 m²	Area dedicated to housing analytical instruments.	N/A	Restricted to trained staff and students only.
CSC411	Water Utilisation: Process Lab	SC, Bld 2, R1-23, 78 + 36 m²	Area used by undergraduate students for research projects.	Twelve (12) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Water Utilisation: Warm Room	SC, Bld 2, R1-24, 30 m²	Growth of microbial organisms and related work. Room controlled at 30 °C.	Eight (8) workstations	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Carbon Chair: Wet Chemistry Lab	SC, Bld 2, R1-5, 50 m²	General wet chemistry work within Carbon Chair.	Twelve (12) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Carbon Chair: Pilot Plant	SC, Bld 2, R1-6, 160 m²	Area for larger furnaces, presses and other equipment related to the Carbon Chair and polymer processing.	N/A	Generally available 24/7, provided compliance with safety requirements after hours.

CSC411	FMG: Fluoro-polymer Laboratory	SC, Bld 2, R2-1, 30 m²	Laboratory scale fluoro-polymer recycling facility	Three (3) workstations.	Generally available 24/7, provided compliance with safety requirements after hours.
CSC411	Carbon Chair: Thermal Analysis Lab	SC, Bld 4, R2-8, 25 m²	Area dedicated for thermal analysis equipment such as TGA, DSC etc.	N/A	Restricted to trained staff and students only.