



**Stellenbosch**  
UNIVERSITY  
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UNIVERSITEIT

**2026**

# **Engineering**

Academic programmes  
and faculty information

**Yearbook, Part 11**

## Accuracy, liability and changes

- Stellenbosch University has taken reasonable care to ensure that the information provided in the Yearbook parts is as accurate and complete as possible.
- Take note, however, that the University's Council and Senate accept no liability for any incorrect information in the Yearbook parts.
- The University reserves the right to change information in the Yearbook parts at any time if necessary.

## The division of the Yearbook

- The Yearbook is divided into 13 parts.
- Parts 1, 2 and 3 of the Yearbook contain general information applicable to all students. Make sure that you understand all provisions in Part 1 (General Rules) of the Yearbook that are applicable to you.
- Parts 4 to 13 of the Yearbook are the Faculty Yearbook parts.

| Part    | Yearbook                         |
|---------|----------------------------------|
| Part 1  | General Rules                    |
| Part 2  | Bursaries and Loans              |
| Part 3  | Student Fees                     |
| Part 4  | Arts and Social Sciences         |
| Part 5  | Science                          |
| Part 6  | Education                        |
| Part 7  | AgriSciences                     |
| Part 8  | Law                              |
| Part 9  | Theology                         |
| Part 10 | Economic and Management Sciences |
| Part 11 | Engineering                      |
| Part 12 | Medicine and Health Sciences     |
| Part 13 | Military Science                 |

## Availability of the Yearbook parts

- The electronic versions of the Yearbook parts are available at [www.su.ac.za/yearbooks](http://www.su.ac.za/yearbooks).
- Parts 1 to 12 are available in both English and Afrikaans. Military Science (Part 13) is only available in English.

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# How to use this Yearbook part

This section gives you guidelines for finding particular information in the different chapters in this Yearbook part. Consult the table of contents for the page numbers of the chapters referred to below.

## Where to find information

### Prospective undergraduate students

- The General Information chapter contains information about:
  - Communication with the Faculty and the University, which includes an explanation of the concepts "application number" and "student number" as well as relevant contact details where you can refer important enquiries to;
  - Language at the University;
  - The degree programmes that you can enrol for and the qualifications that you can obtain as well as important provisions relating to assessment;
  - Other rules that apply to all students; and
  - Awards and prizes available to engineering students.
- The Undergraduate Programmes chapter contains information about:
  - The minimum admission and selection requirements for the various study programmes;
  - Admission based on the recognition of prior learning;
  - The Faculty's undergraduate study programmes; and
  - The modules that must be taken per academic year for the different study programmes, with choices where applicable.
- The Undergraduate Subjects, Modules and Module Contents chapter contains:
  - An explanation of subjects as opposed to modules;
  - An explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter; and
  - Definitions of prerequisite pass, prerequisite and corequisite modules.
- An alphabetical list of undergraduate subjects and modules is available in the back of this Yearbook part.

### Prospective postgraduate students

- The General Information chapter contains information about:
  - Communication with the Faculty and the University, which includes an explanation of the concepts "application number" and "student number" as well as relevant contact details where you can refer important enquiries to;
  - Other rules that apply to all students in the Faculty; and
  - Awards and prizes available to engineering students.
- The Postgraduate Programmes chapter contains information about:
  - The Faculty's postgraduate study programmes;
  - The minimum admission requirements for the various study programmes;
  - Specific closing dates for applications, and other relevant information, for example selection for admission; and
  - The composition of programmes and examination requirements.

### Registered undergraduate students

- The General Information chapter contains information about:
  - Communication with the Faculty and the University with relevant contact details where you can refer important enquiries to;
  - Language at the University;
  - Other rules that apply to all students in the Faculty; and
  - Awards and prizes available to engineering students.
- The Undergraduate Programmes chapter contains information about:
  - The Faculty's policy on the granting of dean's concession assessments to final-year students;
  - The Faculty's undergraduate study programmes;

- The modules that must be taken per academic year for the different study programmes, with choices where applicable; and
- Renewing your registration as undergraduate student every year.
- The Undergraduate Subjects, Modules and Module Contents chapter contains:
  - An explanation of subjects as opposed to modules;
  - An explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter;
  - The abbreviations and definitions used for the teaching loads of individual modules;
  - An indication at each module of what its teaching load is;
  - Definitions of prerequisite pass, prerequisite and corequisite modules, as well as an indication at each module which of the requisites apply to it, if any; and
  - An explanation of how final marks are determined
- An alphabetical list of undergraduate subjects and modules is available in the back of this Yearbook part.

## **Registered postgraduate students**

- The General Information chapter contains information about:
  - Rules that apply to all students; and
  - Awards and prizes for engineering students.
- The Postgraduate Programmes chapter contains information about:
  - The Faculty's postgraduate study programmes;
  - Provisions relating to maximum periods of enrolment and the interruption of master's or doctoral studies; and
  - The composition of programmes and examination requirements.

# 1. General Information

## 1.1 How to communicate with the Faculty and the University

### 1.1.1 Prospective students

- The University allocates an application number to you (for example APP/1234567) when you apply to study at the University.
- The application number is a unique number to identify you and to simplify future communication with the University regarding all your programme applications in a given year.
- Use your application number every time you communicate with the Faculty or the University

### 1.1.2 Current or former Stellenbosch University students

- The University allocates a student number to you when you are admitted to a programme and register at the University.
- The student number is a unique number to identify you and to simplify future communication with the University.
- Use your student number every time you communicate with the Faculty or the University.

### 1.1.3 The Faculty's contact details

Direct communication with the Faculty to one of the following persons:

|                                                       |                        |
|-------------------------------------------------------|------------------------|
| <b>Dean</b>                                           |                        |
| <b>Prof JL (Wikus) van Niekerk:</b>                   | engdean@sun.ac.za      |
| Tel:                                                  | +27 (0)21 808 4204     |
| <i>For appointments contact Marilie Oberholzer:</i>   | marilie@sun.ac.za      |
| Tel:                                                  | +27 (0)21 808 9320     |
| <b>Vice-dean: Research and Industry Liaison</b>       |                        |
| <b>Prof CSL (Corne) Schutte:</b>                      | corne@sun.ac.za        |
| Tel:                                                  | +27 (0)21 808 3617     |
| <i>For appointments contact Marilie Oberholzer:</i>   | marilie@sun.ac.za      |
| Tel:                                                  | +27 (0)21 808 9320     |
| <b>Vice-dean: Teaching and Quality Assurance</b>      |                        |
| <b>Prof C (Celeste) Viljoen:</b>                      | engvdt teach@sun.ac.za |
| Tel:                                                  | +27 (0)21 808 3617     |
| <i>For appointments contact Marilie Oberholzer:</i>   | marilie @sun.ac.za     |
| Tel:                                                  | +27 (0)21 808 4203     |
| <b>Departmental Chairperson: Chemical Engineering</b> |                        |
| <b>Prof C (Christie) Dorfling:</b>                    | chemengchair@sun.ac.za |
| Tel:                                                  | +27 (0)21 808 3674     |
| <i>For appointments contact Francis Layman:</i>       | flayman@sun.ac.za      |
| Tel:                                                  | +27 (0)21 808 4062     |
| <i>For general enquiries:</i>                         | chemeng@sun.ac.za      |
| <i>For postgraduate enquiries:</i>                    | postgradchem@sun.ac.za |
| <b>Departmental Chairperson: Civil Engineering</b>    |                        |
| <b>Prof NPJ (Nico) de Koker:</b>                      | civilhod@sun.ac.za     |
| Tel:                                                  | +27 (0)21 808 4434     |
| <i>For appointments contact Alet Muller:</i>          | aletm@sun.ac.za        |
| Tel:                                                  | +27 (0)21 808 4440     |
| <i>For postgraduate enquiries:</i>                    | amandadw@sun.ac.za     |

| Departmental Chairperson: Electrical and Electronic Engineering                                                                                                                                             |                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>Prof JAA (Japie) Engelbrecht:</b>                                                                                                                                                                        | ee@sun.ac.za         |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 4936   |
| <i>For appointments contact Diana Kruger:</i>                                                                                                                                                               | dkruger@sun.ac.za    |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 4936   |
| <i>For postgraduate enquiries:</i>                                                                                                                                                                          | eepostgrad@sun.ac.za |
| Departmental Chairperson: Industrial Engineering                                                                                                                                                            |                      |
| <b>Prof J (Joubert) van Eeden:</b>                                                                                                                                                                          | industrial@sun.ac.za |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 3970   |
| <i>For appointments contact Karina Smith:</i>                                                                                                                                                               | ksmith@sun.ac.za     |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 4234   |
| <i>For postgraduate enquiries:</i>                                                                                                                                                                          | iepostgrad@sun.ac.za |
| Departmental Chairperson: Mechanical and Mechatronic Engineering                                                                                                                                            |                      |
| <b>Prof SJ (Johan) van der Spuy:</b>                                                                                                                                                                        | mmchair@sun.ac.za    |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 3742   |
| <i>For appointments contact Gillian Cortereal:</i>                                                                                                                                                          | gillianc@sun.ac.za   |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 4374   |
| <i>For postgraduate enquiries:</i>                                                                                                                                                                          | meganies@sun.ac.za   |
| Faculty Officer (student support)                                                                                                                                                                           |                      |
| <b>Ms N (Natalie) White</b>                                                                                                                                                                                 | natalies@sun.ac.za   |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 3614   |
| Faculty Administrator (enquiries relating to academic matters at the Registrar's division)                                                                                                                  |                      |
| <b>Ms N (Nicole) Hartzenburg:</b>                                                                                                                                                                           | nicolepa@sun.ac.za   |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 4835   |
| <b>Mr SN (Norman) Mabunda:</b>                                                                                                                                                                              | nmabunda@sun.ac.za   |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 9760   |
| Faculty Director                                                                                                                                                                                            |                      |
| <b>Mr VS (Enzo) D'Aguanno:</b>                                                                                                                                                                              | vsd@sun.ac.za        |
| Tel:                                                                                                                                                                                                        | +27 (0)21 808 4986   |
| Please visit the Faculty's website at <a href="http://www.su.ac.za/en/faculties/engineering">www.su.ac.za/en/faculties/engineering</a> , where the websites for each of the five departments are indicated. |                      |

## 1.1.4 The University's contact details for enquiries about your studies, bursaries and loans, and residence placements

E-mail: [info@sun.ac.za](mailto:info@sun.ac.za)

Telephone: 021 808 9111

Visit Stellenbosch University's website at [www.su.ac.za](http://www.su.ac.za).

## 1.2 Language at the University

Stellenbosch University (SU) is committed to engagement with knowledge in a diverse society and through the Language Policy aims to increase equitable access to SU for all students and staff. Multilingualism is promoted as an important differentiating characteristic of SU. Afrikaans, English and isiXhosa are used in academic, administrative, professional and social contexts. Pedagogically sound teaching and learning are facilitated by means of Afrikaans and English.

More information concerning language at SU is available on the website [www.su.ac.za/language](http://www.su.ac.za/language).

## 1.3 The engineering profession

### 1.3.1 Definition of engineering

The Engineering Council of South Africa (ECSA) describes engineering as the application of science, engineering science and technology to solve problems that are important economically and that are essential to the progress of society. The solutions must take into account the needs of society, sustainability and the protection of the physical environment. Engineering work requires management and communication, and must be conducted ethically and within the bounds of applicable legislation.

Engineering therefore involves activities, or contributions to activities, that serve economic, social or human needs. It includes:

- Designing and improving materials, components, systems or processes;
- Planning the capacity and location of infrastructure;
- Investigating, advising and reporting on engineering problems;
- Managing or operating plants and processes;
- Managing implementation or construction projects;
- Implementing designs or solutions;
- Research, development and commercialisation of products, and
- Education, training and development of engineering personnel.

### 1.3.2 The role of the professional engineer

Engineering is also a "profession" and, according to the rules of conduct for professional engineers registered with ECSA, registered persons should do the following in the execution of their engineering work:

- Apply their knowledge and skill in the interests of the public and the environment;
- Execute their work with integrity and in accordance with generally accepted norms of professional conduct;
- Respect the interests of the public and honour the standing of the profession;
- Strive to improve their professional skills and those of their subordinates;
- Encourage excellence within the engineering profession; and
- Not prejudice public health and safety.

Professional engineers are the senior partners in the engineering team, which consists of artisans or craftsmen (trained by means of an apprenticeship), technicians or technologists (trained at a university of technology) and professional engineers (trained at a university).

ECSA is vested with statutory powers in South Africa to lay down standards for education, and to register qualified persons as professional engineers. ECSA requires that engineering training prepares the graduates to solve "complex engineering problems", while technologists are trained to solve "broadly defined engineering problems" and technicians are trained to solve "well-defined engineering problems". The characteristics of complex engineering problems include:

- Their solution requires in-depth fundamental and specialised engineering knowledge.
- They can be ill-posed, under- or over-specified, or require identification and refinement.
- They can be on a high-level and involve unfamiliar or infrequently involved issues.
- Their solutions are not obvious and require originality or analysis based on fundamentals.
- Their solutions involve wide-ranging or conflicting issues including technical and interested or affected parties.

### 1.3.3 Registration as professional engineer

#### 1.3.3.1 What it means to register as professional engineer

By law, only persons registered as professional engineers with ECSA may use the title "PrEng". Registering as PrEng gives you a form of recognition that instils a sense of confidence in the mind of the public and clients, since they can be assured that your competence has been assessed by other professionals and that you are bound by a professional code of conduct. Registration as PrEng is a prerequisite for appointment to certain engineering positions and for doing certain engineering work.

#### 1.3.3.2 Requirements for registration

To register as a professional engineer, you must normally meet two requirements:

- You must hold a BEng or BScEng degree that has been accredited by ECSA for this purpose; and
- You must have completed a period of in-service training that satisfies ECSA's requirements in terms of standard and duration (at least three years).

#### 1.3.3.3 Accreditation of programmes by ECSA

ECSA has accredited all the BEng degrees of Stellenbosch University until 2023, when the Council will conduct its next regular accreditation visit, except for the BEng (Electrical and Electronic Engineering), which has been accredited until 2021. This programme's accreditation beyond 2021 is subject to an interim accreditation visit by ECSA in 2021.

### 1.3.3.4 International recognition of programmes

ECSA is a signatory of the Washington Accord and therefore the degrees accredited by ECSA for training professional engineers are recognised internationally by other signatories to the Accord. The training of BEng graduates from Stellenbosch University is therefore recognised for registration as professional engineer (or equivalent) in countries such as the United Kingdom, Ireland, Canada, the USA, Australia and Hong Kong.

## 1.4 The Faculty

This section gives a short overview of the Faculty as a whole, of the buildings housing the Faculty and of the Faculty's main organisational units. The departments of the Faculty are not included in this section since they are discussed in Section 1.5.

### 1.4.1 History

Established in 1944, the Faculty of Engineering was the first Afrikaans engineering faculty in South Africa, and it produced its first graduates in 1945.

Originally there were only three departments of engineering, namely Civil, Mechanical and Electrotechnical Engineering, and the Department of Applied Mathematics. The Departments of Chemical and Metallurgical Engineering and Industrial Engineering were added later, and in 1994 the Departments of Chemical and Metallurgical Engineering were amalgamated into one department, the Department of Chemical Engineering. At present there are five departments in the Faculty, namely Civil Engineering, Electrical and Electronic Engineering, Industrial Engineering, Mechanical and Mechatronic Engineering, and Chemical Engineering.

### 1.4.2 Engineering building complex

The current building complex in Banghoek Road, Stellenbosch, was completed in the seventies and since then it has been expanded from time to time; for example, when the Knowledge Centre was added in 2012. The figure below shows an aerial photograph of the building complex.



**Figure 1.1:** The building complex of the Faculty of Engineering (the numbers are used in the descriptions below).

The buildings in Figure 1.1, and the units housed by each, are:

1a,b: General (Main) Engineering Building

- Various lecture halls and tutorial rooms
- Dean's Division of the Faculty of Engineering
- Applied Mathematics and Computer Science Divisions of the Department of Mathematical Sciences, Science Faculty
- Engineering Study Centre (open-plan study area and eight groupwork rooms)
- Cafeteria

- 1c: Engineering Knowledge Centre
  - Two large lecture halls
  - The Engineering and Forestry Library, a branch of the main University library
  - Two research units
- 2: Industrial Engineering Building
  - Industrial Engineering's computer-based classrooms
  - Department of Industrial Engineering
- 3: Mechanical and Mechatronic Engineering Building
  - Faculty of Engineering Computer User Area (FIRGA) and computer-based classrooms
  - Department of Mechanical and Mechatronic Engineering and its laboratories
  - Department of Industrial Engineering laboratories
  - Schools Centre
- 4: Chemical Engineering Building
  - Various lecture halls and tutorial rooms
  - Department of Chemical Engineering and its laboratories
- 5: Electrical and Electronic Engineering Building (being refurbished in 2023)
  - Various lecture halls and tutorial rooms
  - Department Electrical and Electronic Engineering and its laboratories
- 6: Civil Engineering Building
  - Various lecture halls and tutorial rooms
  - Department Civil Engineering and its laboratories

### 1.4.3 Faculty of Engineering Computer User Area (FECUA)

FECUA is situated on the first three floors of the Mechanical and Mechatronic Engineering Building. These new and expanded facilities consist of a general users' area with 289 desktop computers, as well as three electronic classrooms respectively with 239, 118 and 115 desktop computers. All the desktop computers provide access to the Internet and sophisticated software.

FECUA supports the academic activities of all engineering students. It offers facilities for field-specific tasks like numerical and digital modelling and computer-aided engineering, as well as for more general activities such as access to SUNLearn (the University's platform that provides Internet access to academic information), e-mail, and creating and storing documents like assignments and theses.

### 1.4.4 SET Outreach Programme

The Faculty of Engineering hosts a SET outreach programme that offers schools programmes to stimulate interest in science, mathematics, and technology and to promote skills development among learners and teachers. TRAC is a national programme that focusses on physical science and applied mathematics and motivates learners from secondary schools to study in SET directions at a tertiary level ("SET" stands for "science, engineering and technology"). The programme uses computer technology to reinforce scientific concepts. TRAC's several laboratories are visited daily by learners and their teachers, and TRAC facilitators visit schools with mobile facilities that simulate the laboratory environment. Further details can be found at <https://tracsouthafrica.co>.

## 1.5 Departments and engineering disciplines

This section describes the different engineering disciplines under the department in which they are offered.

### 1.5.1 Department of Chemical Engineering

The degree programmes in chemical engineering are hosted by the Department of Chemical Engineering.

#### What chemical engineering entails

Chemical engineering involves the large-scale operation of processes by which various consumer products are produced, such as chemicals, pharmaceutical products, fertilisers, fuels, metals and other materials. Chemical engineers are also involved where effluents and waste materials are processed and recycled. The processes used range from simple physical separations, such as distillation, evaporation, drying or filtration, to complex chemical synthesis.

## Knowledge and skills you can gain from this programme

The programme in chemical engineering equips you with a thorough knowledge of the fundamental sciences of mathematics, physics and chemistry, as well as thermodynamics, reaction kinetics, mass transfer, reactor design, separation processes, control systems and plant design.

## Career opportunities for chemical engineers

In practice, chemical engineers develop, design, construct and/or operate the processes described above on an economical basis. They work in a wide range of concerns, from large multinational companies to small consultation partnerships.

Chemical engineers, who specialise in mineral processing, play an important role in the mining industry and in metallurgic plants for the production of metals and minerals from ore.

## Departmental laboratories

The Department has pilot-plant facilities, general laboratories for bioprocess engineering, extractive metallurgy, separation technology and water treatment, as well as a computer centre for process simulation and data processing.

## 1.5.2 Department of Civil Engineering

The degree programmes in civil engineering are hosted by this department.

### What civil engineering entails

Civil engineers are responsible for large, permanent works such as irrigation systems, bridges, dams, harbours, canals, airports, roads and streets, pipelines, sewerage systems, railways, structures of various kinds and structure foundations, storm water systems, tunnels, towers, water supply systems, and various kinds of heavy construction work. Through their work they re-create, improve and conserve the environment, and provide the facilities required for efficient community life.

## Knowledge and skills you can gain from this programme

During the first two years of study, a sound foundation is laid in mathematics, chemistry and the engineering sciences. The third and fourth years of the programme progress into specialist areas such as water engineering, structural engineering, transportation engineering and geotechnical engineering. Subjects such as Environmental Engineering and Engineering Management give you a wide frame of reference. In engineering informatics for civil engineers, you develop the ability to use the computer as a powerful aid in solving civil engineering problems.

## Career opportunities for civil engineers

Civil engineers are responsible for the development, planning, design, construction, maintenance and/or operation of large-scale projects. There are various career opportunities in the public and private sectors, from local authorities to government departments, and from consulting firms to construction firms. Several South African civil engineering firms are active internationally, and some are part of large global companies.

## Departmental laboratories

The Department has irrigation, geotechnical, transport, water, concrete, heat transfer, solar energy, strength of materials and structures laboratories, as well as departmental computer facilities.

## 1.5.3 Department of Electrical and Electronic Engineering

The degree programmes in electrical engineering and electronic engineering are hosted by this department.

### What electrical engineering and electronic engineering entail

**Electrical engineers** are responsible for the generation, transmission and conversion of electrical energy (including renewable energy sources) in industrial settings, such as electricity supply, factories, chemical plants, mines, municipalities, railways, and harbours.

**Electronic engineers** specialise in:

- the control of electrical and mechanical robotic systems, particularly embedded controllers;
- the collection, processing and dissemination of information by computer and communication networks, such as cell phone networks, Wi-Fi and mobile data networks; and
- the design of computers and large software systems.

## Knowledge and skills you can gain from this programme

The first part of the programme lays a foundation of mathematics, natural sciences and engineering sciences that is relevant for all electrical and electronic engineers, particularly the techniques required to model systems analytically and design systems systematically. From the second semester of the third year, you can choose to specialise in one of the following elective areas: robotics, electrical energy, telecommunication or informatics.

## Career opportunities for electrical and electronic engineers

Electrical and electronic engineers are responsible for the development, manufacturing and/or operation of various products or systems. There are numerous employment opportunities in the public and private sector, from local authorities to information technology companies, and from large multinational companies to small specialist companies. This technical area offers many opportunities for entrepreneurs to create new high-technology small businesses.

### Departmental laboratories

The Department has laboratories for antennas, control systems, radio and microwave technique, micro-electronics, electronics, electrical circuits, electrical machines, high voltage technique, computer systems, satellite systems and numerical signal processing.

## 1.5.4 Department of Industrial Engineering

The degree programmes in industrial engineering and engineering management are hosted by this department. Please note that engineering management is only offered at postgraduate level.

### What industrial engineering and engineering management entail

**Industrial engineering's** main branches are manufacturing technology and operational systems design. Industrial engineering involves facets of industry that are important in the modern industrial and service environments, such as quality assurance, robotics, engineering economics, operations research, data science, industrial ergonomics and information technology.

**Engineering management** is a specialist area in industrial engineering in which engineering principles are applied to business practices to manage technology or technical processes in enterprises. The contribution of technology in realising the company's strategy is also emphasised.

### Knowledge and skills you can gain from these programmes

The **industrial engineering** programme is an interdisciplinary programme in which training in several applied sciences, for instance mechanical, mechatronic, electrical and electronic engineering, together with economic management, natural sciences, information technology and operational research, are combined as a unit for the design and operation of various operational systems. This programme also particularly trains you to use computers in decision-making for enterprise management.

**Engineering management** requires multi-disciplinary coordination of inputs and contributions from several engineering disciplines, as well as other specialist areas such as project management, risk management, quality management, performance management and feasibility studies.

### Career opportunities for industrial engineers and engineering managers

An industrial engineer's daily tasks involve a great variety of creative activities, especially in modern manufacturing and service industries. An individual industrial engineer's work covers a selected part of a wide spectrum that starts at the design stage, concentrates on the manufacturing or delivering stages (where attention is particularly focussed on planning, efficiency and productivity), and concludes with marketing. Industrial engineers and engineering managers often work in large companies, or offer consulting services to large companies, but many are also responsible for the operation of small enterprises.

### Departmental laboratories

The Department has the following laboratories: rapid product development laboratory, reverse engineering laboratory, three laboratories with advanced computer facilities, quality control laboratory and metrology laboratory.

## 1.5.5 Department of Mechanical and Mechatronic Engineering

The degree programmes in mechanical engineering and mechatronic engineering are hosted by this department.

### What mechanical engineering and mechatronic engineering entail

**Mechanical engineering** is characterised by motion and energy transfer, for example in vehicles, aeroplanes, vessels, missiles, cooling systems, power stations and engines. It also covers machines used in all branches of the economy, for example in process plants and the manufacturing industries.

**Mechatronic engineering** is a combination of precision mechanical engineering, electronics and computer systems. A typical mechatronic system closely integrates mechanical components, electronic sensors, mechanical and electrical actuators and computer controllers. Examples of mechatronic systems are electronic engine control systems, robot systems and automated assembly lines.

### Knowledge and skills you can gain from these programmes

The specialist knowledge these programmes offer you is built on a basis of mathematics, physics and chemistry.

For **mechanical engineering**, the specialist knowledge areas include heat transfer, fluid mechanics, structural mechanics, dynamics and mechanical design. In your final year, you can choose one of three

elective modules; these are finite element structural analysis, computational fluid dynamics and maintenance science. You are also exposed to some of the key elements of mechatronic engineering.

The **mechatronic engineering** programme consists of modules from the BEng (Mechanical) and BEng (Electrical and Electronic) programmes. The emphasis in the programme is on mechatronics, control systems, machine design, electronics and computer systems.

### Career opportunities for mechanical and mechatronic engineers

The multi-faceted training of **mechanical engineers** leads to various professional careers that usually include the development, manufacturing and/or operation of products and systems. Mechanical engineers work in the whole range of companies, from large multinationals to smaller consulting partnerships.

Although mechatronic engineering is one of the smaller engineering disciplines in South Africa, there is a sustained demand for mechatronic engineers. Some **mechatronic engineers** work for large multinational corporations, but the diverse education of mechatronic engineers is sought after in smaller engineering concerns and serves as an excellent base for entrepreneurs. Mechatronic engineers are usually closely involved in the development or operation of systems that contain mechanical, electronic and/or electrical subsystems.

### Departmental laboratories

The Department has various wind tunnels, internal combustion engine testing cells, a towing tank for ship model tests, a test area for structures, and automation and biomedical engineering laboratories, as well as computer facilities for massive parallel computing in computational fluid dynamics and finite element structural analysis.

## 1.6 Rules of the Faculty

This section outlines faculty-specific rules that apply both to undergraduate and to postgraduate students. Rules that apply only to undergraduate or only to postgraduate students can be found in the chapters in this part of the Yearbook that deal specifically with undergraduate and postgraduate programmes. You can find university-wide rules in Part 1 (General Rules) of the University Yearbook.

Please also refer to the following two Faculty documents. These two documents are available to students on the SUNLearn pages of all modules offered by the Faculty of Engineering and, to staff, on the document archive (SharePoint):

- Assessment Rules
- General Stipulations for Under- and Postgraduate Modules

In addition to the two documents named above, the ones in the list below are referred to in this Yearbook part and are available to staff on SharePoint. If you are a current or prospective postgraduate student, you can use the e-mail address at "Postgraduate enquiries" under your current or prospective home department in Section 1.1.3 to request access to these documents. Current and prospective undergraduate students should please contact the Faculty Officer (see Section 1.1.3 above for contact details).

- RPL/CAT Procedures for the Faculty of Engineering
- Postgraduate Processes for the Faculty of Engineering

### 1.6.1 Provisions relating to assessment

- Each item that you submit for assessment (and which may contribute to determining a final mark), must be your own work. No part of it may have been done by another person. The exception is where the relevant lecturer gave written consent that you may use the work of your team members for the item in question.
- If you wish to dispute an assessment's mark, you must first approach your lecturer in this regard and, if necessary, thereafter the departmental chairperson. In all cases, you must do this **within seven calendar days** after the mark has been disclosed. No representations will be considered after this deadline.

### 1.6.2 Absence from assessments

If you were unable to write a test or submit an assessment because you were ill or had any other certifiable reason, the measures in Part 1 (General Rules) of the University Yearbook apply.

### 1.6.3 Academic work during vacations

The following applies to postgraduate and final-year undergraduate students:

- Over and above the time that is allocated for it in the timetable, you may be expected to work on your project, research assignment, thesis or dissertation in the laboratories of your home department during the University vacation.

## 1.6.4 IT-infrastructure

The Faculty's information technology infrastructure is mainly based in the Faculty of Engineering Computer User Area (FIRGA). See Section 1.4.3 above for more on FIRGA.

### 1.6.4.1 Responsibility to read e-mails regularly

The Faculty and the University expect you read all e-mail sent to your University e-mail account regularly (typically daily during the academic year). Important information is sent to these e-mail addresses. It is also important to read these e-mails from time to time during recess periods, particularly the week before lectures recommence.

### 1.6.4.2 Annual levy

To be permitted to use the Faculty's IT infrastructure you must pay a levy each year. All engineering students pay this levy, except for a few postgraduate students who do not study on campus and who are specifically exempted from this obligation.

### 1.6.4.3 Connecting your own hardware to the University IT network

You may only connect hardware that has been approved by the University's Information Technology Division to the University's IT network.

### 1.6.4.4 User area etiquette

Among other things, do the following to show consideration for other users of the communal computer user areas:

- Keep all workstations in the general computer user areas clean and tidy, as you would like to find it.
- Complete the fault report forms, which are kept in the front of the room, so that faulty equipment can be attended to as soon as possible.
- Do not allow long programs to run unattended while you leave a message that the computer must be left alone.
- Make positive suggestions to the manager of FIRGA that will improve the functionality of the system.

### 1.6.4.5 E-mail and network etiquette

Among other things, do the following to show consideration for other e-mail and network users:

- Provide a descriptive title for each e-mail that you send.
- Keep active the setting which automatically sends a read receipt to the sender – confirmation that you have received the message is very useful to the sender because it indicates that your reaction or answer can be expected.
- Read your e-mail regularly and answer all e-mails that are addressed to you personally and that are not intended for general distribution.
- Use proper language and avoid aggression in messages.
- Do not attach large files to e-mails; it misuses disc space. Rather use web facilities (such as Google Drive or Dropbox) to transfer large files.
- Do not use the University's e-mail system for non-academic purposes such as giving notice of bazaars, concerts, etc.

### 1.6.4.6 Misuse of the IT infrastructure

You are strictly forbidden to misuse the IT infrastructure. You misuse the IT infrastructure when you:

- interfere with other students' access to or use of the IT infrastructure. This includes occupying a computer in a computer users' area without using it for university-related purposes.
- access computers or servers in an unauthorised way.
- use software programs in an unauthorised way or use illegal software.
- copy computer programs that you are not authorised to copy or violate copyright.
- access in an unauthorised way and/or copy or change system files, including configuration, user and password files.
- harass others by displaying indecent material or sending unwelcome messages.
- intercept network traffic and wrongfully read e-mail.
- commit any form of fraud via the network, which includes using another person's password.
- play computer games on the network.
- perform any action resulting in the system being overloaded with information, for example sending chain letter messages and spam.

## 1.7 Awards and prizes

In this section you will find a description of the most important awards and prizes that are unique to the Faculty of Engineering. Please refer to Part 2 of the University Yearbook for details regarding other prizes and bursaries that you may be eligible for as an engineering student.

### 1.7.1 Faculty-wide

In Appendix A you will find the names of past recipients of faculty-wide awards.

#### 1.7.1.1 The Dean's Award for Outstanding Achievement

The Faculty awards the Dean's Award for Outstanding Achievement to a student whose undergraduate, as well as postgraduate, performance has been outstanding, similar to recipients of the Chancellor's Medal. The period of study that will be taken into account is usually limited to eight consecutive years of study. To qualify for this award, you must have an excellent academic record and you must also have excelled as a researcher. You must typically have had at least one journal article that you are the main author of accepted for publication by a reputable international journal, and you must have contributed to the published proceedings of one or more international conferences.

The award comprises a silver medal and a cash prize. The departments nominate candidates and the Faculty Committee decides who receives the award. The award will not necessarily be awarded every year.

#### 1.7.1.2 The ECSA Medal of Merit

The Faculty awards the ECSA Medal of Merit to the most deserving BEng graduate in the Faculty.

#### 1.7.1.3 The Jac van der Merwe Prize for Innovation

The Faculty awards the Jac van der Merwe Prize for Innovation to a BEng final-year student whose project or thesis affords the greatest evidence of ingenuity or originality of thought. MultiChoice sponsors this prize of R30 000.

#### 1.7.1.4 Lecturer of the Year

With this award, in the form of a medal, the Faculty recognises contributions over a broad range of activities, including:

- good teaching,
- a formative influence on the Faculty's students,
- a contribution to the development of the Faculty's programmes and/or laboratories, and
- the development of the Faculty in other respects.

The departments nominate candidates each year and the Faculty Committee makes the award on the grounds of the motivations submitted by the departments.

#### 1.7.1.5 Upcoming Researcher of the Year

This award, in the form of a medal, goes to a lecturer or researcher who has made exceptional progress in the field of research over the past few years. The Research Advisory Committee recommends this candidate to the Faculty Committee and the Faculty Committee endorses the award.

#### 1.7.1.6 Annual Teaching Excellence Awards

This award, in the form of a certificate, goes to a lecturer or a team of lecturers who have greatly contributed to enhancing students' learning over the past few years, through a scholarly approach to teaching. The Faculty's nominations for similar University and national awards are normally selected from the nominees for the Faculty award. A panel appointed by the Dean, after consultation with the Faculty's Management Committee, evaluates candidates' teaching portfolios and then chooses the recipients of the Faculty's award, as well as the Faculty's nominees for the University and national awards.

#### 1.7.1.7 Annual Awards to Administrative and Technical Support Staff for exceptional performance

These awards, each in the form of a medal and a once-off cash award, go to candidates who, over a period of time, have made consistent and impactful contributions towards the efficient and effective functioning of the department or division concerned, as well as generally.

Each department and the Dean's Division may each year nominate one person per category by means of a written motivation. The Faculty's management committee considers the written motivations and vote to select the awardees.

### 1.7.1.8 Honorary Member of the Faculty

This award, in the form of a certificate, may be awarded each year to up to three people from outside the Faculty, who have rendered outstanding service to the Faculty over a long period of time and who have promoted the Faculty's interests.

The departments nominate candidates and the Faculty Committee makes the award on the grounds of the motivations provided by the departments.

The awards are announced at the meeting of the Faculty Advisory Board and the certificates are handed over at an Advisory Board meeting or other suitable occasion.

## 1.7.2 Chemical Engineering

- The Department of Chemical Engineering Prize for the best third-year student.
- The SAIMM Prize for the best third-year student in Mineral Processing.
- The Elton Thyse Award for the best student in extractive metallurgy.
- The Christoff Smith Prize for the best student in bioprocess engineering.
- The Stone Three Award for the best final-year student in process control.
- The Stone Three Award for the best final-year student in process design.
- The Department of Chemical Engineering Prize for the best final-year project poster.
- The departmental nominee for the Jac van der Merwe Prize for the most innovative final-year project.
- The SAIMM Prestige Prize for the student with the best final-year project in Mineral Processing.
- The Minerals Education Trust Fund Prize for the best final-year project.
- The Department of Chemical Engineering Prize for the final-year student with the highest average over four years.
- The Chairman's Award for a noteworthy contribution by a final-year student.
- The SAICHe Silver Medal for the best final-year student in the Department of Chemical Engineering.
- The SAPPI SA Prize for the best MEng student.
- The Department of Chemical Engineering Prize for the best PhD student.

## 1.7.3 Civil Engineering

- The Albert Rooseboom Prize for the most deserving final-year student in Advanced Design (Hydraulics).
- The Bergstan South Africa Prize for the best first-year student in Civil Engineering.
- The Bergstan South Africa Prize for the best second-year student in Civil Engineering.
- The Bergstan South Africa Prize for the best third-year student in Civil Engineering.
- The Concrete Society SA Prize for the best thesis, or the most deserving student in concrete technology.
- The best student(s) in the respective postgraduate fire engineering modules.
- The most deserving thesis in Fire Safety or Structural Fire Engineering.
- The GIBB Engineering and Science Prize for the most deserving student in Advanced Design (Transportation, Geotechnique or Engineering Management).
- The GLS Prize for the best thesis/dissertation in water engineering.
- The Haw & Inglis Construction (Pty) Ltd Prize for the best master's student in Civil Engineering.
- The HL Reitz Medal and the AECOM Prize for the best postgraduate student in Civil Engineering.
- The ITS Prize for the best final-year project in road safety.
- The Mariswe (Pty) Ltd Prize for the best final-year student in Transportation Engineering.
- The Melis & Du Plessis Prize for the most deserving undergraduate or postgraduate student in Geotechnique.
- The Peter Dunaiski Prize for the most deserving student in Advanced Design (Structural Engineering).
- The Pretoria Portland Cement Prize for the most deserving work in the field of concrete engineering.
- The SA Institute of Steel Construction Prize for the most deserving student in Steel Construction.
- The SANRAL Prize for the best final-year project in pavement engineering.
- The Western Cape Branch of SAICE Prize for the student who has contributed most to the advancement of Civil Engineering.

- The WML Coast Consulting Engineers Prize for the most deserving postgraduate student in Port and Coastal Engineering.
- The WSP Group (Pty) Ltd Prize for the most deserving final-year student in Hydraulic Engineering.
- The Zutari Prize for the best final-year project in Civil Engineering.
- The Zutari Prize for the most deserving student in Environmental Engineering.
- The Zutari Prize for the most deserving student in Transport Science.
- The Zutari Prize and the Marius Louw Medal for the best final-year student in Civil Engineering.

## 1.7.4 Electrical and Electronic Engineering

Merit certificates are awarded to students who:

- pass a specific undergraduate year with an average above 75%.
- obtain an undergraduate degree with distinction.
- obtain a postgraduate degree or diploma with distinction.

Departmental prizes are awarded for the following achievements:

- The best E&E student in Design E 314.
- The best E&E student in Design E 344.
- The best final year student in the Electromagnetics and Telecommunications focus area.
- The best final year student in the Informatics focus area.
- The best final year student in the Energy focus area.
- The best final year student in the Robotics focus area.
- The best final year student in the Data Engineering focus area.

## 1.7.5 Industrial Engineering

Prizes are awarded for the following achievements:

- The highest average in the first year.
- The highest average in the second year.
- The second-highest average in the third year.
- The highest average in the third year.
- The highest average in the fourth year.
- The final-year student with the highest average over four years.
- The best student over four years in mathematical and operational research subjects.
- The best student over four years in information systems and programming.
- The highest average in Enterprise Design.
- Student nomination: "Who will be the most successful engineer in future?"
- Lecturers' nomination: "Makes Industrial Engineering visible on campus."
- The student who, in the face of adversity or personal challenges, showed grit and determination to complete their studies and become an industrial engineer.
- The best final-year railway project.
- The best final-year project in health systems engineering and innovation.
- The best industrial project that uses aluminium.
- The best system optimisation industrial project.
- The best decision support project.
- The project with the most sophisticated modelling approach.
- The SUnORE bursary for the best industrial project by a SUnORE student who plans to enrol for a master's degree in the following year.
- The best project on additive manufacturing.
- The best industrial project in the field of strategy and/or innovation.
- Industrial project runner-up.
- The best final-year project
- The best postgraduate project in physical asset management.
- The best master's degree project in health systems engineering and innovation.
- The best postgraduate project that involved or utilised 3D printing.
- The best postgraduate project using optimisation methods.
- The best master's and doctoral degree project related to start-ups, venture building and entrepreneurship.

- The most versatile postgraduate student.
- The best overall postgraduate student.
- The best thesis and dissertation project: South African Institute for Industrial Engineering (SAIIE).

## 1.7.6 Mechanical and Mechatronic Engineering

- The AAT Composites Prize for the best final-year project in composite materials.
- The Aluminium Federation of South Africa's Prize for the best final-year project with aluminium.
- The Arthur Child Award for an exceptional postgraduate student in aeronautics.
- The Autodesk Prize for the best use of CAD (Inventor) in a final-year project in Mechanical or Mechatronic Engineering.
- The Centre for Renewable & Sustainable Energy Prize for the best final-year project in renewable energy.
- The Centre for Renewable & Sustainable Energy Prize for the best postgraduate project in renewable energy.
- The Chairperson's Prize awarded to an undergraduate or postgraduate Mechanical or Mechatronic Engineering student for an outstanding achievement as decided by the chairman and lecturers of the Department.
- The Clifford Machines & Technology Prize for the best second-year Mechatronic Engineering student.
- The Clifford Machines & Technology Prize for the best third-year Mechatronic Engineering student.
- The Freddy-Neaves Prize for the most innovative mechanical or mechatronic final-year project in the field of digital image correlation.
- The GeoSUN Prize for the best final-year project in solar or wind energy.
- The Gibela Research Chair Award for the best final-year railway project.
- The HH Industries Prize for the best final-year project that involved or utilised 3D printing.
- The Institute for Biomedical Engineering Prize for the best final-year project in biomedical engineering.
- The Institute for Biomedical Engineering Prize for the best postgraduate student in biomedical engineering.
- The John Thompson Prize for exceptional performance in Mechanical or Mechatronic Engineering.
- The John Thompson Prize for the best final-year project in thermal energy systems.
- The Kelvion Prize for the best second-year student in Mechanical Engineering.
- The Kelvion Prize for the best third-year student in Mechanical Engineering.
- The Kelvion Prize for the best third-year student in Mechanical Engineering in design.
- The Kröger Book Prize for the best final-year project in the field of thermodynamics or heat transfer.
- The MK Aerospace Prize for the best final-year student in Mechanical Engineering.
- The MK Aerospace Prize for the best postgraduate student in Mechanical Engineering.
- The MMW Prize for the most outstanding final-year student in the laboratory environment.
- The MMW Prize for the most outstanding postgraduate student in the laboratory environment.
- The prize for the group with the best project in Machine Design B 344.
- The prize for the group with the best project in Mechatronics 434.
- The Qfinsoft Prize for the best final-year project that uses Ansys CFD/Ansys Mechanical software.
- The Qfinsoft Prize for the best postgraduate project that uses Ansys CFD/Ansys Mechanical software.
- The Qfinsoft Prize for the best PhD dissertation that uses Ansys CFD/Ansys Mechanical software.
- The Route Management Prize for the best master's research thesis in mechanical design.
- The Route Management Prize for the best PhD in mechanical design.
- The SAIMEchE prizes for the best final-year project presentation in each of Mechanical Engineering and Mechatronic Engineering.
- The SAIMEchE Shield, which is shared by the best final-year project in each of Mechanical Engineering and Mechatronic Engineering.
- The Siemens Prize for the best use of Siemens Technology in a final-year project.
- The Simera Prize for the best progress in a final-year project by the middle of the year.
- The Simera Prize for the most independent and innovative student for practical work in the structures laboratory.
- The SIMTEQ Prize for the best use of finite element analysis (structural analysis for stress, deflection, vibration) in a final-year project.

- The SIMTEQ Prize for the best use of mechanical design for electronics (noise, heat, vibration) in a final-year project.
- The SIMTEQ Prize for the best multibody dynamic simulation (any mechanism or moving parts) in a final-year project.
- The SIMTEQ Prize for the best implementation of machine learning or artificial intelligence in any multibody dynamic simulation in a final-year project.
- The TFDesign Prize for the best final-year student in Mechatronic Engineering.
- The TFDesign Prize for the best postgraduate student in Mechatronic Engineering.
- The Triz Engineering Prize for the best final-year project focused on MATLAB/Simulink or Octave, the open-source equivalent of MATLAB.
- The Vibration & Acoustics Prize for the best final-year project in this field.

## 2. Undergraduate Programmes

### 2.1 Qualifications and fields of study

#### Qualification awarded by the Faculty

The Faculty awards the following undergraduate qualification:

- BEng: Bachelor of Engineering

The BEng degree is the basic qualification in engineering that leads to registration as a professional engineer.

#### Fields of study

The BEng degree may be awarded in the following fields of study:

- Chemical Engineering
- Civil Engineering
- Electrical and Electronic Engineering
- Industrial Engineering
- Mechanical Engineering
- Mechatronic Engineering

#### Programmes in each field of study

The Faculty offers two degree programmes in each field of study, namely:

- a four-year degree programme, BEng (4yr)
- a five-year extended curriculum programme, BEng (ECP)

If you have an inadequate school background, the BEng (ECP) can help you to master a BEng programme. Each BEng (ECP) begins with a transition year, which is not part of the four-year BEng. After the transition year, you will follow the normal curriculum of the BEng (4yr) in your chosen field. A BEng (ECP) therefore gives you an alternative access route to the BEng programmes in the Faculty of Engineering.

### 2.2 ECSA accreditation

All off the Faculty's four-year and extended BEng programmes are accredited by the Engineering Council of South Africa (ECSA) for registration as professional engineer. This means that all the programmes include at least the required number of credits per ECSA knowledge area and develops and assesses all the ECSA exit level outcomes. If you complete a BEng programme, you will meet the ECSA requirements for engineers, irrespective of the electives you chose.

### 2.3 Undergraduate enrolment management

The University Council sets targets regarding the fields of study and diversity profile of the student body of Stellenbosch University, as well as the total number of students at the University. The University then manages all the enrolments from prospective undergraduate students to reach these targets and to ensure that the total number of enrolments is within the available capacity. This means that there may be students who meet the admission requirements for a given programme but are not admitted.

The following points of departure apply when undergraduate enrolments are managed:

- Establishing an equitable, transparent and reasonable process for admission to undergraduate and postgraduate programmes.
- Contributing to the creation of an inclusive student community, where diversity is regarded as an asset.
- Attracting and admitting academically excellent students.
- Admitting prospective students who have the potential to graduate successfully and to be well-equipped thought leaders for the future.
- Offering equal opportunities to prospective students who are equally situated, and facilitating redress where individuals or categories of people were or still are disadvantaged due to past unfair discrimination.

## 2.4 How to be admitted to a BEng programme

### 2.4.1 Applicants with no prior tertiary learning

This section applies to you if you have never studied at a traditional university or university of technology before, or if you have studied in a completely unrelated field, like theology, for which you cannot get recognition of prior learning. For more on admission based on the recognition of prior tertiary learning, see Section 2.4.2 below.

#### 2.4.1.1 Admission requirements for BEng (4yr) and BEng (ECP)

The table shows the admission requirements for all the BEng programmes (4yr and ECP) for students starting in BEng studies from 2021 onwards. The percentages shown in the table are the percentages achieved in the applicable school final examination.

| BEng (4yr)                                                                                                                                                                                                                                                                                                                                    | BEng (ECP) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| National Senior Certificate with admission to bachelor's studies, or an exemption certificate issued by the Matriculation Board                                                                                                                                                                                                               |            |
| An average, using the six best matric subjects (excluding Life Orientation and Mathematical Literacy), of at least:                                                                                                                                                                                                                           |            |
| 70%                                                                                                                                                                                                                                                                                                                                           | 60%        |
| Mathematics with at least:<br>70%<br>(or in the Senior Certificate Examination before or in 2007, Mathematics HG: at least a B)                                                                                                                                                                                                               | 60%*       |
| Physical Sciences with at least:<br>60%<br>(or in the Senior Certificate Examination before or in 2007, Physical Science HG with at least a C)                                                                                                                                                                                                | 50%*       |
| English Home Language: 50%, with no Afrikaans requirement; or<br>English First Additional Language: 60%, with no Afrikaans requirement; or<br>English First Additional Language: 50%, together with Afrikaans Home Language: 50%; or<br>English First Additional Language: 50%, together with Afrikaans 2 <sup>nd</sup> Additional Lang.: 60% |            |

\* Only students who have recently passed Matric are considered for the ECP.

Prospective students who meet the above admission requirements must also be selected before they can be admitted. See Section 2.4.1.2 below for the selection process for the BEng (4yr) and Section 2.4.1.3 below for the selection process for the BEng (ECP).

#### 2.4.1.2 Selection process for BEng (4yr)

##### 2.4.1.2.1 Measures used for selection

- The **selection score** is the most important measure used by the Faculty for selecting students for BEng programmes. This score is calculated as follows:  

$$\text{Selection score} = \text{Mathematics mark} + \text{Physical Sciences mark} + 6 \times \text{Matric average}$$
  - The percentages you obtained in Mathematics and Physical Sciences, plus the average percentage of your six best matric subjects (excluding Life Orientation and Mathematical Literacy), are used for calculating the selection score.
  - This means that the selection score takes a broad group of matric subjects into account, and that, in effect, Mathematics and Physical Sciences usually each contribute twice.
  - The maximum score is 800.
- Other measures** used for selection are the following:
  - your school results
  - other relevant information
  - personal interviews – in exceptional circumstances.

### 2.4.1.2.2 How the selection score is used

- The Dean sets an admission threshold and a minimum selection score for each BEng programme. This is done in consultation with the Faculty Management Committee after all complete applications received before the closing date have been processed.

The **admission threshold** is a selection score based on:

- the number of applicants who meet the admission requirements,
- the number of places available in the particular degree programme and
- the points of departure for undergraduate enrolment management as mentioned above in Section 2.3.

The **minimum selection score** is the lowest score that indicates that a student will be reasonably likely to complete the particular programme. This score is based on the Faculty's experience with previous students.

- You will be selected if you:
  - meet the admission requirements and
  - your selection score is equal to, or larger than, the admission threshold score for the particular degree programme that you want to follow.

*Please note:*

- Being selected for one BEng programme does not mean that you have been selected for another BEng programme.
- You may apply for more than one BEng programme and you will be considered for each independently. If you are selected for more than one programme, you will receive more than one offer to choose from.
- If your selection score is below the admission threshold, but above the minimum score for your preferred BEng programme(s), the following happens:
  - you are placed on a waiting list, which means that you may still be admitted to a particular programme if places become available later; or
  - you can apply to be admitted to another BEng programme if you meet the selection requirements for that particular programme. You must contact the Faculty Officer or the Faculty Administrator if you consider changing the programmes you applied for (see Section 1.1.3 for contact information).

### 2.4.1.3 Selection process for BEng (ECP)

You cannot apply directly to be admitted to a BEng (ECP). All prospective BEng students apply to be admitted to a BEng (4yr); then, if you are not selected for a BEng (4yr) but meet the admission requirements for a BEng (ECP), you may be selected for the BEng (ECP). The following applies at selection for the ECP:

- Only a limited number of students are selected.
- Students from educationally underserved environments receive preference.

### 2.4.1.4 Application procedure for BEng (4yr) and BEng (ECP)

#### 2.4.1.4.1 How to apply for a BEng programme

Submit a complete application by **31 July** of the year before the one in which you want to register for a BEng programme. Apply at [www.maties.com](http://www.maties.com).

#### 2.4.1.4.2 Final and provisional admission

- If you have already passed Grade 12 and you are admitted to a specific BEng programme, your admission is final.
- If you are still in Grade 12 when you apply, you may be admitted to a specific BEng programme based on your Grade 11 results. However, this admission is provisional. For your admission to be finalised, the following is necessary:
  - You must submit written proof that you have obtained a National Senior Certificate, or equivalent, that meets the admission requirements of the particular degree programme (see 2.4.1.1).
  - Your admission scores, based on your Grade 12 final examination marks, must be the same or better than your admission scores based on your Grade 11 marks, or must meet the particular programme's admission threshold (described above in Section 2.4.1.2.2).

#### 2.4.1.4.3 Late or unsuccessful application

- If you are granted permission to submit a complete application after the closing date (31 July), you will be considered for admission if there are places available in the particular programme.
- If you applied, before the closing date, using your Grade 11 marks, but were not admitted, you may submit your Grade 12 results to be considered again by contacting the Faculty Officer (see Section 1.1.3 for contact information). You can be admitted if there are places available in the particular programme.

#### 2.4.1.4.4 Failure to register

- If you do not register in the year for which you were admitted, your admission will lapse. If you then apply again for a later year, you will have to be selected again.

### 2.4.2 Applicants with prior tertiary learning

This section explains how you may be admitted to a BEng programme at the Faculty of Engineering if you have already studied in another tertiary programme or at another tertiary institution. This is termed "Credit Accumulation and Transfer (CAT)".

#### 2.4.2.1 Residency requirement for obtaining a BEng degree from Stellenbosch University

Irrespective of your prior tertiary studies, you must pass at least the final two academic years of an approved BEng programme at Stellenbosch University to obtain a BEng degree from this university. The University also requires that you complete at least 50% of the credits of a programme at this university to be awarded the degree by the University.

#### 2.4.2.2 How to obtain recognition for modules from other programmes or institutions

If you have already completed applicable modules before enrolling for the BEng programmes of the Faculty of Engineering, you may apply for the modules that you have completed to be recognised in the place of modules in the relevant BEng programme.

*Please note:* Only credits completed in the preceding five years are normally considered to be transferable.

Your application must:

- be submitted to the Faculty Administrator before **3 January** of your intended first year of study in a BEng programme at Stellenbosch University;
- include your complete academic record; and
- include the content and outcomes of the modules that you are asking recognition for.

Your application will be considered by a committee for recognition of prior learning (RPL/CAT committee) of the particular BEng programme's home department. The Faculty Administrator will give you written feedback by email. Refer to the document "RPL/CAT Procedures for the Faculty of Engineering" for details relating to RPL/CAT committees. (Consult Section 1.6 above to find out how to access this document.)

Recognition will be granted per module (in other words, recognition is not granted for parts of modules) and subject to the following:

- the curriculum, outcomes and credits of the completed module must largely meet or exceed the requirements of the corresponding module within the engineering programme you want to follow,
- exemption or credit transfer may be granted for a maximum of 50% of the credits of a programme, and
- a maximum of 50% of the credits of a completed qualification may be transferred to another qualification.

#### 2.4.2.3 Applicants from other programmes at Stellenbosch University

This section applies to you if you began your studies in another programme at Stellenbosch University and want to switch to a BEng programme.

##### 2.4.2.3.1 Admission requirements for BEng (4yr)

- You must meet the normal language requirements that also apply to applicants without any prior tertiary learning (see Section 2.4.1.1 above).
- You must either have passed:
  - Mathematics 114 and 144, or
  - Engineering Mathematics 115 and 145

- You must either:
  - meet the normal requirements for the BEng (4yr) regarding Physical Sciences (see Section 2.4.1.1 above), *or*
  - have passed physics and chemistry at first-year BSc level.
- You must either:
  - have passed, in one year, all modules within an appropriate first-year BSc programme (where Mathematics 114 and 144, or Engineering Mathematics 115 and 145, were included); *or*
  - have been selected by the home department of the particular BEng programme.

### Students who have already been awarded a BSc degree

- Even if you already have a BSc degree, you will generally only be admitted to the first year of a BEng (4yr) programme (and not to a later year), but you can apply for some of the modules you have passed in the BSc programme to be recognised towards the BEng degree.
- If you have completed a BSc degree programme but took longer than the normal minimum time to complete it, or performed poorly in general, you will normally not be admitted to a BEng (4yr) programme.

### 2.4.2.3.2 Admission requirements for BEng (ECP) second year

The requirements you must meet if you want to apply for admission to the second year of a BEng (ECP) are:

- You must have completed the first year of another appropriate extended curriculum programme within one year of study.
- In that first year, you must have achieved at least the level of performance that is required in the BEng (ECP) to proceed from the first to the second year.

### 2.4.2.3.3 Application procedure

Do the following to apply to be admitted to a BEng-programme on the basis of your prior learning at Stellenbosch University:

- Submit a written application to the Faculty Administrator in the year before you intend to start your studies in engineering.
- Do this after all the final marks have been made available, but before **13 December**.

Your application will be considered by the RPL/CAT committee of the particular programme's home department. If you are admitted to a BEng (4yr), the committee will also decide which of the modules that you have already completed can be recognised in the place of modules in the BEng programme (also see Section 2.4.2.2 for more on how to obtain recognition for modules). The Faculty Administrator will give you written feedback by email.

### 2.4.2.4 Applicants from BEng, BScEng and BSc programmes at other universities in South Africa

This section applies to you if you began your studies in some science or engineering programmes at another university but want to continue your studies in a BEng programme at Stellenbosch University. If you began studying in a BEng or BScEng programme elsewhere, we strongly advise you to do only your first year at the other university and to apply for admission to the second year of a BEng (4yr) at Stellenbosch University.

#### 2.4.2.4.1 Admission requirements for a BEng (4yr)

To be admitted to a BEng (4yr) on the basis of your prior BEng, BScEng or BSc studies at another university, you must meet the following requirements:

- You must meet the normal language requirements that also apply to applicants without any prior tertiary learning (see Section 2.4.1.1 above).
- You must either:
  - meet the normal requirements for the BEng (4yr) regarding Mathematics (see Section 2.4.1.1 above), *or*
  - have passed the equivalents of Engineering Mathematics 115 and 145.
- You must either:
  - meet the normal requirements regarding Physical Sciences (see Section 2.4.1.1 above), *or*
  - have passed physics and chemistry at first-year BSc or BEng level.
- You must meet the requirements to continue with your studies in engineering at the university where you have studied before, or where you are studying at the time of your application.
- You must have been selected by the home department of the particular BEng programme.

#### 2.4.2.4.2 Application procedure

Do the following to apply to be admitted to a BEng (4yr) on the basis of your prior studies in science or engineering at another university:

- Submit a written application to the Faculty Administrator before **31 July** of the year before you plan to start your BEng studies at Stellenbosch University;
- Your application must include:
  - your complete academic record
  - the content and outcomes of the modules that you are asking recognition for

Your application will be considered by the RPL/CAT committee of the particular programme's home department. If you are admitted to a BEng (4yr), the committee will also decide which of those modules that you have already completed can be recognised in the place of modules in the BEng programme (also see Section 2.4.2.2 above for more on how to obtain recognition for modules). The Faculty Administrator will give you written feedback by email.

#### 2.4.2.5 Applicants with a National Diploma, National Higher Diploma, Advanced Diploma, BEngTech or BTech degree from another university in South Africa

This section applies to you if you already have an applicable National Diploma (ND), National Higher Diploma (NHD), Advanced Diploma (AdvDip), BEngTech or BTech degree and have performed well academically.

You can apply to be admitted to the first year of the BEng programmes and for recognition of modules (see Section 2.4.2.2 above for more on how to obtain recognition for modules). Alternatively, you can apply to be admitted to the second or third year of a BEng (4yr) programme if you have passed an assessment in certain required modules, as explained below.

##### 2.4.2.5.1 Admission requirements for the second and third year of the BEng (4yr)

The requirements for admission to the second or third year of a BEng (4yr) on the basis of your prior ND, NHD, AdvDip, BEngTech or BTech studies are as follows:

- You must meet the normal language requirements that also apply to applicants without any prior tertiary learning (see Section 2.4.1.1 above).
- You must pass the normal assessments in the modules indicated below in Sections 2.4.2.5.2 and 2.4.2.5.3. This entails that:
  - you must sit for the relevant assessments with the current BEng students during the official university examination period.
  - you must complete all the assessments in a maximum of two consecutive examination periods: one first-semester and one second-semester examination period. The semester will be determined by the required modules, in other words whether they are offered in the first or second semester.
  - you get only one assessment opportunity to pass a given module.
- You must be selected.

##### 2.4.2.5.2 Modules required for admission to the second year of the BEng (4yr)

To be admitted to the second year of a BEng (4yr), you must have passed the assessments of the following modules:

- Engineering Mathematics 145;
- Applied Mathematics B 154; and
- at most, two further modules as specified by the relevant department. The department will consider your study record and choose the modules to ensure that you have the necessary background for further successful study.

##### 2.4.2.5.3 Modules required for admission to the third year of the BEng (4yr)

To be admitted to the third year of a BEng (4yr), you must have passed the assessments of the following modules, according to the programme you have applied for:

- Chemical Engineering
  - Engineering Mathematics 214
  - Engineering Mathematics 242
  - Applied Mathematics B 224
  - Numerical Methods 262

- Civil Engineering
  - Engineering Mathematics 214
  - Applied Mathematics B 224
  - Applied Mathematics B 242
  - Applied Mathematics B 252
- Industrial Engineering
  - Engineering Mathematics 214
  - Engineering Mathematics 242
  - Production Management 212
  - Engineering Economics 212
- Electrical and Electronic Engineering
  - Engineering Mathematics 214
  - Applied Mathematics B 224
  - Applied Mathematics B 242
- Mechanical Engineering
  - Engineering Mathematics 214
  - Engineering Mathematics 242
  - Applied Mathematics B 224
  - Numerical Methods 262
- Mechatronic Engineering
  - Engineering Mathematics 214
  - Engineering Mathematics 242
  - Applied Mathematics B 224
  - Numerical Methods 262
- All fields of study
  - At most two further modules as specified by the relevant department. The department will consider your study record and choose the modules to ensure that you have the necessary background for further successful study.

#### 2.4.2.5.4 Application and assessment procedure

##### Application procedure

Do the following to apply:

- Apply to the Faculty Administrator by **1 April** of the year before you want to start with the second or third year of the BEng (4yr).
- Your application must include:
  - your complete academic record,
  - the content and outcomes of the modules that you are asking recognition for.

The departmental RPL/CAT committees will consider your application and decide which assessments you must complete.

*Please note* that your first assessment opportunity may already be at the end of the first semester of the year in which you applied.

##### Assessment procedure

- The Faculty Administrator will let you know which assessments you must complete.
- The relevant departments will provide the following for each module so that you can prepare for these assessments:
  - the syllabus,
  - module content,
  - class notes (if applicable), and
  - the name of the prescribed textbook.
- The Faculty Administrator will let you know only whether you have passed or failed a module. These results will not be included in your study record.

### 2.4.2.6 Applicants from universities outside of South Africa

If you have studied at a university outside of South Africa and want recognition for qualifications or modules from that university, you must:

- apply in writing to the Faculty Administrator before **31 July** of the year before your intended study at Stellenbosch University.
- include with your application:
  - your complete academic record,
  - the content and outcomes of the modules that you are asking recognition for.

The International Office and/or the Human Sciences Research Council's assessment of foreign qualifications will be used as the guideline for assessing your prior learning.

If you have a qualification or studied at an institution where the standards are regarded as being on the same level as South African universities, your application will be handled in a similar manner to applications by students from BEng, BScEng and BSc programmes at other universities in South Africa (see Section 2.4.2.4 above). Otherwise, your individual modules will not be recognised, but you may be given the same opportunity as students with a National Diploma, National Higher Diploma, BEngTech or BTech degree to complete specific mainstream assessments (see Section 2.4.2.5 above). The Faculty Administrator will give you written feedback by email.

### 2.4.2.7 Recognition of prior learning not covered in the sections above

If you want to apply for admission based on the recognition of modules completed elsewhere, but your situation is not covered in Sections 2.4.2.3 to 2.4.2.6 above, you must:

- apply before **1 April** of the year before your intended studies at Stellenbosch University.
- include with your application full details of prior learning; that is:
  - the name of the programme,
  - a description (contents, scope and outcomes),
  - the assessment criteria,
  - the type of assessments,
  - the accreditation of the institution, and
  - when the learning was obtained.

*Please note:* If you leave out any of this information, your application cannot be processed.

**Experience in itself is not recognised; it must be learning that has been assessed in a recognised manner.**

The RPL/CAT committee of the relevant department will consider your application by comparing your education with relevant module contents, outcomes and credits. The committee can:

- refuse your application with relevant reasons,
- recognise certain module(s),
- recommend that you complete mainstream assessments for certain modules (the same as applicants with an ND, NHD, AdvDip, BEngTech or BTech; see Section 2.4.2.5 above), and/or
- request a personal interview (which will be considered as an oral assessment). At least two academic staff members must be present during this interview.

The Faculty Administrator will give you written feedback by email.

## 2.5 Changing your BEng degree programme

### Changing programmes after completing your first year

All BEng programmes have largely the same first year, and therefore you can change from one BEng programme to another at the end of your first year. The following applies:

- You automatically qualify to change your degree programme if you passed all the first-year modules of the BEng (4yr) programme in your first year of study, unless you followed the Data Engineering focus area in the BEng (Electrical and Electronic Engineering) programme.
- The second year of the BEng (ECP) and the first year of the four-year programme are the same; therefore, you also automatically qualify to change programmes if you have passed all the modules in the second year of a BEng (ECP).
- If you did not pass all your first-year modules, you must normally have passed 75% of the module credits at the end of your first year to be able to change programmes. Having passed 75% of the module credits does not mean, however, that you will necessarily receive permission to change.
- You must be selected for the new programme before you can make the change.
- You do not have to follow any additional modules for the new programme once you have been selected.

## Changing programmes from your second year onwards

From your second year onwards, the later you change programmes the more modules you will have to catch up on when you make the change.

### Application procedure

Apply in writing to the Faculty Administrator before **13 December** of the year before you want to change programmes.

Please consult the Almanac in Part 1 (General Rules) of the Yearbook for the last date on which programmes may be changed.

### Further guidance and responsibility

The Centre for Student Counselling and Development (CSCD) and the departmental chairpersons in the Faculty of Engineering are available to give you guidance in choosing a field of study.

It is your responsibility to determine whether your bursary conditions allow you to change from one undergraduate programme to another.

## 2.6 Renewing your registration as an undergraduate student each year

As an undergraduate student you must meet the relevant readmission requirements each year to be permitted to register again in the following year. In this section you can find out what is required of you after specific years of study, what to do if you do not meet the requirements and what happens if your studies are interrupted.

### 2.6.1 Requirement to renew registration annually

You must normally register in a BEng programme for each consecutive year, from when you start in a BEng programme until you have completed it. If your registration is interrupted for one or more years, you will have to apply anew for admission and be selected before you may continue your BEng studies.

If your studies were interrupted for a period of three years or longer, the credits you accumulated previously will not automatically be transferred, but you may apply to have the modules you passed during your prior studies recognised (consult Section 2.4.2.2 in this regard).

### 2.6.2 Requirements for renewal after one year of study in a BEng (4yr)

Please refer to the Yearbook Part 1 (General Rules) for the general progression rules regarding readmission.

#### Further conditions

In addition to the general progression rules, you must meet the following conditions to be able to renew your registration:

- You must have passed at least two of the following modules:
  - Applied Mathematics B 124
  - Applied Mathematics B 154
  - Engineering Mathematics 115
  - Engineering Mathematics 145

### 2.6.3 Requirements for renewal after two or more years of study in a BEng (4yr)

Please refer to the Yearbook Part 1 (General Rules) for the general progression rules regarding readmission.

#### Further conditions

In addition to the general progression rules, you must meet the following conditions to be able to renew your registration:

- After 2 years of full-time study, you must normally have passed all the prescribed modules for the first year of the BEng (4yr).
- After 4 years of full-time study, you must normally have passed all the prescribed modules of the first and second years of the BEng (4yr).
- After 6 years of full-time study, you must have completed the programme successfully.

### 2.6.4 Requirements for renewal after one year of study in a BEng (ECP)

You must have passed all the modules of the first year with a weighted average above 65% to be admitted to the second year of the BEng (ECP).

## 2.6.5 Requirements for renewal after two or more years of study in a BEng (ECP)

Please refer to the Yearbook Part 1 (General Rules) for the general progression rules regarding readmission.

### Further conditions

In addition to the general progression rules, you must meet the following conditions to be able to renew your registration:

- After 3 years of full-time study, you must normally have passed all the prescribed modules for the first two years of study of the BEng (ECP).
- After 5 years of full-time study, you must normally have passed all the prescribed modules of the first three years of study of the BEng (ECP).
- After 7 years of full-time study, you must have completed the programme successfully.

## 2.6.6 Requirements for renewal after you have been readmitted

If your readmission is successful, you may continue your BEng studies at the University in each subsequent year under the following condition:

- You must complete at least 70% of the required credits in the immediately preceding year. This requirement replaces the normal requirements regarding the number of credits required for progression per year as given in Part 1 (General Rules) of the University Yearbook.

## 2.7 Rules for following modules from more than one year of study

You may register in a single semester for modules from more than one year of a particular programme. The following rules apply to BEng (4yr) as well as BEng (ECP) students who want to do that:

- To receive a final mark for a module, you must be registered for that module.
- You must meet the requirements regarding normal, co- and pass prerequisites.
- There must be no timetable clashes for classes, tests, assessments or examinations. The University publishes these timetables centrally and it is entirely your responsibility to make sure that there are no clashes.

*Please note the exceptions discussed below.*

- You may register for at most 78 credits per semester.

*Please note the exceptions discussed below.*

- In a single semester, you may not simultaneously register for modules from more than two consecutive years of a degree programme.

*For example:* You may not register for a third-year module and a first-year module in the same semester, but you may register for a first-year module in the first semester and for a third-year module in the second semester, or vice versa.

- In any given semester, you may only register for modules from more than one year if you:
  - have already passed all the modules for the corresponding semester of the more junior years, or
  - if you are also registering for the modules from all the corresponding semesters of the more junior years, which you have not yet passed.

*For example:* You may follow a first-semester module from the third year if you:

- have already passed all the first-semester modules of the first two years, or
- if you have passed all the first-semester modules from the first year, as well as some of the modules from the second year, and you are also registering for the remaining first-semester modules from the second year.

The following exceptions apply to the rules above:

- You may not register for modules with clashing assessment timetables (that is, test, assessment or examination timetables), but you may register for two modules with clashing contact sessions (lectures, tutorials or practicals) if the clashes have been resolved. A clash has been resolved when lecturers from one or both of the clashing modules have granted you written exemption from clashing sessions.
- If you meet the requirements to register for the complete normal semester of a particular year of study, but in that semester you still have to pass one module from an earlier year, the chairperson of the programme's home department (or their delegate) may permit you to register for the complete semester and the additional module. The following apply here:
  - You will be permitted on merit to register for the additional module and must therefore have performed satisfactorily in other respects.
  - The chairperson of the relevant department (or their delegate) will make a decision in consultation with the Dean of the Faculty.
- You may be permitted to register for more than 78 credits in a semester if the chairperson of the programme's home department (or their delegate) supports your request after considering your academic situation.

Also note the stipulations about repeating a module in the section "Assessments and Promotions" in Part 1 (General Rules) of the University Yearbook.

## 2.8 Dean's concession assessments

Please refer to the Yearbook Part 1 (General Rules) for the rules regarding the dean's concession assessments (DCAs) and how to apply for a DCA.

You can find faculty-specific rules regarding the DCAs in the Faculty's "Assessment Rules" (consult Section 1.6 above to find out how to access this document).

## 2.9 Improving your final mark

- **Modules for which only satisfactory attendance is required:** You can improve your final marks *until the end of January*, but you must first get approval from the departmental chairperson of the module's home department.
- **Project-based modules in the final year, where a project contributes a large part of the final mark:** If you are in your final year and did not pass the relevant module, the departmental chairperson may give you an opportunity to improve your final mark at *any time after the normal round of examinations in November*. The following applies:
  - The relevant department will prescribe work for improving your final marks, which you must complete satisfactorily.
  - The examiners may submit the improved final mark *any time after the normal round of examinations*.
  - Marks are submitted for interim approval by the Executive Committee of the Senate.
  - This concession must be limited to no more than two modules per student.
- **All other cases:** Any opportunity to improve your final mark may only be granted *before the date when the final marks of a particular June or December examination are due*.

## 2.10 Electronic pocket calculators

As from your first year, you must own an approved electronic pocket calculator as specified in the Faculty's "General Stipulations for Under- and Postgraduate Modules" (consult Section 1.6 above to find out how to access this document.).

*Please note:*

- In the first and second year of a BEng (4yr), you may only use the prescribed type of pocket calculator in tests, main assessments and examinations.
- In other years of study, some lecturers may also require that you use only the prescribed type of calculator for certain assessments.

## 2.11 Programme structure and content

### 2.11.1 Interpreting the curriculum tables

#### Symbols used

In the tables below, you can find each module's credit value and lecture load. The symbols mean the following:

- L** Number of lecture periods per week
- P** Number of laboratory practicals per week
- T** Number of tutorials periods per week
- S** Number of seminar periods per week
- c** Credit value (SAQA credits: Total number of hours it would typically take a student to complete the module, divided by 10)

#### Time allocations

Lecture, seminar and single tutorial periods are 50 minutes long and normally in the morning. The following applies for consecutive laboratory practical and tutorial periods:

- The ten-minute break between periods is included in the contact time. A load of 2,25 for consecutive tutorial or practical periods in the afternoon means that you start at 14:00 and finish at 16:15. A load of 2,5 consecutive tutorial or practical periods in the afternoon means that you start at 14:00 and finish at 16:30.
- A load of 0,75 typically means that every second week you do a tutorial or practical which takes up half an afternoon (1 hour 20 minutes to 1 hour 30 minutes) or, every fourth week, a full afternoon of three hours.
- When the venue timetable is prepared, a room is allocated for the required number of periods, for example three periods for 2,25 consecutive tutorial or practical periods.

### 2.11.2 Curriculum of BEng (ECP)

The first year of the BEng (ECP) in all fields of study is coordinated by the Science Faculty. From the second year onwards, the curriculum for the ECP in each field of engineering study is the same as the curriculum of the first and later years of the corresponding BEng (4yr) programme and is coordinated by the relevant department.

#### YEAR 1 (ECP) – ALL FIELDS

The curriculum of the first-year of the BEng (ECP) in all fields of study is as follows:

##### Both semesters

|                                                  | L         | P        | T        | S        | c          |
|--------------------------------------------------|-----------|----------|----------|----------|------------|
| Chemistry 176                                    | 3         | 3        | 0        | 0        | 32         |
| Computer Skills 176                              | 1         | 0        | 4        | 0        | 8          |
| Mathematics 186                                  | 3         | 0        | 3        | 0        | 32         |
| Physics 176                                      | 3         | 3        | 0        | 0        | 32         |
| University Practice in the Natural Sciences 176* | 3         | 0        | 0        | 0        | 8          |
| <b>TOTALS</b>                                    | <b>13</b> | <b>6</b> | <b>7</b> | <b>0</b> | <b>112</b> |

\* 5L in the first semester and 1L in the second semester.

##### First semester

|                                     | L        | P        | T        | S        | c         |
|-------------------------------------|----------|----------|----------|----------|-----------|
| Scientific Communication Skills 116 | 3        | 0        | 3        | 0        | 12        |
| <b>TOTALS</b>                       | <b>3</b> | <b>0</b> | <b>3</b> | <b>0</b> | <b>12</b> |

##### Second semester

|                                     | L        | P        | T        | S        | c         |
|-------------------------------------|----------|----------|----------|----------|-----------|
| Preparatory Technical Drawings 146  | 3        | 3        | 0        | 0        | 16        |
| Scientific Communication Skills 146 | 3        | 0        | 0        | 0        | 6         |
| <b>TOTALS</b>                       | <b>6</b> | <b>3</b> | <b>0</b> | <b>0</b> | <b>22</b> |

## YEAR 2 (ECP) AND FURTHER

The curricula of the second and later years of study of each BEng (ECP) are the same as the first and later years of the corresponding BEng (4yr).

### 2.11.3 Curriculum of the first year of all BEng (4yr) programmes, except Data Engineering

The curriculum of the first year of the BEng (4yr) is the same for all fields of study, except for the Data Engineering focus area in the BEng (Electrical and Electronic Engineering) programme:

#### First semester

|                                                                                                                                                                                                                          | L         | P          | T           | S        | c         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|-------------|----------|-----------|
| Applied Mathematics B 124                                                                                                                                                                                                | 4         | 0          | 2           | 0        | 15        |
| Engineering Chemistry 123                                                                                                                                                                                                | 4         | 0          | 2           | 0        | 15        |
| Engineering Mathematics 115                                                                                                                                                                                              | 5         | 0          | 2           | 0        | 15        |
| Engineering Physics 113                                                                                                                                                                                                  | 2         | 0,5        | 0,5         | 0        | 8         |
| Intercultural Communication (Eng) 113                                                                                                                                                                                    | 2         | 0          | 1           | 0        | 8         |
| Engineering Drawings 123                                                                                                                                                                                                 | 1         | 3          | 3           | 0        | 15        |
| <i>Elective repeat modules:</i><br>These modules are offered at the discretion of the home department of the module and may therefore not be offered every year. You may not register for both modules at the same time. |           |            |             |          |           |
| Engineering Chemistry 143*                                                                                                                                                                                               | 4         | 0          | 2           | 0        | 15        |
| Engineering Drawings 143**                                                                                                                                                                                               | 1         | 3          | 3           | 0        | 15        |
| <b>TOTALS</b>                                                                                                                                                                                                            | <b>18</b> | <b>3,5</b> | <b>10,5</b> | <b>0</b> | <b>76</b> |

\* This module repeats the content of Engineering Chemistry 123 and is offered in hybrid format during the academic recess. If you failed Engineering Chemistry 123, you may elect to complete this module instead of repeating Engineering Chemistry 123.

\*\* This module repeats the content of Engineering Drawings 123 and is offered in hybrid format during the academic recess. If you failed Engineering Drawings 123, you may elect to complete this module instead of repeating Engineering Drawings 123.

#### Second semester

|                                                                                                | L               | P             | T                  | S        | c         |
|------------------------------------------------------------------------------------------------|-----------------|---------------|--------------------|----------|-----------|
| Applied Mathematics B 154                                                                      | 3,5             | 0             | 3                  | 0        | 15        |
| Computer Programming 143                                                                       | 3               | 2             | 0                  | 0        | 12        |
| Electrotechnique 143                                                                           | 3,5             | 1             | 2                  | 0        | 15        |
| Engineering Mathematics 145                                                                    | 5               | 0             | 2                  | 0        | 15        |
| Strength of Materials 143                                                                      | 3               | 0             | 2                  | 0        | 12        |
| <i>One of the following modules according to the corresponding programme (see note below):</i> |                 |               |                    |          |           |
| Chemistry C 152                                                                                | 0               | 3             | 0                  | 0        | 6         |
| Electronic Engineering 152                                                                     | 0               | 0             | 3                  | 0        | 6         |
| Engineering Physics 152                                                                        | 2               | 0             | 1                  | 0        | 6         |
| Industrial Engineering 152                                                                     | 0               | 0             | 3                  | 0        | 6         |
| Mechanical Engineering 152                                                                     | 0               | 0             | 3                  | 0        | 6         |
| Mechatronic Engineering 152                                                                    | 0               | 0             | 3                  | 0        | 6         |
| <b>TOTALS</b>                                                                                  | <b>18 or 20</b> | <b>3 or 6</b> | <b>9, 10 or 12</b> | <b>0</b> | <b>75</b> |

Note: Engineering Physics 152 is part of the BEng Civil Engineering programme, and Chemistry C 152 is part of BEng (Chemical Engineering). The modules for the other programmes are as indicated by their names. This choice will not prevent you from changing to another degree programme at the end of the first year if you are eligible for such a change. (Refer to Section 2.5 above for details on changing your degree programme.)

## 2.11.4 Curriculum of four-year BEng (Chemical Engineering)

Home department: Chemical Engineering

### YEAR 1

The common first-year curriculum for BEng (4yr) (see Section 2.11.3).

### YEAR 2

#### First semester

|                                 | L         | P        | T           | S        | c         |
|---------------------------------|-----------|----------|-------------|----------|-----------|
| Applied Mathematics B 224       | 3         | 0        | 3           | 0        | 15        |
| Chemical Engineering 224        | 3         | 0        | 3           | 0        | 15        |
| Chemistry C 224                 | 4         | 2        | 0           | 0        | 15        |
| Engineering Mathematics 214     | 4         | 0        | 2           | 0        | 15        |
| Practical Workshop Training 211 | 0         | 0        | 0           | 0        | 0         |
| Thermodynamics A 224            | 3         | 1        | 2,5         | 0        | 15        |
| <b>TOTALS</b>                   | <b>17</b> | <b>3</b> | <b>10,5</b> | <b>0</b> | <b>75</b> |

#### Second semester

|                             | L         | P        | T          | S        | c         |
|-----------------------------|-----------|----------|------------|----------|-----------|
| Chemical Engineering 254    | 3         | 0        | 3          | 0        | 15        |
| Chemical Engineering 264    | 3         | 1        | 2          | 0        | 15        |
| Chemistry C 254             | 4         | 2        | 0          | 0        | 15        |
| Engineering Mathematics 242 | 2         | 0        | 1          | 0        | 8         |
| Engineering Statistics 243  | 3         | 1        | 2,5        | 0        | 15        |
| Numerical Methods 262       | 2         | 0        | 1          | 0        | 8         |
| <b>TOTALS</b>               | <b>17</b> | <b>4</b> | <b>9,5</b> | <b>0</b> | <b>76</b> |

### YEAR 3

#### Both semesters

|                       | L | P | T | S | c |
|-----------------------|---|---|---|---|---|
| Internship (Eng) 392* | 0 | 0 | 0 | 0 | 0 |
| Internship (Eng) 393* | 0 | 0 | 0 | 0 | 0 |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange; consult the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

#### First semester

|                                 | L         | P         | T         | S        | c         |
|---------------------------------|-----------|-----------|-----------|----------|-----------|
| Chemical Engineering 316        | 3         | 1         | 2         | 0        | 15        |
| Chemical Engineering 317        | 3         | 1         | 2         | 0        | 15        |
| Chemical Engineering D 316      | 2         | 6         | 1         | 0        | 8         |
| Complementary Studies (Eng) 311 | 0         | 0         | 3         | 0        | 4         |
| Heat Transfer A 326             | 3         | 1         | 2         | 0        | 15        |
| Particle Technology 316         | 3         | 1         | 2         | 0        | 15        |
| Philosophy and Ethics 314*      | 3         | 0         | 0         | 0        | 4         |
| <b>TOTALS</b>                   | <b>17</b> | <b>10</b> | <b>12</b> | <b>0</b> | <b>76</b> |

\* Lecture periods used only in first term.

**Second semester**

|                            | L         | P        | T        | S        | c         |
|----------------------------|-----------|----------|----------|----------|-----------|
| Chemical Engineering 344   | 3         | 0        | 2        | 0        | 15        |
| Chemical Engineering 354   | 3         | 0        | 2        | 0        | 15        |
| Chemical Engineering 367   | 3         | 0        | 2        | 0        | 15        |
| Chemical Engineering D 356 | 1         | 6        | 0        | 0        | 15        |
| Mineral Processing 345     | 3         | 1        | 2        | 0        | 15        |
| Vacation Training 361      | 0         | 0        | 0        | 0        | 0         |
| <b>TOTALS</b>              | <b>13</b> | <b>7</b> | <b>8</b> | <b>0</b> | <b>75</b> |

**YEAR 4****Both semesters**

|                            | L        | P        | T        | S        | c          |
|----------------------------|----------|----------|----------|----------|------------|
| Final-year Project (C) 478 | 0        | 6        | 0        | 0        | 32*        |
| <b>TOTALS</b>              | <b>0</b> | <b>6</b> | <b>0</b> | <b>0</b> | <b>32*</b> |

\* 6 credits in the first semester and 26 credits in the second semester.

**First semester**

|                                | L         | P        | T          | S        | c         |
|--------------------------------|-----------|----------|------------|----------|-----------|
| Chemical Engineering 424       | 3         | 1        | 2          | 0        | 15        |
| Chemical Engineering 426       | 3         | 1        | 2          | 0        | 15        |
| Environmental Engineering 414  | 3         | 0        | 2,5        | 0        | 15        |
| Mineral Processing 415         | 3         | 0        | 2          | 0        | 15        |
| Project Management 412         | 3         | 0        | 1          | 0        | 12        |
| <i>Elective repeat module:</i> |           |          |            |          |           |
| Design Project 428*            | 0         | 0        | 0          | 1        | 48        |
| <b>TOTALS</b>                  | <b>15</b> | <b>2</b> | <b>9,5</b> | <b>1</b> | <b>72</b> |

\* This module repeats the content of Design Project 488. If you failed Design Project 488 in the preceding year but obtained a final mark greater than or equal to 40, you may elect to complete this module instead of repeating Design Project 488.

**Second semester**

|                    | L        | P        | T        | S        | c         |
|--------------------|----------|----------|----------|----------|-----------|
| Design Project 488 | 0        | 0        | 6        | 0        | 48        |
| <b>TOTALS</b>      | <b>0</b> | <b>0</b> | <b>6</b> | <b>0</b> | <b>48</b> |

## 2.11.5 Curriculum of four-year BEng (Civil Engineering)

Home department: Civil Engineering

### YEAR 1

The common first-year curriculum for BEng (4yr) (see Section 2.11.3)

### YEAR 2

#### First semester

|                             | L         | P        | T         | S        | c         |
|-----------------------------|-----------|----------|-----------|----------|-----------|
| Applied Mathematics B 224   | 3         | 0        | 3         | 0        | 15        |
| Civil Engineering 224       | 3         | 0        | 2,5       | 0        | 15        |
| Engineering Geology 214     | 3         | 3        | 0         | 0        | 15        |
| Engineering Mathematics 214 | 4         | 0        | 2         | 0        | 15        |
| Strength of Materials 224   | 3         | 0        | 2,5       | 0        | 15        |
| <b>TOTALS</b>               | <b>16</b> | <b>3</b> | <b>10</b> | <b>0</b> | <b>75</b> |

#### Second semester

|                             | L         | P        | T         | S        | c         |
|-----------------------------|-----------|----------|-----------|----------|-----------|
| Applied Mathematics B 242   | 2         | 0        | 1,5       | 0        | 8         |
| Applied Mathematics B 252   | 2         | 0        | 1         | 0        | 8         |
| Building Materials 254      | 3         | 2        | 1         | 0        | 15        |
| Engineering Informatics 244 | 3         | 0        | 2,5       | 0        | 15        |
| Geotechnique 254            | 3         | 0        | 2,5       | 0        | 15        |
| Strength of Materials 254   | 3         | 0        | 2,5       | 0        | 15        |
| Vacation Training 241       | 0         | 0        | 0         | 0        | 0         |
| <b>TOTALS</b>               | <b>16</b> | <b>2</b> | <b>11</b> | <b>0</b> | <b>76</b> |

### YEAR 3

#### Both semesters

|                       | L | P | T | S | c |
|-----------------------|---|---|---|---|---|
| Internship (Eng) 392* | 0 | 0 | 0 | 0 | 0 |
| Internship (Eng) 393* | 0 | 0 | 0 | 0 | 0 |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange; consult the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

#### First semester

|                             | L         | P        | T           | S        | c         |
|-----------------------------|-----------|----------|-------------|----------|-----------|
| Data Analytics (Eng) 324    | 3         | 0        | 2,5         | 0        | 15        |
| Engineering Informatics 314 | 3         | 0        | 2,5         | 0        | 15        |
| Hydraulics 324              | 3         | 0        | 2,5         | 0        | 15        |
| Transport Science 324       | 3         | 1        | 1,5         | 0        | 15        |
| Water Treatment 324         | 3         | 0        | 2,5         | 0        | 15        |
| <b>TOTALS</b>               | <b>15</b> | <b>1</b> | <b>11,5</b> | <b>0</b> | <b>75</b> |

**Second semester**

|                          | L         | P        | T          | S        | c         |
|--------------------------|-----------|----------|------------|----------|-----------|
| Geotechnique 354         | 3         | 1,5      | 1          | 0        | 15        |
| Hydraulics 354           | 3         | 0,5      | 2          | 0        | 15        |
| Structural Design 354    | 3         | 0        | 2,5        | 0        | 15        |
| Theory of Structures 354 | 3         | 0        | 2,5        | 0        | 15        |
| Transport Science 364    | 3         | 1        | 1,5        | 0        | 15        |
| Vacation Training 342    | 0         | 0        | 0          | 0        | 0         |
| <b>TOTALS</b>            | <b>15</b> | <b>3</b> | <b>9,5</b> | <b>0</b> | <b>75</b> |

**YEAR 4****First semester**

|                            | L         | P        | T         | S        | c         |
|----------------------------|-----------|----------|-----------|----------|-----------|
| Hydraulic Engineering 424  | 3         | 0        | 2,5       | 0        | 15        |
| Hydrology 424              | 3         | 0        | 2,5       | 0        | 15        |
| Philosophy and Ethics 414* | 3         | 0        | 0         | 0        | 4         |
| Project Management 412     | 3         | 0        | 1         | 0        | 12        |
| Structural Design 424      | 3         | 0        | 2,5       | 0        | 15        |
| Transport Science 434      | 3         | 1        | 1,5       | 0        | 15        |
| <b>TOTALS</b>              | <b>18</b> | <b>1</b> | <b>10</b> | <b>0</b> | <b>76</b> |

\* Lecture periods used only in first term.

**Second semester**

|                                 | L         | P         | T          | S        | c         |
|---------------------------------|-----------|-----------|------------|----------|-----------|
| Advanced Design (Civil) 446     | 2         | 6         | 0          | 0        | 15        |
| Complementary Studies (Eng) 441 | 0         | 0         | 3          | 0        | 4         |
| Engineering Management 454      | 5         | 0         | 1          | 0        | 15        |
| Environmental Engineering 452*  | 3         | 0         | 2,5        | 0        | 8         |
| Project (Civil Engineering) 458 | 1         | 20        | 0          | 0        | 30        |
| <b>TOTALS</b>                   | <b>11</b> | <b>26</b> | <b>6,5</b> | <b>0</b> | <b>72</b> |

\* Presented during the first seven weeks of the semester.

## 2.11.6 Curriculum of four-year BEng (Electrical and Electronic Engineering)

### Home department: Electrical and Electronic Engineering

The following focus areas are offered:

- Data Engineering
- Electromagnetics and Telecommunication
- Energy
- Informatics
- Robotics

These focus areas give you the opportunity to partially focus your degree programme in your direction of choice as preparation for modern industry and/or postgraduate study.

If you choose the Data Engineering focus area, you must do so from your first year. Otherwise, in the second semester of the third year, you must choose one of the remaining focus areas.

## 2.11.6.1 The Data Engineering focus area

### YEAR 1

#### First semester

|                                       | L         | P          | T           | S        | c         |
|---------------------------------------|-----------|------------|-------------|----------|-----------|
| Applied Mathematics B 124             | 4         | 0          | 2           | 0        | 15        |
| Engineering Chemistry 123             | 4         | 0          | 2           | 0        | 15        |
| Engineering Mathematics 115           | 5         | 0          | 2           | 0        | 15        |
| Engineering Physics 113               | 2         | 0,5        | 0,5         | 0        | 8         |
| Intercultural Communication (Eng) 113 | 2         | 0          | 1           | 0        | 8         |
| Probability Theory and Statistics 114 | 3         | 0          | 3           | 0        | 16        |
| <b>TOTALS</b>                         | <b>20</b> | <b>0.5</b> | <b>10,5</b> | <b>0</b> | <b>77</b> |

#### Second semester

|                             | L         | P        | T         | S        | C         |
|-----------------------------|-----------|----------|-----------|----------|-----------|
| Applied Mathematics B 154   | 3,5       | 0        | 3         | 0        | 15        |
| Computer Programming 143    | 3         | 2        | 0         | 0        | 12        |
| Data Science 141            | 3         | 0        | 3         | 0        | 16        |
| Electrotechnique 143        | 3,5       | 1        | 2         | 0        | 15        |
| Engineering Mathematics 145 | 5         | 0        | 2         | 0        | 15        |
| <b>TOTALS</b>               | <b>18</b> | <b>3</b> | <b>10</b> | <b>0</b> | <b>73</b> |

### YEAR 2

#### First semester

|                             | L         | P        | T        | S        | c         |
|-----------------------------|-----------|----------|----------|----------|-----------|
| Computer Systems 214        | 3         | 2        | 1        | 0        | 15        |
| Computer Science E 214      | 3         | 3        | 0        | 0        | 15        |
| Engineering Mathematics 214 | 4         | 0        | 2        | 0        | 15        |
| Statistics 214              | 3         | 0        | 2        | 0        | 16        |
| Systems and Signals 214     | 3         | 1        | 2        | 0        | 15        |
| <b>TOTALS</b>               | <b>16</b> | <b>6</b> | <b>7</b> | <b>0</b> | <b>76</b> |

#### Second semester

|                             | L         | P          | T          | S        | c         |
|-----------------------------|-----------|------------|------------|----------|-----------|
| Computer Systems 245        | 3         | 3          | 0          | 0        | 15        |
| Data Engineering 245        | 3         | 1          | 1          | 0        | 12        |
| Engineering Mathematics 242 | 2         | 0          | 1          | 0        | 8         |
| Numerical Methods 262       | 2         | 0          | 1          | 0        | 8         |
| Statistics 244              | 3         | 0          | 2          | 0        | 16        |
| Systems and Signals 244     | 3         | 1,5        | 1,5        | 0        | 15        |
| <b>TOTALS</b>               | <b>16</b> | <b>5,5</b> | <b>6,5</b> | <b>0</b> | <b>74</b> |

### YEAR 3

#### Both semesters

|                       | L        | P        | T        | S        | c        |
|-----------------------|----------|----------|----------|----------|----------|
| Internship (Eng) 392* | 0        | 0        | 0        | 0        | 0        |
| Internship (Eng) 393* | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange. Consult the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

**First semester**

|                      | L         | P        | T        | S        | c         |
|----------------------|-----------|----------|----------|----------|-----------|
| Computer Science 314 | 3         | 3        | 0        | 0        | 16        |
| Computer Science 315 | 3         | 3        | 0        | 0        | 16        |
| Design (E) 314       | 1         | 3        | 0        | 0        | 15        |
| Statistics 318*      | 4         | 0        | 2        | 0        | 24        |
| <b>TOTALS</b>        | <b>11</b> | <b>9</b> | <b>2</b> | <b>0</b> | <b>71</b> |

\* From 2026, Statistics 318 replaces Mathematical Statistics 312 and 316. If you failed Mathematical Statistics 312 or 316 in 2025, you must either repeat the failed module(s) or follow Statistics 318 in 2026.

**Second semester**

|                               | L         | P        | T        | S        | C         |
|-------------------------------|-----------|----------|----------|----------|-----------|
| Computer Science 344          | 3         | 3        | 0        | 0        | 16        |
| Computer Science 343          | 3         | 3        | 0        | 0        | 16        |
| Operations Research (Eng) 345 | 3         | 0        | 3        | 0        | 15        |
| Statistics 348*               | 4         | 0        | 2        | 0        | 24        |
| <b>TOTALS</b>                 | <b>13</b> | <b>6</b> | <b>5</b> | <b>0</b> | <b>71</b> |

\* From 2026, Statistics 348 replaces Data Analytics (Eng) 344 and Mathematical Statistics 344. If you failed Data Analytics (Eng) 344 or Mathematical Statistics 344 in 2025, you must either repeat the failed module(s) or follow both Statistics 318 and Statistics 348 in 2026.

**YEAR 4****First semester**

|                               | L         | P          | T          | S        | c         |
|-------------------------------|-----------|------------|------------|----------|-----------|
| Data Engineering 414          | 3         | 1.5        | 1.5        | 0        | 15        |
| Data Engineering 424          | 3         | 1          | 1          | 0        | 15        |
| Operations Research (Eng) 415 | 3         | 0          | 3          | 0        | 15        |
| Optimisation (Eng) 414        | 3         | 0          | 3          | 0        | 15        |
| Philosophy and Ethics 414*    | 3         | 0          | 0          | 0        | 4         |
| Project Management 412        | 3         | 0          | 1          | 0        | 12        |
| <b>TOTALS</b>                 | <b>18</b> | <b>2.5</b> | <b>9.5</b> | <b>0</b> | <b>76</b> |

\* Lecture periods used only in first term.

**Second semester**

|                                  | L        | P         | T        | S        | c         |
|----------------------------------|----------|-----------|----------|----------|-----------|
| Complementary Studies (Eng) 441  | 0        | 0         | 3        | 0        | 4         |
| Complementary Studies (Eng) 451* | 2        | 0         | 0        | 0        | 4         |
| Entrepreneurship (Eng) 444       | 3        | 0         | 3        | 0        | 15        |
| Environmental Engineering 442**  | 3        | 0         | 2        | 0        | 8         |
| Project (E) 448                  | 0        | 20        | 0        | 0        | 45        |
| <b>TOTALS</b>                    | <b>8</b> | <b>20</b> | <b>8</b> | <b>0</b> | <b>76</b> |

\* Offered with corresponding lectures of Introductory Systems Engineering 444.

\*\* Presented during the third term only.

## 2.11.6.2 The Electromagnetics and Telecomms, Energy, Informatics, and Robotics focus areas

### YEAR 1

The common first-year curriculum for BEng (4yr) (see Section 2.11.3).

### YEAR 2

#### First semester

|                             | L         | P        | T        | S        | c         |
|-----------------------------|-----------|----------|----------|----------|-----------|
| Applied Mathematics B 224   | 3         | 0        | 3        | 0        | 15        |
| Computer Systems 214        | 3         | 2        | 1        | 0        | 15        |
| Computer Science E 214      | 3         | 3        | 0        | 0        | 15        |
| Engineering Mathematics 214 | 4         | 0        | 2        | 0        | 15        |
| Systems and Signals 214     | 3         | 1        | 2        | 0        | 15        |
| <b>TOTALS</b>               | <b>16</b> | <b>6</b> | <b>8</b> | <b>0</b> | <b>75</b> |

#### Second semester

|                             | L         | P        | T          | S        | C         |
|-----------------------------|-----------|----------|------------|----------|-----------|
| Applied Mathematics B 242   | 2         | 0        | 1,5        | 0        | 8         |
| Computer Systems 245        | 3         | 3        | 0          | 0        | 15        |
| Electronics 245             | 3         | 1        | 2          | 0        | 15        |
| Energy Systems 244          | 3         | 0,5      | 2,5        | 0        | 15        |
| Engineering Mathematics 242 | 2         | 0        | 1          | 0        | 8         |
| Systems and Signals 244     | 3         | 1,5      | 1,5        | 0        | 15        |
| <b>TOTALS</b>               | <b>16</b> | <b>6</b> | <b>8,5</b> | <b>0</b> | <b>76</b> |

### YEAR 3

#### Both semesters

|                       | L | P | T | S | c |
|-----------------------|---|---|---|---|---|
| Internship (Eng) 392* | 0 | 0 | 0 | 0 | 0 |
| Internship (Eng) 393* | 0 | 0 | 0 | 0 | 0 |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange; consult to the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

#### First semester

|                         | L         | P          | T          | S        | c         |
|-------------------------|-----------|------------|------------|----------|-----------|
| Control Systems 314     | 3         | 1,5        | 1,5        | 0        | 15        |
| Design (E) 314          | 1         | 3          | 0          | 0        | 15        |
| Electromagnetics 314    | 3         | 1          | 2          | 0        | 15        |
| Electronics 315         | 3         | 1,5        | 1,5        | 0        | 15        |
| Systems and Signals 315 | 3         | 1,5        | 1,5        | 0        | 15        |
| <b>TOTALS</b>           | <b>13</b> | <b>8,5</b> | <b>6,5</b> | <b>0</b> | <b>75</b> |

#### Second semester

|                         | L         | P        | T        | S        | c         |
|-------------------------|-----------|----------|----------|----------|-----------|
| Control Systems 344     | 3         | 1,5      | 1,5      | 0        | 15        |
| Design (E) 344          | 1         | 3        | 0        | 0        | 15        |
| Electromagnetics 344    | 3         | 1,5      | 1,5      | 0        | 15        |
| Energy Systems 344      | 3         | 1        | 2        | 0        | 15        |
| Systems and Signals 344 | 3         | 1        | 2        | 0        | 15        |
| <b>TOTALS</b>           | <b>13</b> | <b>8</b> | <b>7</b> | <b>0</b> | <b>75</b> |

**YEAR 4****First semester: Electromagnetics and Telecommunication focus area**

|                              | L         | P        | T        | S        | c         |
|------------------------------|-----------|----------|----------|----------|-----------|
| Data Analytics (Eng) 414     | 3         | 1        | 1        | 0        | 15        |
| High Frequency Technique 414 | 3         | 1        | 1        | 0        | 15        |
| Philosophy and Ethics 414*   | 3         | 0        | 0        | 0        | 4         |
| Project Management 412       | 3         | 0        | 1        | 0        | 12        |
| Systems and Signals 414      | 3         | 1        | 1        | 0        | 15        |
| Telecommunication 414        | 3         | 1        | 1        | 0        | 15        |
| <b>TOTALS</b>                | <b>18</b> | <b>4</b> | <b>5</b> | <b>0</b> | <b>76</b> |

\* Lecture periods used only in first term.

**First semester: Energy focus area**

|                            | L         | P        | T        | S        | c         |
|----------------------------|-----------|----------|----------|----------|-----------|
| Data Analytics (Eng) 414   | 3         | 1        | 1        | 0        | 15        |
| Electronics 414            | 3         | 1        | 1        | 0        | 15        |
| Energy Systems 414         | 3         | 0,5      | 1,5      | 0        | 15        |
| Energy Systems 424         | 3         | 0,5      | 1,5      | 0        | 15        |
| Philosophy and Ethics 414* | 3         | 0        | 0        | 0        | 4         |
| Project Management 412     | 3         | 0        | 1        | 0        | 12        |
| <b>TOTALS</b>              | <b>18</b> | <b>3</b> | <b>6</b> | <b>0</b> | <b>76</b> |

\* Lecture periods used only in first term.

**First semester: Informatics focus area**

|                            | L         | P        | T        | S        | c         |
|----------------------------|-----------|----------|----------|----------|-----------|
| Computer Science 314       | 3         | 3        | 0        | 0        | 16        |
| Data Analytics (Eng) 414   | 3         | 1        | 1        | 0        | 15        |
| Data Engineering 414       | 3         | 1,5      | 1,5      | 0        | 15        |
| Philosophy and Ethics 414* | 3         | 0        | 0        | 0        | 4         |
| Project Management 412     | 3         | 0        | 1        | 0        | 12        |
| Systems and Signals 414    | 3         | 1        | 1        | 0        | 15        |
| <b>TOTALS</b>              | <b>18</b> | <b>6</b> | <b>4</b> | <b>0</b> | <b>77</b> |

\* Lecture periods used only in first term.

**First semester: Robotics focus area**

|                            | L         | P        | T        | S        | c         |
|----------------------------|-----------|----------|----------|----------|-----------|
| Computer Systems 414       | 3         | 1        | 1        | 0        | 15        |
| Control Systems 414        | 3         | 1        | 1        | 0        | 15        |
| Data Analytics (Eng) 414   | 3         | 1        | 1        | 0        | 15        |
| Philosophy and Ethics 414* | 3         | 0        | 0        | 0        | 4         |
| Project Management 412     | 3         | 0        | 1        | 0        | 12        |
| Systems and Signals 414    | 3         | 1        | 1        | 0        | 15        |
| <b>TOTALS</b>              | <b>18</b> | <b>4</b> | <b>5</b> | <b>0</b> | <b>76</b> |

\* Lecture periods used only in first term.

**Second semester: all four of the abovementioned focus areas**

|                                  | L        | P         | T        | S        | c         |
|----------------------------------|----------|-----------|----------|----------|-----------|
| Complementary Studies (Eng) 441  | 0        | 0         | 3        | 0        | 4         |
| Complementary Studies (Eng) 451* | 2        | 0         | 0        | 0        | 4         |
| Entrepreneurship (Eng) 444       | 3        | 0         | 3        | 0        | 15        |
| Environmental Engineering 442**  | 3        | 0         | 2        | 0        | 8         |
| Project (E) 448                  | 0        | 20        | 0        | 0        | 45        |
| <b>TOTALS</b>                    | <b>8</b> | <b>20</b> | <b>8</b> | <b>0</b> | <b>76</b> |

\* Offered with corresponding lectures of Introductory Systems Engineering 444.

\*\* Presented during the third term only.

**2.11.7 Curriculum of four-year BEng (Industrial Engineering)**

Home department: Industrial Engineering

**YEAR 1**

The common first-year curriculum for BEng (4yr) (see Section 2.11.3)

**YEAR 2****First semester**

|                                 | L         | P        | T         | S        | c         |
|---------------------------------|-----------|----------|-----------|----------|-----------|
| Applied Mathematics B 224       | 3         | 0        | 3         | 0        | 15        |
| Electrotechnique 214            | 3         | 1        | 2         | 0        | 15        |
| Engineering Economics 212       | 2         | 0        | 2         | 0        | 8         |
| Engineering Mathematics 214     | 4         | 0        | 2         | 0        | 15        |
| Practical Workshop Training 211 | 0         | 0        | 0         | 0        | 0         |
| Production Management 212       | 2         | 0        | 2         | 0        | 8         |
| Materials Science A 214         | 3         | 3        | 0         | 0        | 15        |
| <b>TOTALS</b>                   | <b>17</b> | <b>4</b> | <b>11</b> | <b>0</b> | <b>76</b> |

**Second semester**

|                                 | L         | P          | T         | S        | c         |
|---------------------------------|-----------|------------|-----------|----------|-----------|
| Industrial Programming 244      | 2         | 0          | 3         | 0        | 15        |
| Introductory Machine Design 244 | 1         | 3          | 2         | 0        | 15        |
| Engineering Mathematics 242     | 2         | 0          | 1         | 0        | 8         |
| Manufacturing Processes 244     | 2         | 1,5        | 1         | 0        | 15        |
| Thermofluid Dynamics 244        | 3         | 1          | 2         | 0        | 15        |
| Numerical Methods 262           | 2         | 0          | 1         | 0        | 8         |
| <b>TOTALS</b>                   | <b>12</b> | <b>5,5</b> | <b>10</b> | <b>0</b> | <b>76</b> |

**YEAR 3****Both semesters**

|                       | L | P | T | S | c |
|-----------------------|---|---|---|---|---|
| Internship (Eng) 392* | 0 | 0 | 0 | 0 | 0 |
| Internship (Eng) 393* | 0 | 0 | 0 | 0 | 0 |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange; consult the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

## First semester

|                                              | L         | P          | T         | S        | c         |
|----------------------------------------------|-----------|------------|-----------|----------|-----------|
| Complementary Studies (Eng) 311 <sup>+</sup> | 0         | 0          | 3         | 0        | 4         |
| Control Systems 314                          | 3         | 1,5        | 1,5       | 0        | 15        |
| Engineering Statistics 314                   | 3         | 0          | 2,5       | 0        | 15        |
| Manufacturing Systems 324                    | 2         | 0          | 2         | 0        | 12        |
| Philosophy and Ethics 314 <sup>*</sup>       | 3         | 0          | 0         | 0        | 4         |
| Production Management 314                    | 3         | 1          | 2         | 0        | 15        |
| Technical Communication 311 <sup>***</sup>   | 2         | 0          | 0         | 0        | 4         |
| <b>TOTALS</b>                                | <b>16</b> | <b>2,5</b> | <b>11</b> | <b>0</b> | <b>69</b> |

<sup>\*</sup> Lecture periods used only in first term.

<sup>\*\*</sup> Lecture periods used only in second term.

<sup>+</sup> If you did not pass Complementary Studies (Eng) 311 (8 credits) in 2019, you must follow Complementary Studies (Eng) 311 (4 credits) and Technical Communication 311 (4 credits).

## Second semester

|                               | L         | P        | T         | S        | c         |
|-------------------------------|-----------|----------|-----------|----------|-----------|
| Data Analytics (Eng) 344      | 3         | 2        | 1         | 0        | 15        |
| Engineering Economics 354     | 3         | 0        | 3         | 0        | 15        |
| Industrial Management 354     | 3         | 0        | 3         | 0        | 15        |
| Operations Research (Eng) 345 | 3         | 0        | 3         | 0        | 15        |
| Quality Assurance 344         | 3         | 0        | 3         | 0        | 15        |
| Vacation Training 351         | 0         | 0        | 0         | 0        | 0         |
| <b>TOTALS</b>                 | <b>15</b> | <b>2</b> | <b>13</b> | <b>0</b> | <b>75</b> |

## YEAR 4

### Both semesters

|                        | L        | P        | T        | S        | c                     |
|------------------------|----------|----------|----------|----------|-----------------------|
| Industrial Project 498 | 0        | 0        | 0        | 1        | 30 <sup>*</sup>       |
| <b>TOTALS</b>          | <b>0</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>30<sup>*</sup></b> |

<sup>\*</sup> 15 credits in the first semester and 15 credits in the second semester.

### First semester

|                               | L         | P          | T        | S        | c         |
|-------------------------------|-----------|------------|----------|----------|-----------|
| Industrial Ergonomics 414     | 3         | 0          | 2        | 0        | 15        |
| Information Systems 414       | 2         | 1,2        | 2        | 0        | 15        |
| Operations Research (Eng) 415 | 3         | 0          | 3        | 0        | 15        |
| Project Management 412        | 3         | 0          | 1        | 0        | 12        |
| <b>TOTALS</b>                 | <b>11</b> | <b>1,2</b> | <b>8</b> | <b>0</b> | <b>57</b> |

### Second semester

|                                            | L         | P        | T         | S        | c         |
|--------------------------------------------|-----------|----------|-----------|----------|-----------|
| Enterprise Design 444                      | 2         | 0        | 2         | 0        | 15        |
| Environmental Engineering 442 <sup>*</sup> | 3         | 0        | 2         | 0        | 8         |
| Industrial Practice 442                    | 2         | 0        | 1         | 1        | 8         |
| Quality Management 444                     | 2         | 0        | 3         | 0        | 15        |
| Simulation 442                             | 3         | 1        | 2         | 0        | 12        |
| Vacation Training 451                      | 0         | 0        | 0         | 0        | 0         |
| <b>TOTALS</b>                              | <b>12</b> | <b>1</b> | <b>10</b> | <b>1</b> | <b>58</b> |

<sup>\*</sup> Presented in the third term only.

## 2.11.8 Curriculum of four-year BEng (Mechanical Engineering)

Home department: Mechanical and Mechatronic Engineering

### YEAR 1

The common first-year curriculum for BEng (4yr) (see Section 2.11.3).

### YEAR 2

#### First semester

|                                                                                                                 | L         | P        | T          | S        | c         |
|-----------------------------------------------------------------------------------------------------------------|-----------|----------|------------|----------|-----------|
| Applied Mathematics B 224                                                                                       | 3         | 0        | 3          | 0        | 15        |
| Electrotechnique 214                                                                                            | 3         | 1        | 2          | 0        | 15        |
| Engineering Mathematics 214                                                                                     | 4         | 0        | 2          | 0        | 15        |
| Strength of Materials 224                                                                                       | 3         | 0        | 2,5        | 0        | 15        |
| Materials Science A 214                                                                                         | 3         | 3        | 0          | 0        | 15        |
| <i>Choose either the following elective module or the corresponding elective module in the second semester:</i> |           |          |            |          |           |
| Practical Workshop Training 211                                                                                 | 0         | 0        | 0          | 0        | 0         |
| <b>TOTALS</b>                                                                                                   | <b>16</b> | <b>4</b> | <b>9,5</b> | <b>0</b> | <b>75</b> |

#### Second semester

|                                                                                                                | L         | P        | T         | S        | c         |
|----------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|----------|-----------|
| Engineering Mathematics 242                                                                                    | 2         | 0        | 1         | 0        | 8         |
| Electrical Drive Systems 244                                                                                   | 3         | 1        | 2         | 0        | 15        |
| Introductory Machine Design 254                                                                                | 2         | 3        | 1         | 0        | 15        |
| Thermodynamics A 244                                                                                           | 3         | 0        | 3         | 0        | 15        |
| Numerical Methods 262                                                                                          | 2         | 0        | 1         | 0        | 8         |
| Strength of Materials W 244                                                                                    | 3         | 1        | 2         | 0        | 15        |
| <i>Choose either the following elective module or the corresponding elective module in the first semester:</i> |           |          |           |          |           |
| Practical Workshop Training 241                                                                                | 0         | 0        | 0         | 0        | 0         |
| <b>TOTALS</b>                                                                                                  | <b>15</b> | <b>5</b> | <b>10</b> | <b>0</b> | <b>76</b> |

### YEAR 3

#### Both semesters

|                       | L | P | T | S | c |
|-----------------------|---|---|---|---|---|
| Internship (Eng) 392* | 0 | 0 | 0 | 0 | 0 |
| Internship (Eng) 393* | 0 | 0 | 0 | 0 | 0 |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange; consult the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

#### First semester

|                                 | L         | P        | T         | S        | c         |
|---------------------------------|-----------|----------|-----------|----------|-----------|
| Complementary Studies (Eng) 311 | 0         | 0        | 3         | 0        | 4         |
| Fluid Mechanics 314             | 3         | 1        | 2         | 0        | 15        |
| Philosophy and Ethics 314*      | 3         | 0        | 0         | 0        | 4         |
| Machine Design A 314            | 2         | 2        | 2         | 0        | 15        |
| Modelling 333                   | 3         | 0        | 3         | 0        | 16        |
| Strength of Materials W 334     | 3         | 1        | 2         | 0        | 15        |
| Technical Communication 311**   | 2         | 0        | 0         | 0        | 4         |
| <b>TOTALS</b>                   | <b>16</b> | <b>4</b> | <b>12</b> | <b>0</b> | <b>73</b> |

\* Lecture periods used only in first term.

\*\* Lecture periods used only in second term.

**Second semester**

|                          | L         | P        | T        | S        | c         |
|--------------------------|-----------|----------|----------|----------|-----------|
| Control Systems 354      | 4         | 1        | 2        | 0        | 18        |
| Data Analytics (Eng) 344 | 3         | 2        | 1        | 0        | 15        |
| Machine Design B 344     | 2         | 2        | 2        | 0        | 15        |
| Thermofluid Dynamics 344 | 3         | 1        | 2        | 0        | 15        |
| Vacation Training 341    | 0         | 0        | 0        | 0        | 0         |
| Vibration and Noise 354  | 3         | 1        | 1        | 0        | 12        |
| <b>TOTALS</b>            | <b>15</b> | <b>7</b> | <b>8</b> | <b>0</b> | <b>75</b> |

**YEAR 4****Both semesters**

|                        | L        | P        | T        | S        | c          |
|------------------------|----------|----------|----------|----------|------------|
| Mechanical Project 478 | 2        | 3        | 0        | 0        | 45*        |
| <b>TOTALS</b>          | <b>2</b> | <b>3</b> | <b>0</b> | <b>0</b> | <b>45*</b> |

\* Five credits in the first semester and 40 credits in the second semester.

**First semester**

|                                                      | L         | P               | T               | S        | c            |
|------------------------------------------------------|-----------|-----------------|-----------------|----------|--------------|
| Energy Systems M 434                                 | 3         | 1               | 2               | 0        | 15           |
| Heat Transfer A 414                                  | 3         | 1               | 2               | 0        | 15           |
| Experimental Techniques 413**                        | 4         | 4               | 0               | 0        | 12           |
| Project Management 412                               | 3         | 0               | 1               | 0        | 12           |
| <i>Choose one of the following elective modules:</i> |           |                 |                 |          |              |
| Finite Element Methods 414                           | 3         | 1               | 2               | 0        | 15           |
| Maintenance Management 414                           | 3         | 0,5             | 2,5             | 0        | 15           |
| Mechanical Engineering 414*                          | 3         | 1               | 2               | 0        | 15           |
| Numerical Fluid Dynamics 414                         | 3         | 1               | 2               | 0        | 15           |
| <b>TOTALS</b>                                        | <b>16</b> | <b>6,5 or 7</b> | <b>7 or 7,5</b> | <b>0</b> | <b>74***</b> |

\* Not presented every year.

\*\* If you failed Mechatronics 424 in 2024, you must take Mechatronics 434 (as offered to Mechatronic Engineering students)

\*\*\* Including 5 credits from Mechanical Project 478.

**Second semester**

|                                      | L        | P        | T        | S        | c            |
|--------------------------------------|----------|----------|----------|----------|--------------|
| Environmental Engineering 442*       | 3        | 0        | 2        | 0        | 8            |
| Introductory Systems Engineering 444 | 3        | 3        | 0        | 0        | 15           |
| Production Management 444            | 3        | 0        | 2        | 0        | 12           |
| Vacation Training 441                | 0        | 0        | 0        | 0        | 0            |
| <i>Elective repeat module:</i>       |          |          |          |          |              |
| Finite Element Methods 474**         | 3        | 1        | 2        | 0        | 15           |
| <b>TOTALS</b>                        | <b>9</b> | <b>3</b> | <b>4</b> | <b>0</b> | <b>75***</b> |

\* Presented in the third term only.

\*\* This module repeats the content of Finite Element Methods 414 and is offered in hybrid format. If you failed Finite Element Methods 414, you may elect to complete this module instead of repeating Finite Element Methods 414 the following year.

\*\*\* Including 40 credits from Mechanical Project 478.

## 2.11.9 Curriculum of four-year BEng (Mechatronic Engineering)

Home department: Mechanical and Mechatronic Engineering

### YEAR 1

The common first-year curriculum for BEng (4yr) (see Section 2.11.3).

### YEAR 2

The first semester is the same as for BEng (Mechanical Engineering).

#### Second semester

|                                                                                                                | L         | P        | T         | S        | c         |
|----------------------------------------------------------------------------------------------------------------|-----------|----------|-----------|----------|-----------|
| Engineering Mathematics 242                                                                                    | 2         | 0        | 1         | 0        | 8         |
| Electrical Drive Systems 244                                                                                   | 3         | 1        | 2         | 0        | 15        |
| Introductory Machine Design 254                                                                                | 2         | 3        | 1         | 0        | 15        |
| Thermofluid Dynamics 254*                                                                                      | 3         | 0        | 3         | 0        | 15        |
| Numerical Methods 262                                                                                          | 2         | 0        | 1         | 0        | 8         |
| Strength of Materials W 244                                                                                    | 3         | 1        | 2         | 0        | 15        |
| <i>Choose either the following elective module or the corresponding elective module in the first semester:</i> |           |          |           |          |           |
| Practical Workshop Training 241                                                                                | 0         | 0        | 0         | 0        | 0         |
| <b>TOTALS</b>                                                                                                  | <b>15</b> | <b>5</b> | <b>10</b> | <b>0</b> | <b>76</b> |

\* If you failed Thermodynamics A 244 in 2025, you must take Thermodynamics A 244 (still offered to Mechanical Engineering students).

### YEAR 3

#### Both semesters

|                       | L | P | T | S | c |
|-----------------------|---|---|---|---|---|
| Internship (Eng) 392* | 0 | 0 | 0 | 0 | 0 |
| Internship (Eng) 393* | 0 | 0 | 0 | 0 | 0 |

\* These are optional modules that allow selected students to interrupt their credit-bearing studies for one year to complete internships at approved organisations, or to complete a semester of credit-bearing exchange; consult the module contents in Section 4.3 for further details. These optional modules may not be available in all years and you should confirm their availability before making any arrangements.

#### First semester

|                                 | L         | P        | T         | S        | c         |
|---------------------------------|-----------|----------|-----------|----------|-----------|
| Complementary Studies (Eng) 311 | 0         | 0        | 3         | 0        | 4         |
| Computer Systems 214            | 3         | 2        | 1         | 0        | 15        |
| Thermofluid Dynamics 314 ***    | 3         | 1        | 2         | 0        | 15        |
| Philosophy and Ethics 314*      | 3         | 0        | 0         | 0        | 4         |
| Machine Design A 314            | 2         | 2        | 2         | 0        | 15        |
| Modelling 333                   | 3         | 0        | 3         | 0        | 16        |
| Technical Communication 311**   | 2         | 0        | 0         | 0        | 4         |
| <b>TOTALS</b>                   | <b>16</b> | <b>5</b> | <b>11</b> | <b>0</b> | <b>73</b> |

\* Lecture periods used only in first term.

\*\* Lecture periods used only in second term.

\*\*\* If you failed Fluid Mechanics 314 in 2025, you must take Fluid Mechanics 314 (still offered to Mechanical Engineering students).

## Second semester

|                          | L         | P        | T        | S        | c         |
|--------------------------|-----------|----------|----------|----------|-----------|
| Computer Systems 245     | 3         | 3        | 0        | 0        | 15        |
| Control Systems 354      | 3         | 1        | 2        | 0        | 16        |
| Data Analytics (Eng) 344 | 3         | 2        | 1        | 0        | 15        |
| Electronics 245          | 3         | 1        | 2        | 0        | 15        |
| Vacation Training 341    | 0         | 0        | 0        | 0        | 0         |
| Vibration and Noise 354  | 3         | 1        | 1        | 0        | 12        |
| <b>TOTALS</b>            | <b>15</b> | <b>8</b> | <b>6</b> | <b>0</b> | <b>73</b> |

## YEAR 4

### Both semesters

|                                                      | L        | P        | T        | S        | c          |
|------------------------------------------------------|----------|----------|----------|----------|------------|
| <i>Choose one of the following elective modules:</i> |          |          |          |          |            |
| Mechatronic Project 478                              | 2        | 3        | 0        | 0        | 45*        |
| Mechatronic Project 488                              | 2        | 3        | 0        | 0        | 45*        |
| <b>TOTALS</b>                                        | <b>2</b> | <b>3</b> | <b>0</b> | <b>0</b> | <b>45*</b> |

\* Five credits in the first semester and 40 credits in the second semester.

### First semester

|                              | L         | P           | T          | S        | c           |
|------------------------------|-----------|-------------|------------|----------|-------------|
| Design (E) 314               | 1         | 3           | 0          | 0        | 15          |
| Electronics 315              | 3         | 1,5         | 1,5        | 0        | 15          |
| Experimental Techniques 413* | 4         | 4           | 0          | 0        | 12          |
| Mechatronics 434             | 3         | 3           | 0          | 0        | 12          |
| Project Management 412       | 3         | 0           | 1          | 0        | 12          |
| <b>TOTALS</b>                | <b>14</b> | <b>11,5</b> | <b>2,5</b> | <b>0</b> | <b>71**</b> |

\* If you failed Heat Transfer A414 (15 credits) in 2025, you can repeat Heat Transfer A 414 (still offered to Mechanical Engineering students) or follow Experimental Techniques 413.

\*\* Including 5 credits from Mechatronic Project 478/488.

### Second semester

|                                      | L        | P        | T        | S        | c           |
|--------------------------------------|----------|----------|----------|----------|-------------|
| Environmental Engineering 442*       | 3        | 0        | 2        | 0        | 8           |
| Introductory Systems Engineering 444 | 3        | 3        | 0        | 0        | 15          |
| Production Management 444            | 3        | 0        | 2        | 0        | 12          |
| Vacation Training 441                | 0        | 0        | 0        | 0        | 0           |
| <b>TOTALS</b>                        | <b>9</b> | <b>3</b> | <b>4</b> | <b>0</b> | <b>75**</b> |

\* Presented in the third term only.

\*\* Including 40 credits from Mechatronic Project 478/488.

## 2.11.10 Measures for repeating modules that have been removed from programmes

As a result of programme changes, transitional measures are being implemented to accommodate students who must repeat modules that are no longer part of a particular programme. If you must repeat a module, look below under the name of the relevant field of study for the measures that apply to you.

### Civil Engineering

| Module previously in programme | Last year offered                                            | Transitional measure               |
|--------------------------------|--------------------------------------------------------------|------------------------------------|
| Engineering Statistics 314     | Still offered in the BEng (Industrial Engineering) programme | Follow Engineering Statistics 314. |

### Electrical and Electronic Engineering

| Module previously in programme | Last year offered                                                                                                          | Transitional measure                                                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electronics 365                | 2021 (only for repeating students)                                                                                         | After 2021: Follow the regular third-year programme.                                                                                                                                                      |
| Data Engineering 344           | 2022                                                                                                                       | After 2022: Follow Data Engineering 414.                                                                                                                                                                  |
| Computer Science 334           | 2023 (only for repeating students, and fourth-year Electrical and Electronic students with Data Engineering as focus area) | After 2023: Follow Computer Science 343.                                                                                                                                                                  |
| Computer Science (E) 414       | 2024                                                                                                                       | After 2024: Follow Data Analytics (Eng) 414                                                                                                                                                               |
| Mathematical Statistics 214    | 2025 (only for repeating students)                                                                                         | After 2025: Repeat the module or follow Statistics 214.<br>Mathematical Statistics 214 is still offered in the Faculty of Economic and Management Sciences.                                               |
| Mathematical Statistics 245    | 2025 (only for repeating students)                                                                                         | After 2025: Repeat the module or follow both Statistics 214 and Statistics 244.<br>Mathematical Statistics 245 is still offered in the Faculty of Economic and Management Sciences.                       |
| Mathematical Statistics 246    | 2025 (only for repeating students)                                                                                         | After 2025: Repeat the module or follow both Statistics 214 and Statistics 244.<br>Mathematical Statistics 246 is still offered in the Faculty of Economic and Management Sciences.                       |
| Mathematical Statistics 312    | 2026 (only for repeating students)                                                                                         | After 2026: Repeat the module or follow Statistics 318.<br>Mathematical Statistics 312 is still offered in the Faculty of Economic and Management Sciences.                                               |
| Mathematical Statistics 316    | 2026 (only for repeating students)                                                                                         | After 2026: Repeat the module or follow Statistics 318.<br>Mathematical Statistics 316 is still offered in the Faculty of Economic and Management Sciences.                                               |
| Mathematical Statistics 344    | 2026 (only for repeating students)                                                                                         | After 2026: Repeat the module or follow both Statistics 318 and Statistics 348.<br>Mathematical Statistics 344 is still offered in the Faculty of Economic and Management Sciences.                       |
| Data Analytics (Eng) 344       | 2026 (only for repeating students)                                                                                         | After 2026: Repeat the module or follow both Statistics 318 and Statistics 348<br>Data Analytics (Eng) 344 is still offered in the BEng programmes in Industrial, Mechanical and Mechatronic Engineering. |

### Industrial Engineering

| Module previously in programme | Last year offered | Transitional measure                        |
|--------------------------------|-------------------|---------------------------------------------|
| Materials Science A 244        | 2024              | After 2024: Follow Materials Science A 214  |
| Thermofluid Dynamics 214       | 2024              | After 2024: Follow Thermofluid Dynamics 244 |

### Mechanical Engineering

| Module previously in programme | Last year offered | Transitional measure                                                                                 |
|--------------------------------|-------------------|------------------------------------------------------------------------------------------------------|
| Materials Science A 244        | 2024              | After 2024: Follow Materials Science A 214                                                           |
| Thermodynamics A 214           | 2024              | After 2024: Follow Thermodynamics A 244                                                              |
| Electrical Drive Systems 324   | 2025              | After 2025: Follow Electrical Drive Systems 244                                                      |
| Fluid Mechanics 244            | 2024              | After 2024: Follow Fluid Mechanics 314                                                               |
| Mechatronics 424               | 2024              | After 2024: Follow Mechatronics 434<br>Still offered in the BEng (Mechatronic Engineering) programme |

### Mechatronic Engineering

| Module previously in programme | Last year offered | Transitional measure                                                                                    |
|--------------------------------|-------------------|---------------------------------------------------------------------------------------------------------|
| Materials Science A 244        | 2024              | After 2024: Follow Materials Science A 214                                                              |
| Thermodynamics A 214           | 2024              | After 2024: Follow Thermodynamic A 244                                                                  |
| Thermodynamics A 244           | 2025              | After 2025: Follow Thermodynamics A 244<br>Still offered in the BEng (Mechanical Engineering) programme |
| Fluid Mechanics 244            | 2024              | After 2024: Follow Fluid Mechanics 314                                                                  |
| Fluid Mechanics 314            | 2025              | After 2025: Follow Fluid Mechanics 314<br>Still offered in the BEng (Mechanical Engineering) programme  |
| Heat Transfer A 414            | 2024              | After 2024: Follow Heat Transfer A 414<br>Still offered in the BEng (Mechanical Engineering) programme  |

## 3. Postgraduate Programmes

In this chapter you will find Faculty-wide rules that apply to postgraduate study in engineering at this University. Please contact the relevant departmental chairperson for further details. For contact details, see Section 1.1.3 in the chapter "General Information" above.

### 3.1 Qualifications and fields of study

#### Qualifications

The Faculty awards the following postgraduate qualifications:

*Please note:* Figure 3.1 in Section 3.2 illustrates the postgraduate structure and admission paths.

- **PGDip (Engineering): Postgraduate Diploma in Engineering**  
The postgraduate diploma comprises an in-depth study in preparation for a master's programme or a broadened study involving more than one engineering discipline. The PGDip (Eng) does not lead to registration as a professional engineer.
- **PGDip (Engineering Science): Postgraduate Diploma in Engineering Science**  
The postgraduate diploma comprises an in-depth study in preparation for a master's programme in engineering science.
- **MEng: Master of Engineering**  
Two MEng qualifications are offered by the Faculty:
  - The MEng (Structured) is based on coursework and the emphasis is on the advanced application of engineering sciences in design.
  - The MEng (Research) consists of a research project, which must culminate in a satisfactory thesis about the research project.
- **MEngSc: Master of Engineering Science**  
Two MEngSc qualifications are offered by the Faculty:
  - The MEngSc (Structured) is based on coursework and the emphasis is on the advanced application of engineering sciences.
  - The MEngSc (Research) consists of a research project that must culminate in a satisfactory thesis about that research project.
- **PhD: Doctor of Philosophy**  
The PhD degree programme comprises a research project and a dissertation on that project. The Faculty will only award the degree if the candidate has generated new knowledge through research.
- **DEng: Doctor of Engineering**  
The DEng may be awarded to candidates whose research has, over a number of years, made a substantial contribution towards humanity's knowledge in the field of engineering.

The following qualification has been phased out:

- **MScEng: Master of Science in Engineering**  
The last students started in this programme in February 2011.

#### Fields of study

The PGDip (Engineering), MEng (Structured), MEng (Research) and PhD can be awarded in the following fields of study (home departments are indicated in brackets):

- Chemical Engineering (Department of Chemical Engineering)
- Civil Engineering (Department of Civil Engineering)
- Electrical Engineering (Department of Electrical and Electronic Engineering)
- Electronic Engineering (Department of Electrical and Electronic Engineering)
- Engineering Management (Department of Industrial Engineering)
- Industrial Engineering (Department of Industrial Engineering)
- Mechanical Engineering (Department of Mechanical and Mechatronic Engineering)
- Mechatronic Engineering (Department of Mechanical and Mechatronic Engineering)

Further, the Faculty offers the following qualifications and fields of study (the organisational unit that hosts each one is indicated in brackets):

- PGDip (Engineering Science) (Institute for Biomedical Engineering)
- MEngSc (Structured) in Biomedical Engineering (Institute for Biomedical Engineering)
- MEngSc (Research) in Biomedical Engineering (Institute for Biomedical Engineering)

- MEngSc (Research) aimed at interdisciplinary study (can be offered by any of the Faculty's departments)
- PhD in Biomedical Engineering (Institute for Biomedical Engineering)

Unless stated otherwise, the arrangements given below for the PGDip (Engineering), MEng and PhD also apply to the corresponding programmes in engineering science and biomedical engineering.

Not all the programmes, fields of study and postgraduate modules are presented in a given year.

## 3.2 Postgraduate admission model for the Faculty of Engineering

The postgraduate programme structure and paths for admission are illustrated in Figure 3.1 below and apply to all postgraduate students who have been admitted from 2005 onwards. If you do not meet the qualification requirements shown in the model, the Faculty Board must first approve your admission to the relevant postgraduate programme.

The credit values in Figure 3.1 correspond to 1 credit for 10 hours of work for you as a student. The NQF levels refer to the National Qualification Framework.

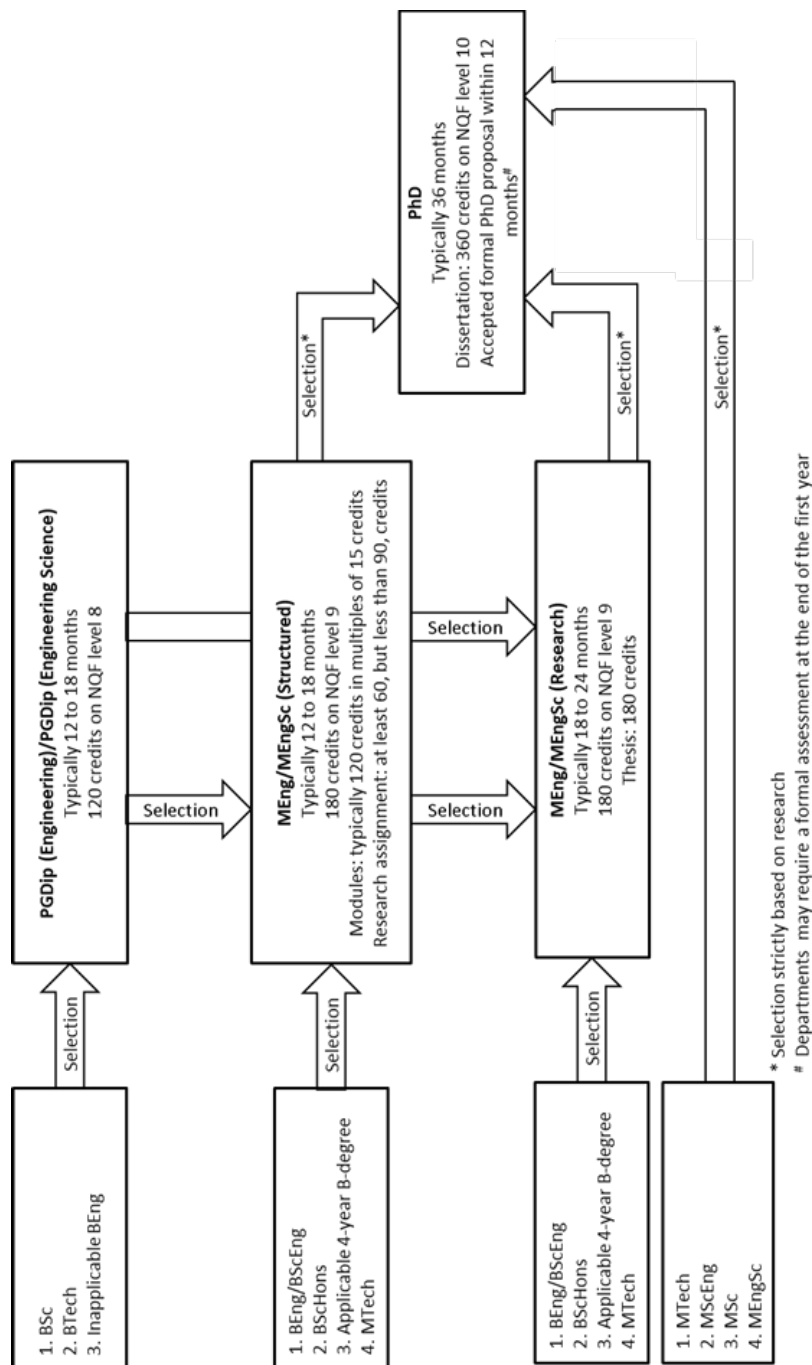


Figure 3.1: Postgraduate admission model

### 3.3 Recognition of prior learning

Sections 2.4.2.2 and 2.4.2.7 in the chapter "Undergraduate Programmes", regarding the recognition of modules that you have completed elsewhere, also apply here, except for the following:

- Exemption from module(s) can be granted on the strength of short courses you have completed that fall outside of the HEQSF (in other words, non-credit-bearing short courses), on condition that the course contents, duration and assessment of the short course are at least equivalent to the same of the relevant module(s).
- If you hold the required qualification for admission, but did not perform well enough, the departmental committees for Recognition of Prior Learning / Credit Accumulation and Transfer (RPL/CAT) may recognise supplementary learning and work experience to grant you admission, provided that your learning and experience show that you now have the potential to complete the relevant programme successfully.  
*For example*, if you did not achieve 60% in the final year of your previous qualification, but you have completed advanced projects successfully, then an RPL/CAT committee may allow you to enrol for a master's degree.
- Departmental RPL/CAT committees can consider recognising your work experience and projects for module credits, but not for research modules. Note that such work experience and projects must be of an appropriate scope and advanced nature.

### 3.4 Provisions regarding enrolment and conversion of programmes

#### 3.4.1 Periods of enrolment

Table 3.1 below shows the following for the respective postgraduate programmes:

- the minimum number of years you must be enrolled,
- for how long you can normally expect to be enrolled,
- how many years you may enrol without having to apply for readmission (that is, the maximum period of enrolment for each postgraduate programme, as approved by the Faculty Board in 2004), and
- the year you will require permission for readmission, if you have not completed the programme by then.

**Table 3.1: Periods of enrolment for postgraduate programmes**

| Programme                               | Years of Enrolment |   |   |   |   |   |   |   |   |
|-----------------------------------------|--------------------|---|---|---|---|---|---|---|---|
|                                         | 1                  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| PGDip (Eng) Full-time                   | M                  | X | - | - | - | - | - | - | - |
| PGDip (Eng) Part-time                   | M                  | F | X | - | - | - | - | - | - |
| MEng (Structured) Full-time             | M                  | F | X | - | - | - | - | - | - |
| MEng (Structured) Part-time             | M                  | N | F | X | - | - | - | - | - |
| MEng (Research) Full-time               | M                  | N | F | X | - | - | - | - | - |
| MEng (Research) Part-time               | M                  | N | N | F | X | - | - | - | - |
| MEngSc (Structured) Full-time           | M                  | F | X | - | - | - | - | - | - |
| MEngSc (Structured) Part-time           | M                  | N | F | X | - | - | - | - | - |
| MEngSc (Research) Full-time             | M                  | N | F | X | - | - | - | - | - |
| MEngSc (Research) Part-time             | M                  | N | N | F | X | - | - | - | - |
| PhD Full-time (after master's)          | M                  | M | N | F | X | - | - | - | - |
| PhD Full-time (after BEng, no master's) | M                  | M | M | N | F | X | - | - | - |
| PhD Part-time (after master's)          | M                  | M | N | N | N | F | X | - | - |
| PhD Part-time (after BEng, no master's) | M                  | M | M | N | N | N | F | X | - |

**Key:**

|   |                                                                                                                    |                                      |
|---|--------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| M | Minimum (mandatory) enrolment period. (Under exceptional circumstances the degree may be completed in this period) | Normal maximum period of enrolment   |
| N | Normal enrolment after minimum. (The period required to complete the degree normally spans M and N)                |                                      |
| F | Final concessional year (may register without having to apply for readmission)                                     |                                      |
| X | Enrolment only if readmission has been approved by the Faculty Board or, for a PhD, the Senate.                    | Allowed in exceptional circumstances |
| - | Further registrations normally not allowed                                                                         |                                      |

### 3.4.2 Continued enrolment during the maximum period of enrolment

You must register as a student every year for the full duration of your studies, until you are awarded the degree or diploma concerned (see the section "Continuation of Registration for Postgraduate Programmes" in Part 1 (General Rules) of the University Yearbook), except if the Faculty Board approves an interruption of your studies (consult Section 3.4.4, "Interruption of studies", below).

You must make sufficient progress in your studies each year to be permitted to register again. If your progress is insufficient, the relevant departmental chairperson may recommend to the Faculty Board that the Board prevent you from continuing your postgraduate studies. The Faculty Board could, among other things, consider the following:

- whether it is reasonable to expect you to complete the programme within the relevant maximum period of enrolment, taking into account your progress to date; and
- to what extent you have, to date, shown that you can work independently, regarding assignments, theses and dissertations.

### 3.4.3 Continued enrolment after the maximum period of enrolment

After the normal maximum enrolment period, you may only re-register as a postgraduate student if:

- you apply to be readmitted in order to continue your studies:
  - to the chairperson of the relevant department
  - by **15 January** of the year in which you want to continue your enrolment;
- the particular departmental chairperson recommends approving the application; and
- as a PGDip (Eng), MEng or MEngSc student, you have obtained the Faculty Committee's permission; *or*  
as a PhD student, you have obtained the Senate's permission, on the Faculty Board's recommendation.

The Faculty Committee and Board will normally only once grant or recommend that your permitted maximum period of enrolment be extended.

See Table 3.1 above in Section 3.4.1 for the maximum periods of enrolment for the respective postgraduate programmes.

### 3.4.4 Interruption of studies

The Faculty Board may approve an interruption of your studies according to Part 1 (General Rules) of the Yearbook. Otherwise you must register as a student every year for the full duration of your studies until you are awarded the degree or diploma concerned. If the Faculty Board has approved your interruption of studies, the particular period will not be taken into account when it is determined whether or not you have exceeded the maximum allowed enrolment period. If the Faculty Board has not approved the interruption, the period of the interruption will be taken into account.

If you interrupted your studies without approval from the Faculty Board, you must apply anew at the relevant department for admission before you may enrol again. If the interruption was for two or more years, the relevant department may require you to start the programme over, with a different research topic (if applicable).

### 3.4.5 Permission required for part-time enrolment

If you want to enrol part time, you must obtain approval from the departmental chairperson of your prospective home department. To get this approval, you must show that you will be a bona fide part-time student. Follow your prospective home department's procedures for submitting your application to study part time.

The Faculty will normally not allow you to change from full-time to part-time enrolment in its postgraduate programmes. In exceptional circumstances you may submit an application for such a change during the normal duration of the programme. Follow the procedure of your home department. The relevant departmental chairperson will make a recommendation to the Dean, who will consider permission for the change.

### 3.4.6 Converting between postgraduate programmes

#### 3.4.6.1 From PGDip (Eng) to MEng

If your case is deserving, the Faculty Board may recommend to the Senate that your registration for a PGDip (Eng) be converted to registration for an MEng. You may convert if you:

- have progressed above the expected standards in your studies and
- want to continue studying at a master's level.

#### 3.4.6.2 From MEng to MScEng

Since the MScEng programme is being phased out, you may no longer convert to it.

#### 3.4.6.3 From MEngSc and MEng (Research) to PhD

If your case is deserving, the Faculty Board may recommend to the Senate that your registration for a master's degree in engineering may be converted to registration for a doctorate degree. This applies only to registration for MEngSc and MEng (Research). Applications are handled according to the rules in Part 1 (General Rules) of the Yearbook.

## 3.5 Postgraduate Diploma in Engineering (PGDip (Eng))

### 3.5.1 Admission requirements

To be considered for admission to a PGDip (Eng) programme, you must:

- hold at least an approved BTech, BEng or BSc degree from a South African university or university of technology; *or*
- hold other academic degree qualifications and appropriate experience that have been approved by the Faculty Board. The relevant department's chairperson must make a recommendation regarding such qualification and experience to the Faculty Board.

Also refer to the postgraduate admission model in Figure 3.1 in Section 3.2 near the beginning of this chapter.

### 3.5.2 Selection

Irrespective of the admission requirements above, you must be selected for the PGDip programme by the home department of the relevant field of study.

### 3.5.3 Application procedure

Submit your written application for admission to the PGDip (Eng) to the Registrar at least three months before the start of the first semester. Official application forms will then be sent to you. You must also provide the following information to the University along with your application forms:

- details of qualifications already obtained and appropriate experience gained,
- certified copies of the relevant certificates,
- the field of study of the PGDip (Eng) that you want to follow.

To obtain further details about the application procedure, please send an e-mail to the address at "Postgraduate enquiries" under the relevant home department in Section 1.1.3.

### 3.5.4 Duration and period of enrolment

- Table 3.1 in Section 3.4.1 earlier in this chapter shows the minimum, normal and maximum time you have available to complete the PGDip (Engineering) as a full-time or part-time student. Full-time students can normally complete the programme in one academic year (from February to November).

### 3.5.5 Pass requirements

You must obtain a final mark of at least 50% in each of the modules prescribed by the home department's chairperson.

### 3.5.6 Programme structure

- Depending on the composition of a PGDip (Eng), it may be presented in semester, self-study or block courses.
- The programme must include at least 120 credits on NQF level 8 (modules with a 7xx number).
- The chairperson of the home department may prescribe that you to undertake preparatory and/or supplementary study.
- As a student in a PGDip programme, you may normally not register for modules on NQF level 9 (i.e. modules with an 8xx module number).

## 3.6 Master of Engineering (MEng)

### 3.6.1 Admission requirements

To be considered for admission to the MEng (Research) and MEng (Structured) programmes, you must:

- hold at least a BEng, a BScHons, another relevant four-year bachelor's degree, an MTech, or a PGDip (Eng); *or*
- hold other academic degree qualifications and appropriate experience that have been approved by the Faculty Board. The relevant department's chairperson must make a recommendation regarding such qualification and experience to the Faculty Board.

Also refer to the postgraduate admission model in Figure 3.1 in Section 3.2 near the beginning of this chapter.

### 3.6.2 Selection

Irrespective of the admission requirements above, you must be selected for an MEng programme by the home department of the relevant field of study.

### 3.6.3 Application procedure

You must apply in writing to the Registrar for admission as a master's student. Provide the following information:

- details of qualifications already obtained,
- certified copies of the relevant certificates,
- your proposed field of study or subject of your thesis.

To obtain further details about the application procedure, please send an e-mail to the address at "Postgraduate enquiries" under the relevant home department in Section 1.1.3.

### 3.6.4 Duration and period of enrolment

Table 3.1 in Section 3.4.1 above shows the minimum, normal and maximum time available to you to complete the MEng (Structured) and the MEng (Research) as a full-time or part-time student. Note that the MEng (Structured) takes at least 12 months to complete if you are a full-time student, that is from February in the first year to January in the second year. Module scheduling constraints, however, often lead to full-time students only completing the programme at the end of the second year. Many full time MEng (Research) students complete the programme in two academic years by starting in February of the first year and receiving the degree in March of the third year.

### 3.6.5 Programme description: MEng (Structured)

The MEng (Structured) programme consists of 180 credits on NQF level 9. It comprises:

- a research assignment that contributes a minimum of 60 credits, but fewer than 90 credits, at NQF level 9;
- a number of required modules that contribute the balance of the required 180 credits at NQF level 9 after the credits of the research assignment have been considered; and
- possibly some supplementary modules.

The required and supplementary modules are prescribed by the chairperson of the relevant home department, while the topic of the research assignment is subject to the chairperson's approval. In the research assignment the emphasis is on the practical application of the theory and on assessing how valuable the impact of this application is.

Depending on their content, the modules in MEng (Structured) programmes may be presented in semester or block format. Particulars should be requested from the home department of the module (see the address for postgraduate enquiries under the home department in Section 1.1.3).

### 3.6.6 Programme description: MEng (Research)

For the MEng (Research) programme you must complete a thesis with a minimum credit value of 180 on NQF level 9.

#### Supplementary modules

In the following cases you must normally also complete supplementary modules:

- if you are admitted to any MEng (Research) programme without meeting the admission requirements.
- if supplementary modules are prescribed for all students in some MEng (Research) programmes (refer to the relevant department's website).

Supplementary modules are prescribed by the chairperson of your home department on the basis of:

- the requirements of the specific field of study.
- the specific objectives of your studies, your academic background and your experience.
- the availability of lecturing personnel who can lead students in the specific fields of study and modules.

Supplementary modules are normally taken from MEng (Structured), PGDip (Eng) or even BEng programmes.

#### Thesis requirements

You must satisfactorily complete a research project that has been approved by the chairperson of the relevant home department and submit a thesis on this project. It must be evident from your thesis that you are capable of independent scientific and technical investigation and interpretation of the results. You must add a declaration to your thesis, stating that the thesis has not been submitted at another university for a degree and that it is your own work. You must write the entire thesis yourself. The body of the thesis must form a coherent whole. This normally comprises an introduction, a background study, one or more chapters where the core contribution is developed or designed, a set of experiments by which the quality of the contribution is tested and a conclusion chapter. The thesis must also include a complete list of the references used.

The thesis has to satisfy the length restrictions imposed by your home department and it will not be submitted to the examiners if it does not comply with these restrictions.

If you want to graduate at the December graduation ceremony, you must submit your thesis for final examination on or before **1 September**, unless your home department specifies differently. If you want to graduate in March, you must normally submit your thesis on or before **1 November**, unless your home department specifies differently.

### 3.6.7 Examination and requirements to pass: MEng (Structured)

To be awarded the degree MEng (Structured), you must:

- attend all classes as required by the chairperson of the relevant home department;
- pass all required and supplementary modules, as well as the research assignment. This may include independent study, assignments and other forms of assessment. To pass you must achieve a minimum final mark of at least 50, or a final result of "satisfactorily completed".

#### How your final mark is determined

Your weighted average, which is determined based on the credit weighting of all required modules and the research assignment, is normally used as your final mark for the MEng (Structured). Your marks for supplementary modules are not used for determining your final mark.

### 3.6.8 Examination and requirements to pass: MEng (Research)

To be awarded the degree MEng (Research), you must:

- attend all classes as required by the chairperson of the relevant home department;
- pass all prescribed and supplementary modules. This may include independent study, assignments and other forms of assessment. To pass you must have achieved a final mark of at least 50, or a final result of "satisfactorily completed". These modules must be passed as soon as possible. You cannot submit your thesis to the examiners before you have passed these modules;
- satisfactorily complete an oral examination;
- obtain a final mark of at least 50 for your thesis examination; and
- submit a journal article on your thesis research, which has been approved by your supervisor(s) (or when requested by the departmental chairperson, if the requirement for an oral examination was waived for you). Your supervisor(s) may decide whether or not the article will be submitted to a journal or a conference. Even if the thesis is classified as confidential or secret, you must still submit the article.

You must normally be present at your host department when the oral examination is conducted.

Details about the examination process are given in the Faculty's "Postgraduate Processes for the Faculty of Engineering" (Section 1.6 above indicates how to access this document).

### How your final mark is determined

Only the mark awarded for your thesis is normally used to determine your final mark for the MEng (Research). Your marks for supplementary modules are not used for determining the final mark.

## 3.7 Doctor of Philosophy (PhD) in the Engineering Faculty

### 3.7.1 Admission requirements and continued admission after your first year of study

To be considered for admission to the PhD-programme you must:

- hold at least an MScEng, MSc, MEng, or MTech degree, all with a significant research component; *or*
- have reached (in another manner) a standard of competence in your field of study which is deemed sufficient for this purpose by the Senate.

Also refer to the postgraduate admission model in Figure 3.1 in Section 3.2 near the beginning of this chapter.

Within your first year of PhD studies, you must get permission to continue your registration. To get this permission you must:

- complete a formal assessment of your research proposal to the satisfaction of the Faculty Board (please refer to the Faculty's "Postgraduate Processes for the Faculty of Engineering"; see Section 1.6 for access details); *and*
- after completing this assessment, receive the Faculty Board's approval of your dissertation topic and supervisor(s).

### 3.7.2 Selection

Irrespective of the admission requirements above, you must be selected for the PhD programme by the home department of the relevant field of study.

### 3.7.3 Application procedure

You must apply for admission as a PhD student on the University's online application portal:

<https://www.su.ac.za/en/apply>. Provide the information as required on the portal, which will include the following:

- your contact information,
- qualifications you have already completed (also provide certified copies of these qualifications if you did not obtain them from Stellenbosch University),
- the date you intend to begin your PhD studies,
- the name of a supervisor and, if applicable, the names of one or more co-supervisors.

### 3.7.4 Duration and periods of enrolment

Table 3.1 in Section 3.4.1 earlier in this chapter shows the minimum, normal and maximum time available to you to complete your PhD studies as a full-time or part-time student. Many full-time PhD students complete the programme in three academic years by starting in February of the first year and receiving the degree in March of the fourth year.

### 3.7.5 Programme composition and requirements for obtaining the PhD degree

The PhD programme comprises 360 credits of research on NQF level 10 that leads to a dissertation.

The University can award the PhD degree to you if you have, in addition to meeting the minimum registration requirements:

- done original research in the field of engineering sciences:
  - under the supervision of a supervisor; and
  - to the satisfaction of the University.

- submitted a satisfactory dissertation which in the Senate's view shows that:
  - you have made a specific contribution that enriches knowledge in the particular subject area, and
  - that you have exhibited independent critical judgement.

Also note that along with the dissertation you must submit a declaration stating that the dissertation has not already been submitted at another university for the purpose of obtaining a degree, and that it is your own work.

- satisfactorily completed an oral examination, except in special circumstances where the Senate has approved exemption from the oral examination; and
- submitted proof at your oral examination that you have already submitted a journal article to a journal of acceptable standard. The article must report the research of your dissertation. If the dissertation is classified as confidential or secret, you must submit the journal article to the examination committee at the oral examination.

You must normally be present at your host department when the oral examination is conducted.

Details about the examination process are given in the Faculty's "Postgraduate Processes for the Faculty of Engineering" (Section 1.6 above indicates how to access this document).

### 3.7.6 Submitting your dissertation for examination

The examination is arranged according to the procedures given in the Faculty's "Postgraduate Processes for the Faculty of Engineering" (Section 1.6 above indicates how to access this document).

If you want to graduate at the **December graduation** ceremony, you must submit your dissertation for final examination on or before **1 August**, unless your home department specifies differently. For the **March graduation** ceremony, you must submit your dissertation on or before **1 November**, unless your home department specifies differently.

As a PhD candidate you must get written permission from your supervisor(s) to submit your dissertation for examination.

You can submit your dissertation in any of the formats described in the relevant section of the chapter "Postgraduate Qualifications" in Part 1 (General Rules) of the Yearbook. The requirements regarding the number of copies you must submit, as well as the other requirements you must meet before the degree can be awarded to you, are set out in the same chapter.

If your dissertation contains research in the form of published and/or unpublished articles:

- it should at least contain:
  - an introductory overview,
  - an overview of the dissertation's structure with a summary of the most important results,
  - conclusions that detail the originality and importance of the research, and
  - recommendations that explain the basis of future work;
- it may only present research if the research work and the originality of the research are substantially your own work. For each article, the dissertation must include a declaration in which you indicate your contribution to the article in the format prescribed in the relevant section of the chapter "Postgraduate Qualifications" in Part 1 (General Rules) of the Yearbook.

## 3.8 Doctor of Engineering (DEng)

The DEng is a senior doctorate, usually awarded to persons who already have a PhD in Engineering and who have made a significant and outstanding contribution to a field of the engineering sciences over a period of several years.

### 3.8.1 Admission requirements

To be considered for admission to the DEng you must:

- have completed at least one of the following periods of study and work:
  - at least two years must have passed after you obtained the PhD in Engineering; *or*
  - at least five years must have passed after you obtained an MSc, MScEng or MEng degree; *or*
  - a period of at least nine years must have passed after you obtained a BEng degree; *or*
  - after you reached a standard of competence in your field of study in another manner that is the Senate considers sufficient for this purpose;
- after completing the specified periods of study, have been working full-time in your field to the satisfaction of the Senate; and
- have performed advanced original research and/or creative work to the satisfaction of the University in a field of the engineering sciences.

### 3.8.2 Selection

Irrespective of the admission requirements above, you must be selected for the DEng by the home department of the relevant field of study.

The Faculty Board's approval is required for admission to the DEng.

### 3.8.3 Application procedure

The Faculty or a department usually nominates a DEng candidate, but you can also apply to be admitted to the DEng by contacting the chairperson of the relevant home department. You must provide your CV, including a complete list of all your publications.

To apply for the DEng or to obtain further details about the application procedure, please send an e-mail to "Postgraduate enquiries" of the relevant home department in Section 1.1.3.

### 3.8.4 Duration and period of enrolment

The normal period of enrolment for a DEng degree is one year. This is also the minimum required period of enrolment.

### 3.8.5 Programme composition and requirements for obtaining the DEng degree

The programme comprises the preparation of a dissertation that:

- is based on your original and previously published works; and
- describes your contribution to the enrichment of knowledge of the engineering sciences.

To obtain the DEng degree, your dissertation must demonstrate, in the Senate's judgement, that you have made a significant and outstanding contribution to the enrichment of knowledge of the engineering sciences.

### 3.8.6 Examination of the dissertation

The requirements relating to the submission date and the number of copies you must submit, as well as the other requirements you must meet before the degree can be awarded to you, can be requested by e-mail from the address for postgraduate enquiries under the relevant home department listed in Section 1.1.3. Also refer to the chapter "Postgraduate Qualifications" in Part 1 (General Rules) of the Yearbook.

DEng candidates are not required to do an oral examination.

## 4. Undergraduate Subjects, Modules and Module Contents

### 4.1 Explanation of numbering system and abbreviations

It is important that you take note of the definitions of a few terms in order to understand and use this chapter fully. The example below shows how these terms will appear in the module descriptions in Section 4.3, "Undergraduate subjects, modules and module contents", further on in this chapter.

**Example:**

The entry for the module normally referred to as **Engineering Mathematics 145**, is as follows:

#### **38571 Engineering Mathematics**

##### **145 (15) Further Differential and Integral Calculus (5L; 2T)**

Complex numbers; complex transcendental functions; integration techniques; conic sections; polar graphs; parametric equations; partial derivatives; introduction to matrices and determinants; introduction to differential equations.

*Home Department: Mathematical Sciences*

*Required Modules:*

*P Engineering Mathematics 115*

#### Explanation of terms in the example:

- **Five-digit subject number and name**

##### **38571 Engineering Mathematics**

- The subject number in the example is **38571** and it is associated with the subject name **Engineering Mathematics**.

- **Module code**

##### **145 (15) Further Differential and Integral Calculus (5L; 2T)**

The module code consists of a three-digit number that is unique to the specific module that resorts under the particular subject. The module code of this module is **145** and has the following meaning:

- The first digit refers to the year of study in which the module is presented, for example:

*Year 1: 145*

*Year 2: 245*

*Year 3: 345*

*Year 4: 414*

Engineering Mathematics **145** is therefore normally presented in the first year.

(Honours degree programmes and postgraduate diplomas are indicated with a 7, master's degree programmes with an 8 and doctoral degree programmes with a 9.)

- The second digit indicates the semester that the module will be presented in. The numbers that indicate semesters are as follows:

- **1, 2 or 3** – modules are presented in the first semester.

*Semester 1: 214, 324, 334*

- **4, 5 or 6** – modules are presented in the second semester.

*Semester 2: 342, 354, 364*

- **7, 8 or 9** – modules are presented in both semesters, which are year modules.

*Year module (both semesters): 278, 288, 391*

*Engineering Mathematics 145 is presented in the **second semester**.*

- The third digit distinguishes between various modules of the same subject that have the same first two digits. In Engineering Mathematics **145** this digit is **5**.

- **Credit value**

##### **145 (15) Further Differential and Integral Calculus (5L; 2T)**

The number between brackets after the module code indicates the credit value of the module. According to the example you can therefore obtain **15 credits** by passing Engineering Mathematics 145. According to the SAQA definition, the credit value is one tenth of the number of hours of work that you would typically have to do to complete the module (which includes your own study time, tests, examinations and contact sessions such as lectures). For a module of 15 credits you will

therefore have to do approximately 150 hours of work. For typical 15-credit engineering modules, this means that a student should work 10 hours per week (including contact time) during the semester, which typically has 12 weeks of lectures. That leaves about 30 hours for preparing for and writing the main assessments.

- **Module topic**

145 (15) Further Differential and Integral Calculus (5L; 2T)

- **Further Differential and Integral Calculus** indicates the topic that will be dealt with in this specific module.

- **Teaching load**

145 (15) Further Differential and Integral Calculus (5L; 2T)

- The teaching load of a module gives you both the teaching load and the type of teaching per week that you can expect in a particular module. For the module Engineering Mathematics 145 you can expect **five lectures and two tutorials** per week for the duration of the module. The following abbreviations are used for the teaching load:

- **L** – Lectures lasting 50 minutes each, for example 5L
- **P** – Practical periods lasting 50 minutes, for example 1P, 2P, 3P
- **T** – Tutorials lasting 50 minutes, for example 1T, 2T
- **S** – Seminars lasting 50 minutes, for example 1S

- Also see Section 2.11.1 above for more details about the timetabling of laboratory practicals and tutorial periods.

- **Required modules**

- The required modules indicate the modules that are required before you may register for a particular module. There are three requirement categories: prerequisite pass, prerequisite and corequisite modules, as indicated below by the letters **PP**, **P** and **C**:

- **PP** – Prerequisite pass module

A prerequisite pass module is a module that you must *pass* before you can take the module(s) for which it is a prerequisite pass module.

- **P** – Prerequisite module

A prerequisite module is a module in which you must obtain a *final mark of at least 40*, before you can take the module for which it is a prerequisite module. If you registered for a prerequisite module while it was examined by the "examination" assessment system, your *class mark* for it must be 40 for you to meet the prerequisite.

If you have once complied with a prerequisite rule, your compliance will remain valid for the period given in the applicable assessment rules, even if you repeat the prerequisite module and do not meet the minimum level when repeating the module.

*Please note:* You must *pass* all the modules you used as prerequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

- **C** – Corequisite module

A corequisite module is a module that you must register for in an *earlier semester* than the module for which it is a corequisite, *or in the same semester*.

*Please note:* You must *pass* all the modules you used as corequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

- For certain modules you must also first have departmental approval before you may register for that module. Various requirements may be considered by a departmental chairperson (or his/her delegate) before granting such approval and you should not assume that approval will always be granted. For example, the Department of Industrial Engineering must judge that you have a reasonable chance to graduate in a particular year (in other words, you must be admitted to the final year) before you may register for Industrial Project 498 in that year.

*Please note* that if different module particulars appear for the same module in different parts of the University Yearbook, the version in the Yearbook part of the faculty that offers the module, will take precedence.

## 4.2 Determining final marks

Your performance in a module is usually determined by means of **flexible assessment**. The University's regulations in this regard are set out in Part 1 (General Rules) of the Yearbook. The Faculty's implementation of and approved deviations from the University regulations are set out in the Faculty Assessment Rules (see Section 1.6 above for access to this document). For modules offered by home departments outside of the Engineering Faculty, refer to the assessment rules of the relevant home faculty.

There are also modules in which **satisfactory attendance** is the only requirement and where you do not receive a final mark. You must execute **all** your **assignments** satisfactorily to be credited with the module.

In some modules there are outcomes that you must achieve to pass the module, but that are not part of the formula normally used in a given module to calculate your final mark. To assess your achievement of those outcomes, **subminima** are normally used on certain assessments (or parts of assessments). The outcomes and subminima are made known at the start of the semester (normally in the relevant module framework). If you do not satisfy the subminimum for a certain outcome, it means that you have not met that outcome. In that case, your final mark for the module may not exceed 45. During or after the completion of the semester's classes it may also become clear that you can no longer pass the module because of a subminimum. If that happens, you will normally not be admitted to further assessment opportunities for the particular module. In examination modules this can lead to your class mark being limited to 35 or less.

## 4.3 Undergraduate subjects, modules and module contents

### 36315 Advanced Design (Civil)

#### 446 (15) Design Project (2L; 6P)

Each student completes a comprehensive design. The design can be done from any of the three subject areas. The detailed design is done by each student individually.

*Home Department: Civil Engineering*

*Required Modules:*

*P (Hydraulics 354 and Hydraulic Engineering 424) or P (Transportation 364 and Transportation 434) or P (Structural Design 354 and Structural Design 424)*

### 20753 Applied Mathematics B

#### 124 (15) Statics (4L; 2T)

Vectors; forces; sum of forces at a point; direction cosines and direction angles; components and component vectors; scalar products; vector products; moment of a force; force systems on rigid bodies; equivalent force systems; couples; line of action of the resultant; equilibrium of a rigid body; friction; centre of mass; centroid; volumes; definite integration; moment of inertia of areas.

*Home Department: Mathematical Sciences*

#### 154 (15) Dynamics (3.5L; 3T)

Kinematics of particles in one and two dimensions: linear and curvilinear motion; Cartesian, polar and cylindrical coordinate systems; normal-tangential coordinates; relative motion; pulley systems. Kinetics of particles: the equations of motion; work and energy; power; impulse and momentum; impact.

*Home Department: Mathematical Sciences*

*Required Modules:*

*C Engineering Mathematics 115*

*P Applied Mathematics B 124*

#### 224 (15) Dynamics of Rigid Bodies (3L; 3T)

Planar kinematics of rigid bodies: rotation and translation; absolute motion; relative motion; instantaneous centre of zero velocity; Planar kinetics of rigid bodies: mass moment of inertia; the equations of motion; work and energy; impulse and momentum; angular impulse and angular momentum. Vibrations of particles and rigid bodies.

*Home Department: Mathematical Sciences*

*Required Modules:*

*P Applied Mathematics 144 or P Applied Mathematics B 154*

**242 (8) Vector Analysis (2L; 1,5T)**

The straight line and the plane; space curves, derivatives and integrals of vectors, curves, unit tangent vectors, arc length; surfaces, partial derivatives of vectors, the gradient vector, vector fields, vector differential operators; line integrals, gradient fields; surface integrals in the plane, Green's theorem, surface integrals in space, Stokes' theorem; volume integrals; Divergence theorem; centres of mass and moments of inertia of 1-, 2- and 3-dimensional bodies.

*Home Department: Mathematical Sciences*

*Required Modules:*

*C Applied Mathematics B 224*

*P Engineering Mathematics 145*

**252 (8) Applied Mathematics for Civil Engineers (2L; 1T)**

Mathematical modelling: correct identification of problems and specification of assumptions; formulation of ordinary and partial differential equations; analytical solutions; interpretation of a solution in terms of the initial problem.

*Home Department: Mathematical Sciences*

**39020 Building Materials****254 (15) Basic Building Materials Practice (3L; 2P; 1T)**

Composition, manufacturing, mechanical behaviour and durability of construction materials in civil engineering, including concrete, masonry, polymers, steel and timber; test methods for control and characterisation.

*Home Department: Civil Engineering*

*Required Modules:*

*P Engineering Chemistry 123 or P Engineering Chemistry 143*

**11576 Chemical Engineering****224 (15) Principles and Processes of Chemical Engineering (3L; 3T)**

Introduction to processes and basic unit operations with their depiction on flow diagrams; principles of mass and energy balancing, phase diagrams; examples of typical chemical manufacturing processes and inherently safer design principles.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Engineering Chemistry 123 or P Engineering Chemistry 143*

**254 (15) Mass and Energy Balances (3L; 3T)**

Mass balances, energy balances, heats of reaction and of solution, vapour-liquid and liquid-liquid phase equilibria, ideal solutions, Raoult's law, Henry's constant, energy balances over process systems, combined mass and energy balances.

*Home Department: Chemical Engineering*

*Required Modules:*

*PP Chemical Engineering 224*

*P Thermodynamics A 224*

**264 (15) Fluid Mechanics for Chemical Engineers (3L; 1P; 2T)***2 Practicals per semester*

Physical properties of liquids and gases; dimensional analysis and related calculations; fluid statics; fluid kinematics; fluid dynamics; continuity, momentum and energy equations; viscous flow in pipes and closed ducts; friction charts; flow in non-round channels; flow measurement; losses in pipe systems, series and parallel pipes; boundary layers; turbomachinery; design of pump and piping systems; compressible flow; pipes and fittings

*Home Department: Chemical Engineering**Required Modules:**P Applied Mathematics B 224**P Thermodynamics A 224**P Engineering Mathematics 214***271 (15) Supplementary Studies A (3L; 3T)**

The module content is arranged according to the requirements of individual students.

*Home Department: Chemical Engineering***316 (15) Reaction Engineering I (3L; 1P; 2T)***1 Practical per semester*

Mole balance, reaction stoichiometry and conversion; homogeneous reactions; the reaction rate law; principles of reactor design; ideal batch reactors; constant flow reactors; plug flow, continuous stirred tank, packed bed; design for simple and multiple reactions; influence of temperature and pressure; non-ideal flow; residence time distribution; data analysis and modelling of various reaction systems.

*Home Department: Chemical Engineering**Required Modules:**C Chemical Engineering 317**P Chemical Engineering 254**P Engineering Mathematics 214***317 (15) Thermodynamics (3L; 1P; 2T)***1 Practical per semester*

Equations of state for real gases and thermodynamic transformation relationships, thermodynamic properties of pure components, mixing rules for non-ideal vapour mixtures, vapour liquid equilibria, theory and application of solution thermodynamics and excess Gibbs energy, chemistry of reaction equilibria, multi-component and multi-phase equilibrium. Simulation of selected thermodynamic behaviour, using standard process simulation packages.

*Home Department: Chemical Engineering**Required Modules:**PP Thermodynamics A 224**PP Chemical Engineering 254**PP Chemical Engineering 264*

*Any two of the above three modules are required.*

*P Thermodynamics A 224**P Chemical Engineering 254**P Chemical Engineering 264**P Engineering Mathematics 214**P Engineering Mathematics 242***344 (15) Process Modelling and Analysis (3L; 2T)**

Dynamic modelling and simulation of single and integrated process units. Laplace domain modelling and block diagram representations. Control objectives, feedback control and dynamic performance of control systems. Digital and practical implementation of feedback control

*Home Department: Chemical Engineering**Required Modules:**PP Engineering Mathematics 214**P Numerical Methods 262**C Chemical Engineering 316*

**354 (15) Reaction Engineering II (3L; 2T)**

Reaction mechanisms. Energy balances in reactor design; design of complex homogeneous and/or heterogeneous non-isothermal reaction systems; catalytic reactions; deactivation of catalysts; external and internal mass transfer.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 316*

*P Heat Transfer A 326*

**367 (15) Mass Transfer Operations (3L; 2T)**

Distillation: batch and continuous distillation; McCabe-Thiele graphical method; multicomponent, extractive and pressure-swing distillation; plate and packed columns; gas absorption; other mass transfer unit operations consisting of a selection from: cooling towers, drying, liquid-liquid extraction, crystallisation and adsorption.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 317*

**371 (15) Supplementary Studies (1L)**

The module content is arranged according to the requirements of individual students.

*Home Department: Chemical Engineering*

**424 (15) Bioprocess Engineering (3L; 1P; 2T)**

*1 Practical per semester*

Chemical composition of cells; cellular structure and classification; nutrient requirements; metabolic macromolecules, their structures and functions; energy generation, storage and transfer; basic cellular metabolism; basic recombinant DNA technology; process design equations for batch, fed-batch and continuous bioprocesses; endogenous respiration and energy of maintenance concepts; measurement and prediction of oxygen transfer rate; bioreactor scale-up; thermal death and degradation kinetics; batch and continuous sterilisation; downstream processing.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 254*

*C Chemical Engineering 316*

**426 (15) Process Control (3L; 1P; 2T)**

*1 Practical per semester*

Enhancements to single loop feedback control. Multivariable control. Simulation and design of control systems. Introduction to process data analysis and monitoring.

*Home Department: Chemical Engineering*

*Required Modules:*

*PP Engineering Mathematics 242*

*P Chemical Engineering 316*

*P Chemical Engineering 344 [as presented in 2025 onwards] OR C Chemical Engineering 426 [as presented up to 2024]*

**41696 Chemical Engineering D****316 (8) Laboratory and Pilot Studies I (2T; 6P)**

*2 Practicals per semester*

Introduction to experimental design. Processing, interpretation and reporting of experimental data. Effective technical communication. Appropriate technical writing style and referencing. Structuring and writing of coherent technical reports. Structuring and delivering oral presentations.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 264*

*P Engineering Statistics 243*

**356 (15) Laboratory and Pilot Studies II (1L; 6P)***4 Major practicals per semester*

Design and conduct practical experiments on laboratory and pilot plant scale. Evaluation, interpretation and writing complete technical reports on the experiments. Sampling and practical data interpretation on chemical plants.

[Presented by the Department of Chemical Engineering (85%)]

Techniques in analytical chemistry: principles of analysis, choice of analytical method, sample preparation. Selected methods, among others UV/vis, AA and mass spectroscopy, chromatography, ICP (8 L, 3 demonstrations).

[Presented by the Department of Chemistry and Polymer Science (15%)]

*Home Department: Chemical Engineering*

*Required Modules:*

*C Heat Transfer A 326*

*C Chemical Engineering 316*

*C Chemical Engineering 367*

*C Mineral Processing 345*

*P Chemical Engineering D 316*

**11479 Chemistry****176 (32) Introduction to Chemistry (3L; 3P)**

For students in the BSc (Extended Curriculum Programmes). This module deals with the following themes: classification of matter; atoms, molecules and ions; stoichiometry; reactions in aqueous solutions; atomic structure; chemical bonding and molecular structure; the periodic table; weak acids and weak bases; electrochemistry; introduction to basic organic chemistry and an introduction to thermodynamics. Examples that illustrate the importance and relevance of science as an everyday phenomenon will be highlighted.

*Home Department: Chemistry and Polymer Science*

**48321 Chemistry C****152 (6) Chemistry Laboratory Practicals (3P)**

Development of laboratory skills by performing introductory chemistry experiments.

*Home Department: Chemistry and Polymer Science*

*Required Modules:*

*P Engineering Chemistry 123 or P Engineering Chemistry 143*

**224 (15) Industrial Chemistry I (4L; 2P)***8 Practicals per semester*

Electronic structure, bonding models; solid-state chemistry; introduction to coordination chemistry. Chemical thermodynamics, introduction to a statistical mechanical understanding of entropy, applications of Gibbs free energy, chemical equilibrium, electrochemistry, elementary chemical kinetics.

*Home Department: Chemistry and Polymer Science*

*Required Modules:*

*PP Engineering Chemistry 123 or PP Engineering Chemistry 143*

*PP Chemistry C 152*

**254 (15) Industrial Chemistry II (4L; 2P)***8 Practicals per semester*

Organic chemistry: basic nomenclature, introduction to preparation and reactions of alkenes, alkynes, alkyl halides, alcohols, ketones, carboxylic acids and esters, among others; Introduction to polymer chemistry: chemistry of polymerisation reactions, *inter alia* polyesters, polyamides.

*Home Department: Chemistry and Polymer Science*

*Required Modules:*

*P Chemistry C 224*

## 18481 Civil Engineering

### 224 (15) Measurement, Problem-solving and Communication skills (3L; 2,5T)

Problem solving theory and practice; outcome prediction and assessment; risk evaluation and mitigation; complexity and uncertainty. Effective written and oral communication; development of sound argument; synthesis and interpretation; paraphrasing, quoting and referencing. Utilisation of data: Microsoft Excel functions, data visualisation tools, basic data sets. Introduction to statistics: discrete and continuous random variables, medians, standard deviation.

*Home Department: Civil Engineering*

*Required Modules:*

*P Engineering Mathematics 115*

## 13362 Complementary Studies (Eng)

### 311 (4) Community Interaction and Leadership Development (3T)

Community interaction in the context of Stellenbosch University and South Africa. Contextual leadership themes, challenges and opportunities.

*Home Department: Engineering (Admin)*

*Required Modules:*

*Must be in at least the third year of registration in a four-year BEng programme, or in at least the fourth year of registration in a BEng extended curriculum programme.*

### 441 (4) Community Interaction and Leadership Development (3T)

Community interaction in the context of Stellenbosch University and South Africa. Contextual leadership themes, challenges and opportunities.

*Home Department: Engineering (Admin)*

*Required Modules:*

*Must be in at least the third year of registration in a four-year BEng programme, or in at least the fourth year of registration in a BEng extended curriculum programme.*

### 451 (4) Legal and Safety Aspects of Engineering Practice (2L)

Contract and intellectual property aspects of engineering practice. Public liability considerations in product development and production. Safety considerations and implications of the Occupational Health and Safety Act in engineering practice.

*Home Department: Mechanical and Mechatronic Engineering*

## 30317 Computer Programming

### 143 (12) Computer Programming (3L; 2P)

Introduction to computer systems. Introduction to a programming environment; expressions; conditional statements; iterative structures; data types; static and dynamic data structures; file handling; abstract data types; objects; structured program design. Emphasis is placed on modular programming for engineering applications.

[Presented by the Department of Electrical and Electronic Engineering (75%) and by the Department of Mechanical and Mechatronic Engineering (25%)]

*Home Department: Electrical and Electronic Engineering*

## 18139 Computer Science

### 314 (16) Concurrency (3L; 3P)

Introduction to programming techniques and principles of concurrent systems, from operating systems to application programs. This includes communication, synchronisation, scheduling and load balancing. Several parallel and distributed architectures will be covered.

*Home Department: Mathematical Sciences*

*Required modules:*

*P Computer Science 214 or P Computer Science E 214*

*P Computer Science 244 or P Computer Systems 245*

**315 (16) Machine Learning (3L; 3T)**

Dimension reduction techniques; machine-learning techniques based on maximum-likelihood, maximum-posterior and expectation-maximisation estimates; modelling using logistic regression, Gaussian mixtures and hidden Markov models.

*Home Department: Mathematical Sciences*

*Required Modules:*

*P Computer Science 144 or P Computer Science E 214*

*P Mathematics 214 or P Applied Mathematics 214 or P Engineering Mathematics 214*

*P (Mathematical Statistics 245 and Mathematical Statistics 246) or C Statistics 318*

**343 (16) Databases and Web Centric Programming (3L; 3P)**

Introduction to relational databases. Mapping relational model onto object model. Implementing a database application in the context of the web. Web services. Server-side scalability. Virtualization. Cloud Computing.

*Home Department: Mathematical Sciences*

*Required Modules:*

*For programmes in Engineering:*

*P Computer Science E 214*

*P Computer Systems 245*

*For other programmes: please refer to the Yearbook part for the Faculty of Science.*

**344 (16) Program Design (3L; 3P)**

Program specifications as guidelines for program design; reusable frameworks for program design; testability of program designs; development of a medium-sized system to illustrate the practical application of the principles of program design.

*Home Department: Mathematical Sciences*

*Required Modules:*

*P Computer Science 214 or (P Computer Science E 214 and P Computer Systems 245)*

**59536 Computer Science E****214 (15) Object-Oriented Programming (3L; 3P)**

Formulation and solution of problems by means of computer programming in an object-oriented set-up; principles of testing and debugging; key concepts in object orientation: abstraction, encapsulation, inheritance and polymorphism; design patterns as abstractions for the creation of reusable object-oriented designs; searching and sorting algorithms; complexity theory for the analysis of algorithms; fundamental methods in the design of algorithms; dynamic data structures.

*Home Department: Mathematical Sciences*

*Required Modules:*

*PP Computer Programming 143*

*P Engineering Mathematics 115*

*P Engineering Mathematics 145*

**50040 Computer Skills****176 (8) Computer Skills (1L; 4T)**

This module is taken by students in the BSc (Extended Curriculum Programmes). Utilisation of computers in computer users' areas on campus. Introduction to an operating system, Internet, E-mail, word processing, spreadsheet and presentation software.

*Home Department: Mathematical Sciences*

*36153 Computer Systems*

## 36153 Computer Systems

### 214 (15) Introduction to Computer Systems (3L; 2P; 1T)

Boolean algebra; combinational and sequential circuit analysis and design; state machines; central processing unit; assembler language programming.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*P Computer Programming 143 or P (Computer Science 114 and Computer Science 144)*

### 245 (15) Microprocessors (3L; 3P)

Microprocessor programming; basic microprocessor architecture; bus, memory and input-output systems.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Computer Systems 214*

### 414 (15) Computer Systems (3L; 1P; 1T)

Programmable logic; hardware description languages; embedded systems; computer networks.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Computer Systems 245*

## 23965 Control Systems

### 314 (15) Classical Control Systems (3L; 1,5P; 1,5T)

Classical feedback control of dynamic systems; feedback control architecture; dynamic modelling of mechanical, electronic and electro-mechanical systems; transfer functions; block diagrams; stability; transient effects and steady state error; root locus analysis and design; frequency response analysis and design; PID controllers; lead and lag compensation.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Engineering Mathematics 214*

### 344 (15) Modern Control Systems (3L; 1,5P; 1,5T)

Continuous state space models, analysis and synthesis; continuous estimators; transient and steady state response of state variable representations; pole placement for finite time responses; Discrete systems, Z-transforms; ZOH circuits, difference equations; emulation design; discrete root locus; discrete state space analysis and design; practical issues: A/D and D/A convertors, quantisation effects and anti-aliasing filters.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Control Systems 314*

### 354 (18) Design of Control Systems for Mechanical and Mechatronic Systems (4L; 1P; 2T)

Design of control systems: PID controllers; lead and lag compensation; frequency response analysis design. Continuous state space models, analysis and synthesis; continuous estimators; transient and steady state response of state variable representations; pole placement techniques. Discrete control systems, Z-transforms; ZOH circuits; difference equations; practical considerations: A/D and D/A converters and filters.

Until 2021: Root locus design; discrete root locus.

From 2022: Bode and polar plot diagrams

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Modelling 334 or P Modelling 333*

**414 (15) Non-linear Control Systems (3L; 1P; 1T)**

Modelling of non-linear systems; analysis and synthesis using describing functions, phase plane and Lyapunov methods. Discrete state-variable models for sampled plants, pole placement feedback and observer analysis and synthesis for regulators and servo trackers. Optimal LR and Kalman observer analysis and synthesis.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Control Systems 344*

**13856 Data Analytics (Eng)****324 (15) Statistics and Data Analytics for Civil Engineers (3L; 2,5T)**

*Offered from 2021.*

Probability distributions, sampling theory, correlation analysis, statistical inference, regression. Formal data analytics processes: goal definition, data pre-processing, mining and modelling, validation and evaluation. Data cleaning: filtering, handling of missing data, inconsistency detection, outlier removal, data normalisation, reduction. Introduction to machine learning: supervised and unsupervised learning.

[Presented by: Statistics and Actuarial Science (50%) and Electrical and Electronic Engineering (50%)]

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*P Civil Engineering 224*

*PP Engineering Mathematics 115*

*PP Engineering Mathematics 145*

**344 (15) Data Analytics Applications in Industrial Engineering (3L; 2P; 1T)**

The need for data analytics; formal data analytics processes, including CRISP-DM and KDD; data cleaning and data transformation with dimension reduction; supervised learning: regression, k-nearest neighbours, decision trees, random forests; unsupervised learning: k-means; data-driven decision-making; group project.

[Presented by the Department of Industrial Engineering (78%) and the Department of Mechanical and Mechatronic Engineering (22%)]

*Home Department: Industrial Engineering*

*Required Modules:*

*PP Engineering Mathematics 214*

*P Engineering Statistics 314 or P Probability Theory and Statistics 114 or P Modelling 334 followed in 2021 or later; or P Modelling 333*

**414 (15) Data Analytics Applications in Electrical and Electronic Engineering (3L; 1P; 1T)**

The goal of data analytics and machine learning; data cleaning and preparation; training, validation and test sets; regression: linear regression; classification: K-nearest neighbours, naive Bayes, logistic regression, decision trees; unsupervised learning: K-means; data visualisation: PCA, t-SNE; a brief introduction to neural networks; group project.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*P Engineering Mathematics 214*

*P Systems and Signals 344 or P Mathematical Statistics 214 or P Statistics 214*

**14019 Data Engineering****245 (12) Big Data Platforms (3L; 1P; 1T)**

The various technologies and infrastructure required to support effective decision-making based on big data, including databases for big data, data warehouses, data platforms, data streams, data fusion and data visualisation.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Computer Programming 143 or P Computer Science 144*

**414 (15) Fundamentals of Deep Learning (3L; 1,5P; 1,5T)**

Fundamentals of neural networks and their application in engineering problems. Limitations of neural networks. Design of feed-forward neural networks, auto-encoders, convolutional neural networks and recurrent neural networks. Technical report writing. A major design assignment that also involves experiments for validation, culminating in a report.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*P Engineering Mathematics 214 or P Mathematics 214 or P Applied Mathematics 214*

*P Systems and Signals 344 or P Mathematical Statistics 214 or P Statistics 214*

**424 (15) Probabilistic Graphical Models for Machine Learning (3L; 1P; 1T)**

Representation: reasoning patterns, Bayes nets, Markov random fields, templates and temporal models. Inference: elimination, sum product, max product, max sum and junction tree algorithms. Learning: maximum likelihood, maximum posterior, Bayesian learning. Designing algorithms to implement the aforementioned.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*P Systems and Signals 344 or P Mathematical Statistics 245 or C Statistics 318*

**14026 Data Science****141 (16) Data Science (4L; 2P)**

Fundamental data science concepts; data-analytic thinking; types of data; the data cycle; CRISP data mining process; describing a dataset numerically; describing a dataset graphically; organising data; file formats; data manipulation in R software; introduction to predictive modelling; overfitting; data leakage; model evaluation; other data science tasks and techniques; data ethics; communicating results.

*Home Department: Statistics and Actuarial Science*

**46833 Design (E)****314 (15) Digital Design (1L; 3P)**

Design philosophy; design techniques; milestones; data interpretation; development of simple software and hardware in order to demonstrate a small functional microprocessor system; debugging of digital circuits; report writing.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Computer Systems 245*

**344 (15) Electronic Design (1L; 3P)**

Design of a complex electronic system with circuit and software components; problem solution; application of scientific and engineering knowledge; design techniques for software and circuits; experiments; data-interpretation; fault diagnosis; use of equipment and software; independent learning; technical report writing.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electronics 315*

*C Computer Science E 214*

## 47929 Design Project

### 428 (48) Design

Methods of process design (including heuristics), inherently safe design, control, plant layout, process flow sheets, complex plant material and energy balances, piping and instrumentation diagrams, equipment selection, risk management, HAZOP studies, cost estimation and profitability. Application of procedural and non-procedural methods to develop the best process for a major plant design, and factors and criteria involved. The identification, formulation, analysis and solution of a complex process-plant design problem through the synthesis of unit operations, including application of mathematical, natural and engineering sciences and appropriate engineering methods and tools.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Design Project 488 (must be completed (but failed with a final mark  $\geq 40$ ) in the year preceding Design Project 428. This implies that if you also fail Design Project 428, you must take Design Project 488 again in the second semester.)*

### 488 (48) Design (9T)

Methods of process design (including heuristics), inherently safe design, control, plant layout, process flow sheets, complex plant material and energy balances, piping and instrumentation diagrams, equipment selection, risk management, HAZOP studies, cost estimation and profitability. Application of procedural and non-procedural methods to develop the best process for a major plant design, and factors and criteria involved. The identification, formulation, analysis and solution of a complex process-plant design problem through the synthesis of unit operations, including application of mathematical, natural and engineering sciences and appropriate engineering methods and tools.

*Home Department: Chemical Engineering*

*Required Modules:*

*Final-year Enrolment*

## 11949 Electrical Drive Systems

### 244 (15) Principles of Electrical Machines and Power Electronics (3L; 1P; 2T)

Non-ideal transformer model; introduction to machine principles; alternating current machine principles; basic working in the steady state of synchronous generators, synchronous motors and induction motors; inverter-fed induction machine drives; basic working in the steady state of direct current motors and direct current generators; converter-fed direct current machine drives; basic working of single-phase induction motors; introduction to electrical energy storage technologies.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electrotechnique 214*

## 51357 Electromagnetics

### 314 (15) Electromagnetics (3L; 1P; 2T)

Electrostatics; magnetostatics; Ohmic conduction; Lorentz force law; laws of Coulomb, Ampère, Faraday and Gauss; Maxwell's equations; capacitance; inductance.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Applied Mathematics B 224*

*C Applied Mathematics B 242*

### 344 (15) Electromagnetics (3L; 1,5P; 1,5T)

Maxwell's equations; electromagnetic waves; transmission lines; antennas.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electromagnetics 314*

## 39802 Electronic Engineering

### 152 (6) Introduction to Electronic Design (3T)

Basic structured electronic design and synthesis.

*Home Department: Electrical and Electronic Engineering*

## 12491 Electronics

### 245 (15) Electronics (3L; 1P; 2T)

Semiconductor physics; pn junctions; diode circuits; thyristors; bipolar transistors; MOSFETs; DC biasing of transistor circuits; transistor switches; logical gates.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Systems and Signals 214 or C Electrotechnique 214*

### 315 (15) Electronics (3L; 1,5P; 1,5T)

BJT, FET and power amplifiers; frequency response of transistor amplifiers; current sources; differential and operational amplifiers.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electronics 245*

### 414 (15) Electronics (3L; 1P; 1T)

The terminal properties of power electronic switches; basic DC-to-DC converters: the buck, boost and buck-boost converters; half-bridge and full-bridge converters; switch-mode power supplies; basic inductor and transformer design; simulation and closed-loop control of converters; DC-to-AC inverters and control; the converter-fed DC machine system; the converter-fed induction machine system.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electronics 315*

*C Control Systems 314*

## 12599 Electrotechnique

### 143 (15) Introduction to Circuit Theory (3,5L; 1P; 2T)

Introduction to basic circuit terminology and elements, including dependent sources; Ohm's law, Kirchhoff's laws; node-voltage analysis and mesh-current analysis; superposition; Thévenin and Norton equivalents; basic DC power and energy concepts; introduction to capacitors and inductors; first-order RC and RL circuit steady-state and transient analysis; modelling of physical systems using RL and RC circuits; introduction to magnetic circuits.

*Home Department: Electrical and Electronic Engineering*

### 214 (15) Electrotechnique (3L; 1P; 2T)

Sinusoidal sources; phasors; instantaneous, average, real and reactive power; passive circuit elements in the frequency domain; balanced three-phase circuits; first- and second-order transfer functions; Bode plots; cascaded circuits; resonance; ideal filters; ideal operational amplifiers.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electrotechnique 143*

## 43915 Energy Systems

### 244 (15) Electrical Energy Systems (3L; 0,5P; 2,5T)

Introduction to power systems; single and three-phase alternating current theory; power transformers; per-unit system; modelling of transmission lines; steady-state operation of transmission lines; power flow studies.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Systems and Signals 214*

### 344 (15) Energy Conversion (3L; 1P; 2T)

Introduction to electrical machine systems; DC machine principles; steady-state operation of DC machines; AC machine principles; steady-state operation of synchronous and induction machines; finite element modelling and analysis of electrical machines; basic control aspects of DC and induction machines; dq0 transformation; dq0 AC machine modelling and dynamics.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Energy Systems 244*

### 414 (15) Renewable Energy Systems (3L; 0,5P; 1,5T)

Introduction to renewable energy resources; principle of renewable energy power conversion; commercially viable renewable energy technologies; renewable energy system sizing and design; maximum power point control technology; power conditioning and grid integration of renewable energy systems; economic benefits and environmental impact assessment.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Energy Systems 344*

### 424 (15) Electrical Energy Systems (3L; 0,5P; 1,5T)

Power systems: symmetrical components; symmetric and asymmetric faults, protection systems; power system stability. High voltage: HV measuring equipment; measuring techniques and tests; insulation coordination; theory and characteristics of insulating materials; electrical discharges.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Energy Systems 244*

*C Energy Systems 344*

## 51365 Energy Systems M

### 434 (15) Mechanical Energy Systems (3L; 1P; 2T)

Thermodynamic relationships for ideal and non-ideal gases, Joule-Thompson throttling effect; further applications of air-water-vapour mixtures in the psychrometrics of air conditioning systems and cooling towers; mass and energy balances for reactive systems; the principles of internal combustion engines. Boiler, pump and atmospheric cooling systems; advanced analysis of vapour and combination power cycles; Stirling cycle; high-pressure water and pebble bed modular nuclear reactor-based cycles; introduction to solar energy; analytical determination of available radiant energy; central collector; parabolic trough and solar chimney power station cycles. Wind and ocean energy.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Fluid Mechanics 314*

*P Thermodynamics A 244*

## 49484 Engineering Chemistry

### 123 (15) Chemistry for Engineering Students (4L; 2T)

Basic concepts, units and dimensions, significant figures, conversion between unit systems; components of matter, atomic structure, the periodic table and chemical bonding; stoichiometry; chemical reactions (acid-base, precipitation and redox); properties of mixtures and solutions; chemical equilibrium; electrochemistry; gas laws, state functions and the relationships between T, P and V; introduction to basic engineering applications.

*Home Department: Chemical Engineering*

*Required Modules:*

*C Engineering Mathematics 115*

### 143 (15) Chemistry for Engineering Students (Elective Repeat Module) (Hybrid Format)

Basic concepts, units and dimensions, significant figures, conversion between unit systems; components of matter, atomic structure, the periodic table and chemical bonding; stoichiometry; chemical reactions (acid-base, precipitation and redox); properties of mixtures and solutions; chemical equilibrium; electrochemistry; gas laws, state functions and the relationships between T, P and V; introduction to basic engineering applications.

*Home Department: Chemical Engineering*

*Required Modules:*

*C Engineering Chemistry 123 (must be completed in the same academic year as Engineering Chemistry 143. This implies that if you fail Engineering Chemistry 143, you must take Engineering Chemistry 123 again.)*

*Departmental approval: Registration depends on your overall academic record and the available capacity.*

## 46825 Engineering Drawings

### 123 (15) Orthographic Drawings (1L; 3P; 3T)

Projection planes; points, lines and planes in space; trace points of lines and trace lines of planes; true lengths and true angles between lines and planes; true angles between planes; new projection planes; interpenetrations; developments; isometric projections. Works drawings: 1st- and 3rd-angle projections; line alphabet; dimensioning; scale; three-view drawing layout; auxiliary views; hidden detail; introduction to sections and cross-hatching. Introduction to 2D CAD and 3D parametric CAD.

*Home Department: Mechanical and Mechatronic Engineering*

### 143 (15) Orthographic Drawings (Elective Repeat Module) (Hybrid Format)

Projection planes; points, lines and planes in space; trace points of lines and trace lines of planes; true lengths and true angles between lines and planes; true angles between planes; new projection planes; interpenetrations; developments; isometric projections. Works drawings: 1st- and 3rd-angle projections; line alphabet; dimensioning; scale; three-view drawing layout; auxiliary views; hidden detail; introduction to sections and cross-hatching. Introduction to 2D CAD and 3D parametric CAD.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*C Engineering Drawings 123 (must be completed in the same academic year as Engineering Drawings 143. This implies that if you fail Engineering Drawings 143, you must take Engineering Drawings 123 again.)*

*Departmental approval: Registration depends on your overall academic record and the available capacity.*

## 18791 Engineering Economics

### 212 (8) Engineering Economics (2L; 2T)

Introduction to accounting; financing, tax and growth of a business. Income, balance sheet and cash flow statements. Financial ratios.

*Home Department: Industrial Engineering*

### 354 (15) Engineering Economics (3L; 3T)

The capital cycle, time value of money, discounted cash flow, equivalence and returns, after tax cash flow analyses, inflation and exchange rates. Working capital cycles, the cost of capital, cost accounting, budgets. Introduction to the macro economy and the SA budget.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Engineering Economics 212*

## 59552 Engineering Geology

### 214 (15) Geology for Civil Engineers (3L; 3P)

This module does not grant admission to Geology 224, 244 and 254.

Identification of, classification of and distinguishing between the common rock-forming minerals, based on their chemistry and crystal structure. Classification of and distinguishing between the various sedimentary, igneous and metamorphic types. The basic processes affecting the earth and how they are interrelated through the paradigm of plate tectonics. Geological time and how the rock record preserves a history of past geological events. The general geological history and stratigraphy of southern Africa. General landscape-forming processes, weathering, etc. Engineering geology of South Africa and most common geotechnical constraints. Surveying techniques, including acquisition and analysis of spatial data; projections, coordinates and mapping; land surveying and 3D measurement utilising GIS, GPS and Total Station techniques.

Presented by: Earth Sciences (30%) and Civil Engineering (70%)

*Home Department: Civil Engineering*

*Required Modules:*

*P Engineering Chemistry 123 or P Engineering Chemistry 143*

## 59560 Engineering Informatics

### 244 (15) Object-Oriented Programming and Modelling (3L; 2,5T)

Basic concepts of object-oriented programming, illustrated through engineering applications of machine learning, data analytics and discrete simulation models.

*Home Department: Civil Engineering*

*Required Modules:*

*P Computer Programming 143*

### 314 (15) Foundation of the Finite Element Method (3L; 2,5T)

Boundary value problems and integral forms of physical problems, Galerkin finite element methods for the solution of these problems, solution of systems of linear equations, implementation of a finite element object model.

*Home Department: Civil Engineering*

*Required Modules:*

*P Engineering Informatics 244*

*P Applied Mathematics B 242*

*P Strength of Materials 254*

## 51373 Engineering Management

### 454 (15) Engineering Economics and Professional Practice (5L; 1T)

Engineering economics: basic concepts, time value of money; relation between present, future and serial values; cash flow. Economic analysis, comparison and decision-making among alternatives: net present value, internal rate of return, cost/benefit models, handling of risk. Life cycle costing, depreciation and replacement decision. Development financing.

Professional practice: Engineering Act, ethical code, professional registration and accountability. Practice management and business plans. Design and construction management, the role of the client. Sustainability. Tender documentation. Strategic management. Project safety. Infrastructure asset management. Building information models. Communication skills.

*Home Department: Civil Engineering*

## 38571 Engineering Mathematics

### 115 (15) Introductory Differential and Integral Calculus (5L; 2T)

To take this module, you must have a mark of at least 6 (or 70%) for Mathematics on your NSC or your IEB school-leaving certificate or must have successfully completed the first year of a suitable extended curriculum programme.

Mathematical induction and the binomial theorem; functions; limits and continuity; derivatives and rules of differentiation; applications of differentiation; the definite and indefinite integral; integration of simple functions.

*Home Department: Mathematical Sciences*

### 145 (15) Further Differential and Integral Calculus (5L; 2T)

Complex numbers; complex transcendental functions; integration techniques; conic sections; polar graphs; parametric equations; partial derivatives; introduction to matrices and determinants; introduction to differential equations.

*Home Department: Mathematical Sciences*

*Required Modules:*

*P Engineering Mathematics 115*

### 214 (15) Differential Equations and Linear Algebra (4L; 2T)

Ordinary differential equations of first order; linear differential equations of higher orders; Laplace transforms and applications. Matrices: linear independence, rank, eigenvalues.

*Home Department: Mathematical Sciences*

*Required Modules:*

*PP Mathematics 114 or PP Engineering Mathematics 115 or PP Mathematics 144 or PP Engineering Mathematics 145*

*P Mathematics 144 or P Engineering Mathematics 145*

### 242 (8) Series and Partial Differential Equations (2L; 1T)

Infinite series and Taylor series; Fourier series; introduction to partial differential equations; Fourier transforms.

*Home Department: Mathematical Sciences*

*Required Modules:*

*PP Mathematics 144 or PP Engineering Mathematics 145 or PP Engineering Mathematics 214*

*P Engineering Mathematics 214*

## 59420 Engineering Physics

### 113 (8) Physics for Engineering Students (2L; 0,5P; 0,5T)

Introduction to physics and physical quantities, including introduction to atomic physics; oscillatory motion, introduction to wave motion, superposition and standing waves, sound waves, light, refraction, polarisation; introduction to nuclear physics.

*Home Department: Physics*

### 152 (6) Physics for Engineering Students (2L; 1T)

Introduction to basic relativity and basic quantum mechanics. Continued study of waves, acoustics and optics based on Engineering Physics 113.

*Home Department: Physics*

*Required Modules:*

*P Engineering Physics 113*

## 59498 Engineering Statistics

### 243 (15) Statistics and Data Processing for Chemical Engineers (3L; 1P; 2,5T)

*1 Practical per semester*

Applied probability theory; applications based on discrete and continuous random variables and their probability distributions. Descriptive statistics and graphical presentations. Simple and multiple linear regression. Hypothesis testing and analysis of variance. Experimental design. Error propagation. Applications to chemical engineering experiments and simulations. Technical communication of experimental results and statistical analysis.

[Presented by the Department of Chemical Engineering (50%) and by the Department of Statistics and Actuarial Science (50%)]

*Home Department: Chemical Engineering*

*Required Modules:*

*C Chemical Engineering 224*

*C Chemical Engineering 264*

### 314 (15) Engineering Statistics (3L; 2,5T)

Applied probability theory; applications based on discrete and continuous random variables and their probability distributions, such as the normal, gamma, lognormal, log-Pearson type 3 (LP3), Gumbel (EV1) distributions; queuing processes; joint distributions; descriptive statistics and graphical presentations; moments, averages, median and standard deviations; moment generating functions; variation coefficient; skewness coefficient; peaking coefficient; sampling theory; point and interval estimation; hypothesis testing;  $\mu^2$  and K-S testing; simple linear and non-linear regression and correlation analyses; introduction to multiple linear regression; introduction to analysis of variance and experimental design.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*PP Engineering Mathematics 115*

*PP Engineering Mathematics 145*

## 59501 Enterprise Design

### 444 (15) Enterprise Design (2L; 2T)

Systems engineering, approaches towards enterprise modelling and supply chain management. Concepts like knowledge management, innovation, and different life cycles will be applied through the complete design of an enterprise within formal information, manufacturing and organisational architectures.

*Home Department: Industrial Engineering*

*Required Modules:*

*Final-year enrolment*

## 59455 Entrepreneurship (Eng)

### 444 (15) Entrepreneurship (Eng) (3L; 3T)

Business strategy: business as a system; life cycles; competitiveness forecasts; entry into the market; portfolio decisions; long-term profitability; marketing management; introduction to the theory of organisation. Financial management: time-value of money, basic discounting concepts; economic analysis of investment proposals; introduction to financing and dividend decisions.

*Home Department: Electrical and Electronic Engineering*

## 50431 Environmental Engineering

### 414 (15) Environmental Engineering (3L; 2,5T)

Environmental engineering principles, including sustainable development; impacts of engineering developments on the broader environment; environmental impact assessments, environmental risk assessments and environmental management. Workplace risks (OHS Act), HAZOP studies and workplace risk management. Water chemistry and engineering techniques for water treatment and potable water production, including material and energy balances. Aspects and abatement of air pollution. Solid- and hazardous-waste management and immobilisation.

*Home Department: Chemical Engineering*

*Required Modules:*

*C Particle Technology 316*

*C Chemical Engineering 316*

### 442 (8) Engineering and the Environment (3L; 2T)

Energy and the environment; environmental engineering principles, including sustainable development, ethical elements of environmental management and socio-ecological factors in decision-making; environmental assessments and management, including pollution control and abatement, environmental impact and risk assessments, environmental auditing, environmental management systems and ISO 14000 standards; environmental governance and related legislation.

*Home Department: Chemical Engineering*

*Required Modules:*

*Prerequisite for Engineering students: All the prescribed modules for the first two years of the relevant BEng programme*

*Prerequisite for AgriSciences students: All the modules for the first two years of the Wood Products Science programme*

### 452 (8) Environmental Engineering for Civil Engineers (3L; 2,5T)

Ecology and the environment. Environmental engineering principles, ethical elements of environmental management. The water environment, including pollution, integrated environmental processes and environmental assessments and management. Environmental governance and related legislation; solid waste management; integrated development planning (IDP), including public participation. Integrated coastal management. Water quality, impacts of pollution on natural waterbodies, water quality considerations for drinking water abstraction.

*Home Department: Civil Engineering*

*Required Modules:*

*All the prescribed modules for the first two years of the relevant four-year BEng programme*

## 36242 Experimental Techniques

### 413 (12) Experimental Techniques (4L; 4P)

Techniques applied in the design and performance of experiments, and in the analysis of experimental results. Covers aspects of instrument calibration, data acquisition, and measurement accuracy and uncertainty. Students design an experiment, perform one or more typical mechanical or mechatronic experiments in laboratories and analyse a set of experimental data.

*Home Department: Mechanical & Mechatronic Engineering*

*Required Modules:*

*P Modelling 333 or P Modelling 334*

## 13683 Final-year Project (C)

### 478 (32) Final-year Project in Chemical Engineering (6P)

*(2P in Semester 1; 6P in Semester 2)*

Independent execution of a theoretical and/or experimental investigation in the field of chemical engineering, with formal oral presentations and the submission of a comprehensive final report.

*Home Department: Chemical Engineering*

*Required Modules:*

*Final-year enrolment*

## 41726 Finite Element Methods

### 414 (15) Finite Element Methods (3L; 1P; 2T)

Revision of strength of materials concepts; principle of virtual work; truss/beam elements; plane stress/strain elements; isoparametric formulation; 3D elements; axisymmetric elements; plate and shell elements; structural symmetry; dynamic analysis; buckling analysis; use of finite element software to solve simple problems.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Strength of Materials W 334*

### 474 (15) Finite Element Methods (Elective Repeat Module) (Hybrid Format)

Revision of strength of materials concepts; principle of virtual work; truss/beam elements; plane stress/strain elements; isoparametric formulation; 3D elements; axisymmetric elements; plate and shell elements; structural symmetry; dynamic analysis; buckling analysis; use of finite element software to solve simple problems.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*C Finite Element Methods 414 (must be completed (but failed) in the same academic year as Finite Element Methods 474. This implies that if you also fail Finite Element Methods 474, you must take Finite Element Methods 414 again.)*

## 44415 Fluid Mechanics

### 314 (15) First Course in Fluid Mechanics (3L; 1P; 2T)

Physical properties of liquids and gases; fluid statics and manometers, forces on and stability of buoyant bodies, pressure centre and meta-centre; fluid kinematics; fluid dynamics; integral relations for a control volume; introduction to vector analysis; differential relations; continuity, momentum and energy equations; Bernoulli and Navier-Stokes equations; similarity theory, dimensional analysis; viscous flow in pipes and closed ducts; friction charts; flow in non-round channels; flow measurement; losses in pipe systems, series and parallel pipes; basic theory of turbomachines; pumps; characteristic curves of pumps; pump systems.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Applied Mathematics B 224*

*P Thermodynamics A 244*

*P Engineering Mathematics 214*

## 13857 Food Process Engineering

### 414 (15) Food Process Engineering Fundamentals (3L; 1P; 2T)

Engineering approach to problem-solving; thermodynamic properties of water and an ideal gas; conservation of mass, momentum and energy; thermodynamic processes in closed and open systems; generation, usage and reticulation of steam; pump and pipe systems; steady-state conduction, convection; air-water vapour mixtures and air conditioning processes.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*PP Mathematics (Bio) 124*

*PP Food Science 244*

### 444 (15) Food Process Engineering Applications (3L; 2T)

Behaviour, pumping and properties of Newtonian and non-Newtonian fluids; the refrigeration cycle and refrigeration components and equipment; storage of food products by cooling and freezing; heat transfer, including the determination of heat transfer coefficients, boiling and condensation; transient heat transfer during heating, freezing and thawing; mass transfer; thermal processing of foodstuffs; evaporation and concentration; drying theory and drying equipment; mixing; process control.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Food Process Engineering 414*

### 39667 Geotechnique

#### 254 (15) Geotechnical Theories (3L; 2,5T)

Geotechnical soil properties: particle size analysis, plasticity, soil classification, phase relationships, compaction. Ground water movement: permeability, seepage theory, flow nets, filter design. Effective stress: theory of effective stress, stress by own weight and seepage effects. Elastic stress theory: stresses and immediate settlement resulting from surface loading. Consolidation settlement: settlement of clay soil, rate of settlement, total and immediate settlement.

*Home Department: Civil Engineering*

*Required Modules:*

*C Engineering Geology 214*

#### 354 (15) Sliding Resistance, Retaining Walls, Foundations and Slopes (3L; 1,5P; 1T)

Shear strength: shear testing, shear behaviour of sand and clay, stress paths, pore pressure coefficients. Lateral earth pressure: earth pressure theory, gravity walls, embedded walls. Bearing capacity: shallow foundations, eccentric loads, settlement on sand, piles. Slope stability: parallel slips, circular slip, method of slices, safety factors.

Practical: consolidation test in the oedometer.

*Home Department: Civil Engineering*

*Required Modules:*

*C Strength of Materials 224*

*C Geotechnique 254*

### 33928 Heat Transfer A

#### 326 (15) Heat Transfer (3L; 1P; 2T)

*1 Practical per semester*

Heat conduction; steady and unsteady conduction. Convection: boundary layer equations, laminar and turbulent flow, natural convection, boiling and condensation. Heat exchangers: overall transfer coefficients, parallel, transverse and cross-flow, logarithmic mean temperature difference, effectiveness-NTU calculations, types and design principles. Radiation: absorption and emission, black bodies, emissivity, form factors, radiation heat transfer between surfaces, radiating gases. Mass transfer: diffusion processes, transport analogies, Colburn j-factors, combined mass and heat transfer.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Thermodynamics A 224*

*P Chemical Engineering 254*

*P Chemical Engineering 264*

*P Engineering Mathematics 242*

**414 (15) Heat Transfer (3L; 1P; 2T)**

Heat conduction; analytical for steady and unsteady conduction. Convection: boundary layer equations, laminar and turbulent flow, natural convection, boiling and condensation. Heat exchangers: overall transfer coefficients, parallel, transverse and cross-flow; logarithmic mean temperature difference, effectiveness-NTU calculations, types and design principles. Radiation: absorption and emission, black bodies, emissivity, form factors, radiation heat transfer between surfaces, radiating gases. Mass transfer: diffusion processes, transport analogies, Colburn j-factors, combined mass and heat transfer.

Homework assignments in the form of self-study, tutorial problems, designs or seminars form an integral part of the module.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Fluid Mechanics 314 or P Thermofluid Dynamics 314*

*P Thermodynamics A 244 or P Thermofluid Dynamics 254*

**52124 High Frequency Technique****414 (15) High-Frequency Technique (3L; 1P; 1T)**

Smith chart and applications; impedance-matching networks; amplifier design; oscillator design; high-frequency systems; electromagnetic compatibility; electro-dynamics and radiation; wire antennas; antenna design; HF metrology.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electromagnetics 344*

**21350 Hydraulic Engineering****424 (15) Storm Water Drainage and Coastal Engineering (3L; 2,5T)**

Storm water hydraulics: general introduction and guidelines; design floods. Storm water discharge: run-off over land, roads, parking areas, curbs and inlets, storm-water pipe systems; flood attenuation ponds; canals, culverts and bridge damming. Introduction to coastal engineering and sediment transport; theory of ocean waves; wave parameters for practical application to coastal engineering problems; design of basic coastal protection. Application of proven hydraulic and coastal engineering science and techniques, using the latest technologies, to design sustainable solutions in collaboration with stakeholders for the benefit of society.

*Home Department: Civil Engineering*

*Required Modules:*

*P Hydraulics 324*

*P Hydraulics 354*

**14400 Hydraulics****324 (15) Flow Theory and Pipe Flow (3L; 2,5T)**

Hydrostatics; pressure and pressure measurement; pressure forces on submerged bodies; flotation and buoyancy; principles of fluid flow; flow patterns; fundamental equations of fluid dynamics; application of the conservation laws to fluids; application of the energy and momentum equations; velocity and discharge measurement; potential flows; real and ideal fluids; behaviour of real fluids; viscous flow; stability of laminar flow and the onset of turbulence; shearing in turbulent flows; the boundary layer; implications of the boundary layer; cavitation; surface tension; flow in pipes and closed conduits; fundamentals of pipe flow; laminar flow; turbulent flow; local head loss; partially full pipes; pipeline systems and design; series, parallel and branched pipe systems; distribution systems; design of pumping mains; hydraulic machines; classification of machines; continuous flow pumps; pump selection; turbines; cavitation in hydraulic machines; surge in pipelines; surge protection; effects of rapid valve closure; unsteady compressible flow; complex problems.

*Home Department: Civil Engineering*

*Required Modules:*

*PP Applied Mathematics B 154*

*PP Engineering Mathematics 145*

*P Applied Mathematics B 224*

### **354 (15) Open Channel Flow and Hydraulic Structures (3L; 0,5P; 2T)**

Open channel flow and flow classification; uniform flow; rapidly varied flow; energy conservation; hydraulic jump. Momentum principle; critical depth flow measurement; gradually varied flow; flow profile classification; backwater (transitional) curve calculation (direct and standard step methods); unsteady flow; waves in open channel flow. Hydraulic structures; sharp- and broad-crested weirs and submergence; dam spillways; energy dissipaters; flow control gates; side channel spillways and outlet structures.

*Home Department: Civil Engineering*

*Required Modules:*

*P Hydraulics 324*

## **14397 Hydrology**

### **424 (15) Flood and Resource Hydrology (3L; 2,5T)**

A systematic overview of the different components of the hydrological cycle and its applicability in a Smart Engineering environment; variability of the South African climate, hydrological processes, sources of data and the characteristics of South African data. The analysis of hydrological data, including probabilities, gap filling, regression, exceedance and non-exceedance probabilities and all other basic statistic parameters. Storage yield analysis: philosophy and concepts, time series, human influences on catchments, the adaptation of water demand for a sustainable environment, catchment models. Stochastic data. Low flow analysis, analysis of time series, regionalised data for South Africa and geohydrology, including artificial recharge. Flood design techniques (empiric, deterministic and probabilistic) and extreme floods, including innovative data use, such as radar data.

*Home Department: Civil Engineering*

*Required Modules:*

*P Hydraulics 354*

*P Data Analytics (Eng) 324*

## **31496 Industrial Engineering**

### **152 (6) Introduction to Industrial Engineering (3T)**

Manufacturing and service systems, introductory production principles with applications, introductory optimisation, system variation, productivity measurement and analysis.

*Home Department: Industrial Engineering*

## **44792 Industrial Ergonomics**

### **414 (15) Industrial Ergonomics (3L; 2T)**

Operation analysis, work standards; reduction of setup times, training practices, remuneration, anthropometry, workstation and tool design, man/machine interfaces, work physiology and biomechanics, work design, cognitive work, connecting the human to the cloud, aspects of occupational health and safety.

*Home Department: Industrial Engineering*

## **53937 Industrial Management**

### **354 (15) Industrial Management (3L; 3T)**

Industry dynamics and the value chain, BPR (Business Process Re-engineering); SCM (Supply Chain Management) and logistics management, information technology and e-commerce within the framework of a formal ERP (Enterprise Resource Planning) system.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Production Management 314*

## **10618 Industrial Practice**

### **442 (8) Management and Organisational Behaviour (2L; 1T; 1S)**

Work and people organisation, organisational culture, motivation principles, motivation methods, building groups into teams, conflict management and negotiation, managing organisational change, overview of labour legislation, guest lectures by engineers from industry.

*Home Department: Industrial Engineering*

*Required Modules:*

*Final-year enrolment*

## **47422 Industrial Programming**

### **244 (15) Industrial Programming (2L; 3T)**

Use of spreadsheets: data manipulation, numerical methods, graphs, basic financial calculations, planning and analysis of scenarios and optimising. Visual Basic for Applications for spreadsheet use. Basic computer communication. Theory and application of forecasting with emphasis on spreadsheet applications.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Engineering Mathematics 145*

## **25445 Industrial Project**

### **498 (30) Industrial Project (1S)**

Independent execution of a theoretical and/or practical investigation in the field of industrial engineering, and the submission of a comprehensive report. (The project runs for the whole final year, with 30% of the project completed in the first semester, and 70% in the second semester.)

*Home Department: Industrial Engineering*

*Required Modules:*

*Final-year enrolment*

## **48062 Information Systems**

### **414 (15) Information Systems (2L; 1,2P; 2T)**

Techniques and resources required for the design, development and implementation of information systems; system development life cycle; entity-relationship models; data flow models; normalisation; design of input and output interfaces; quality assurance of the information system; system implementation; design, development and implementation of an Internet-based information system in group projects.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Industrial Programming 244*

## **14213 Intercultural Communication (Eng)**

### **113 (8) Introduction to Intercultural Communication for Engineers (2L; 3T)**

Dimensions of culture, such as individualism and collectivism, power distance, uncertainty avoidance, and masculinity and femininity. The "Describe-Analyse-Evaluate" framework. Barriers to effective intercultural communication, such as stereotyping and prejudice. Writing assignments related to intercultural communication in the engineering context, with introduction to coherence, style and referencing. Introduction to engineering studies. Reading-skills development. Basic skills in use of Microsoft Word and Excel.

*Home Department: Engineering (Admin)*

## 13363 Internship (Eng)

### 392 (O) Industrial Experience (OT)

Students experience, or observe first-hand, typical engineering work in an appropriate industry. The work must be performed under the direct supervision of an engineer from an appropriate discipline. Students are required to, within their discipline: apply fundamental engineering principles to solve practical problems in an industrial context; develop an enhanced understanding of the nature, processes and challenges of industrial practice; and develop their technical and interpersonal skills.

The student's home department's prior approval of the scope and nature of the work is required. The scope of the student's work in this module should be at least 1700 hours. Students are required to submit three reports: (a) shortly after commencing the internship, a report on the agreement between the student and employer, detailing the scope and nature of the work; (b) a progress report halfway through their training; and (c) a final report at the end of their training. The latter two reports must explain the nature and scope of the work conducted, as well as the technical details of work that they experienced or observed. References by students' industrial supervisors on their conduct must be submitted with these reports.

Students are normally not allowed to register for any other undergraduate module(s) in the year that a student is registered for this module.

*Home Department: Engineering (Admin)*

*Required Modules:*

*PP All modules of the first two years of a 4-year BEng*

*Departmental approval*

### 393 (O) Industrial Experience and International Exchange (OT)

This module can be offered either in one or in both semesters. If it is offered in both semesters, it comprises Parts 1 and 2 as described below. If it is offered in only one semester, it comprises only Part 2.

**Part 1:** Students experience, or observe first-hand, typical engineering work or research in an appropriate industry or research institution for least 600 hours. The work must be performed under the direct supervision of an engineer from an appropriate discipline. Students are required to, within their engineering discipline, apply fundamental engineering principles to solve practical problems in an industrial context and develop their technical and interpersonal skills. The home department's prior approval of the scope and nature of the work is required. Students are required to submit at least two reports: (a) shortly after commencing the internship, a report on the agreement between the student and host, detailing the scope and nature of the work; (b) a final report at the end of their training. The latter report must explain the nature and scope of the work conducted, as well as the technical details of work that they experienced or observed. References by students' supervisors on their conduct must be submitted with these reports.

**Part 2:** Students also undertake an exchange to an engineering faculty outside South Africa for at least 600 hours of participation in projects and/or modules. The host faculty, as well as the combination of the projects and modules, are subject to the prior approval of the student's home department at Stellenbosch University.

Students are normally not allowed to register for any other undergraduate module(s) at Stellenbosch University in the semester(s) that a student undertakes Internship 393, unless the modules are part of an exchange agreement between the Engineering Faculty and the host faculty.

*Home Department: Engineering (Admin)*

*Required Modules:*

*PP All modules of the first two years of a 4-year BEng*

*Departmental approval*

## 39705 Introductory Machine Design

### 244 (15) Design Process, Machine Parts and Machine Drawing (1L; 3P; 2T)

Conceptual design process, human factors in design. Design for assembly. Machine parts: seals, couplings, keys, retaining rings and bearings. Freehand sketches, part models, 2D detail drawings of parts and part lists, 3D modelling and interference checking. Drawing standards: measurement instrumentation for manufacturing, surface roughness, tolerancing, geometric tolerancing, shrink fits, welding symbols. Design of belt and chain drives. Working drawings and design projects in which the theory is applied.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Engineering Drawings 123 or P Engineering Drawings 143*

*P Strength of Materials 143*

## **254 (15) Mechanics of Machines and Machine Drawing (2L; 3P; 1T)**

Modelling of mechanical systems: kinematics of planar mechanisms, velocity and acceleration diagrams, balancing. Machine parts: seals, couplings, keys, retaining rings and bearings. Drawing standards: measurement instrumentation for manufacturing, surface roughness, tolerancing, geometric tolerancing, shrink fits, welding symbols. Working drawings.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Engineering Drawings 123 or P Engineering Drawings 143*

*P Applied Mathematics B 224*

## **14212 Introductory Systems Engineering**

### **444 (15) Introductory Systems Engineering (3L; 3P)**

Principles of systems engineering. System and system element requirements development. System of systems. Principles of system life cycle management. Development of software to support digitalisation of engineered systems. Contract and intellectual property aspects of engineering practice. Public liability considerations in product development and production. Safety considerations and implications of the Occupational Health and Safety Act in engineering practice.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Mechatronics 424 or P Mechatronics 434 or P Machine Design B 344*

## **16020 Machine Design A**

### **314 (15) Fatigue, Fracture Mechanics and Machine Components (2L; 2P; 2T)**

Design for 3D static and dynamic loads, static failure, fatigue, fracture mechanics, deflection and stiffness, buckling. Design for machining, metal casting, welding, forging and plastic injection moulding. Design projects where the theory is applied to the mechanical design of multi-degree-of-freedom mechatronic systems subject to inertial loads due to acceleration, including actuator selection, inertia matching and working drawings that contain multiple levels of assemblies.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Introductory Machine Design 254*

*P Strength of Materials W 244*

## **16039 Machine Design B**

### **344 (15) Design of Machine Subsystems (2L; 2P; 2T)**

Design of lead screws, bolt connections, fasteners, springs, clutches, brakes. Cam analysis and design. Kinematics of gear systems and forces. Gear design. Shaft connections. Pressure vessel code design. Design projects where theory is applied.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Machine Design A 314*

## **11745 Maintenance Management**

### **414 (15) Maintenance Management (3L; 0,5P; 2,5T)**

Strategic maintenance planning, plant acquisition policy, business interface, structuring of maintenance objectives, reliability statistics, Reliability Centred Maintenance, plant maintenance life planning and scheduling, preventive maintenance, top-down/bottom-up approach, managing maintenance resources, maintenance organisation, human factors, maintenance team work, Total Productive Maintenance, maintenance systems, maintenance budgeting, maintenance control, short-term work planning, management of shutdowns, network analysis technique for management of shutdowns, other shutdown methodologies, spare-part management, maintenance management information systems.

*Home Department: Industrial Engineering*

## 34134 Manufacturing Processes

### 244 (15) Manufacturing Processes (2L; 1,5P; 1T)

Mechanical properties of materials; casting processes; shaping of plastics; powder metallurgy; metal forming; bulk deformation of material; sheet metal working; principles of metal machining; machining operations and equipment; cutting tools for machining; economic considerations for machining; welding processes; mechanical assembly; non-traditional machining. Factory visits.

*Home Department: Industrial Engineering*

*Required Modules:*

*C Materials Science A 214*

## 45381 Manufacturing Systems

### 324 (12) Manufacturing Systems (2L; 2T)

Introduction to manufacturing systems; sustainable manufacturing; product design; reverse engineering; concurrent engineering; additive manufacturing.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Manufacturing Processes 244*

## 30325 Materials Science A

### 214 (15) Materials Science A (3L; 3P)

Atomic structure and interatomic bonding; crystallography: fundamentals, metallic and ceramic crystal structures; polymer structures; microscopy; diffusion; dislocations and plastic deformation; strengthening mechanisms for metals, recovery, recrystallisation and grain growth; mechanical properties and testing of metals; failure: ductile and brittle fracture, fatigue, creep; phase diagrams: fundamentals, binary systems, iron-iron carbide system; phase transformations: fundamentals, microstructural and property changes in iron-carbon alloys (steels and cast irons); properties and applications of metals, ceramics and polymers; composite materials; fabrication and processing of engineering materials; corrosion; application to real-life case studies.

*Home Department: Mechanical and Mechatronic Engineering*

## 22853 Mathematical Statistics

### 214 (16) Distribution Theory and Introduction to Statistical Inference (4L; 2P)

Continuous stochastic variables; expected value and variance of a continuous stochastic variable; important continuous distributions; uniform, normal, exponential, gamma, beta. Moments and moment-generating functions for discrete and continuous distributions. Bivariate probability distributions; marginal and conditional distributions; the multinomial and bivariate normal distribution; determining the distribution of functions of variables. The central limit theorem (without proof). Samples and sampling distributions: the standard parametric cases. Interval estimation and hypothesis testing: applying these principles in the standard cases of parametric inference. Data representation and description, calculating and interpreting sample measures.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*PP Probability Theory and Statistics 114 or PP Probability Theory and Statistics 144*

*PP (Mathematics 114 and Mathematics 144) with an average final mark of at least 60% for the two together, or PP Mathematics 214 with a final mark of at least 55%. (If you passed Engineering Mathematics 115 and Engineering Mathematics 145 with an average mark of at least 60% for the two together, or Engineering Mathematics 214 with a final mark of at least 55%, you are exempt from this prerequisite pass.)*

**245 (8) Statistical Inference (2L; 1P)**

Introduction to statistical inference. Principles of point estimation: efficiency, minimum variance unbiased estimators, consistency. Method of moments estimators. Maximum likelihood estimators. The Neyman-Pearson lemma: proof and applications. Likelihood ratio tests. Parametric estimation theory and hypothesis testing. Bayesian inferential statistics.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*PP Mathematical Statistics 214*

**246 (8) Linear Models in Statistics (2L; 1P)**

Advanced matrix algebra. Stochastic vectors and matrices. The multivariate normal distribution. Maximum likelihood estimation of parameters in the multivariate normal distribution. Distributions of quadratic forms. The simple linear regression model. The method of least squares. Inference in the simple linear regression model. Introduction to R software.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*PP Mathematical Statistics 214*

**312 (16) Statistical Inference and Probability Theory (3L; 1P)**

Advanced distribution theory, sequences of random variables, limit theory for sequences, generating functions, sampling distributions and approximations. Sufficiency. Different approaches to inference. Goodness-of-fit methods. Bayes inference: Decision theory and Bayes risk using loss functions, Bayesian belief networks and Bayesian classification. Markov Chain Monte Carlo simulation techniques: Gibbs sampling and Metropolis-Hasting algorithms.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*PP Mathematical Statistics 245*

*P Mathematical Statistics 246 with a final mark of at least 40%*

*P Mathematics 214 or P Engineering Mathematics 214*

**316 (16) Regression and Predictive Modelling (3L; 1P)**

Fitting regression models by means of matrices. The multiple linear regression model. Inference in the multiple linear regression model. Residual analysis. Variable selection techniques. Ridge regression. Lasso regression. Linear methods for classification. The use of R software to fit models in practice.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*PP Mathematical Statistics 246*

*P Mathematical Statistics 245 with a final mark of at least 40%*

*P Mathematics 214 or P Engineering Mathematics 214*

**344 (16) Stochastic Processes and Statistical Learning (3L; 1P)**

Introduction to stochastic processes. Markov processes and their applications. Introduction to martingale theory and applications. Introduction to statistical learning.

*Home Department: Statistics and Actuarial Science*

*Required Modules:*

*P Mathematical Statistics 312*

*P Mathematical Statistics 316*

**21539 Mathematics****186 (32) Introductory Mathematics (3L; 3T)**

For BSc (Extended Curriculum Programme) and BEng (Extended Curriculum Programme) students.

*To take this module, you must have a mark of at least 5 (or 60%) for Mathematics on your NSC or your IEB school-leaving certificate.*

An introduction to calculus, linear algebra and mathematical reasoning: different presentations of functions in terms of formulas, graphs, tables and stories; inverse of a function; exponential and logarithmic functions; trigonometric functions and their inverse functions; modelling with functions. Gradual progression from average to instantaneous rate of change; limits; basic integration. Systems of equations; analytic geometry; mathematical induction; binomial theorem.

*Home Department: Mathematical Sciences*

## 39292 Mechanical Engineering

### 152 (6) An introduction to mechanical engineering (3T)

Mechanical machines and components; freehand drawings; modelling of machines and components; conceptual design process; layout and assembly of a mechanical system; basic experimental investigation.

*Home Department: Mechanical and Mechatronic Engineering*

### 414 (15) Specialist Topics in Mechanical Engineering (3L; 1P; 2T)

Topics from specialist areas in mechanical engineering, such as air-conditioning and refrigeration, aeronautical engineering, marine engineering, vehicle engineering and machine design. The exact content of the module is determined annually as dictated by the availability of specialist lecturers and the requirements of students.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*Final-year enrolment*

## 39179 Mechanical Project

### 478 (45) Capstone Project for Mechanical Engineering Students (1L; 2P)

Professional communication: written and oral project presentations, reports. Independent execution of theoretical and/or practical design and/or investigation in the field of mechanical engineering with formal oral presentations and the submission of a final comprehensive report.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*Final-year enrolment*

## 10886 Mechatronic Engineering

### 152 (6) An introduction to mechatronic engineering (3T)

Mechanical machines and components; freehand drawings; modelling of machines and components; conceptual design process; layout and assembly of a mechatronic system; basic experimental investigation.

*Home Department: Mechanical and Mechatronic Engineering*

## 56790 Mechatronic Project

### 478 (45) Capstone Project for Mechatronic Engineering Students (1L; 2P)

Professional communication: written and oral project presentations, reports. Independent execution of theoretical and/or practical design and/or investigation in the field of mechatronic engineering with formal oral presentations and the submission of a final comprehensive report.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*Final-year enrolment*

### 488 (45) Capstone Project for Mechatronic Engineering Students (1L; 2P)

Professional communication: written and oral project presentations, reports. Independent execution of theoretical and/or practical design and/or investigation in the field of mechatronic engineering with formal oral presentations and the submission of a final comprehensive report.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*Final-year enrolment*

## 50458 Mechatronics

### 424 (12) Mechatronic Design (3L; 3P)

Mechatronic systems design. Sensors, actuators; digital and analogue interfaces; sequential control with ladder logic, programmable logic controllers and computers. One or more projects in which mechanics, electronics, computer use and control are integrated.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Control Systems 354*

## 47988 Mineral Processing

### 345 (15) Mineral Processing (3L; 1P; 2T)

Mineral growths and principles of liberation; solid state analysis; population balances; mineral liberation and liberation distributions; classification with sieves and hydrocyclones; empirical models; comminution; density-based separation equipment; surface chemistry and flotation; hydrometallurgical principles and unit operations; Pourbaix diagrams; introductory mass balance reconciliation.

[Presented by Dept Chemical Engineering, 80% of module.]

Introduction to mineralogy. Characterisation of materials in the solid state: scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS) and wave length dispersion spectroscopy; X-ray fluorescence (XRF) and X-ray diffraction techniques (XRD); reflectance and transmittance microscopic techniques and image analysis; microscopic techniques based on polarised light and etched materials, sample preparation for solid state characterisation and spectroscopic techniques. Laser ablation, glow discharge and spark discharge optical emission spectra.

[Presented by Dept Earth Sciences, 20% of module.]

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 254*

*P Particle Technology 316*

### 415 (15) Materials Extraction and Selection (3L; 2T)

Process metallurgy of natural raw materials and secondary materials: applied phase and reaction equilibrium thermodynamics relevant to solid and liquid solutions, molten alloys, slag and matte melts. Processing methods related to high temperature reactions and related extraction techniques in pyrometallurgy to obtain metals, alloys and solutions containing metallic species, with consideration of thermodynamics. Extraction of metals from ferrous oxides and sulphides with regard to selection and characterisation of pyrometallurgical reactors, including refractory materials at high temperatures. Materials in chemical engineering with reference to structure, properties and behaviour of metals, ceramics, composites and polymers. Selection of materials for chemical engineering applications with consideration of prediction and prevention of failure and corrosion.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 317*

## 56804 Modelling

### 334 (16) Modelling and Simulation of Mechanical Systems (3L; OP; 3T)

Formulation of differential equations for mechanical, electrical, thermal and fluid systems, solutions using Laplace transforms, block diagrams and transfer functions; state space formulation. Transient and stationary behaviour; frequency response analysis.

The statistics of measurement and reliability, expected values, distributions and probability density functions; operations and transformation of random variables; programming with R.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Engineering Mathematics 214*

*P Engineering Mathematics 242*

## 53678 Numerical Fluid Dynamics

### 414 (15) Numerical Fluid Dynamics (3L; 1P; 2T)

Modelling of flow: elements of numerical flow software, conservation laws and differential equations for mass, momentum and energy, boundary conditions, equation of state, grid types and generation, linearisation, discretisation, false diffusion, SIMPLE pressure correction algorithm, stability, relaxation factors, source term linearisation, error calculations, convergence, use of commercial codes; course project.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Thermofluid Dynamics 344*

## 36323 Numerical Methods

### 262 (8) Numerical Methods (2L; 1T)

Introduction to MATLAB; zeros of functions; solving of systems of linear equations; numerical differentiation and integration; interpolation and curve-fitting; numerical methods for solving ordinary and partial differential equations.

*Home Department: Mathematical Sciences*

*Required Modules:*

*P Engineering Mathematics 214*

## 59528 Operations Research (Eng)

### 345 (15) Operations Research (Deterministic Models) (3L; 3T)

The systems approach to problem-solving; problems leading to linear programming, network, integer and non-linear programming models; algorithms for solving such models; tasks, including exercises with computer packages.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Engineering Mathematics 214*

### 415 (15) Operations Research (Stochastic Models) (3L; 3T)

Analysis of problems leading to a selection of deterministic and stochastic dynamic programming models, Markov chains and waiting-line models; techniques for solving such models; decisions under uncertainty; Bayes' theorem; multi-criteria decision-making; local-search and population-based metaheuristics.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Engineering Statistics 314 or P Probability Theory and Statistics 114*

## 14020 Optimisation (Eng)

### 414 (15) Non-linear Optimisation (3L; 1,5P; 1,5T)

Local vs. global optima, classification of stationary points, the Karush-Kuhn-Tucker conditions, Lagrangian relaxation. Numerical methods: gradient-based methods, the Broyden-Fletcher-Goldfarb-Shanno algorithm, the simplex algorithm, the Nelder-Mead algorithm. Metaheuristic methods: trajectory based methods (tabu search and simulated annealing), evolutionary algorithms (genetic algorithms and differential evolution), swarm intelligence (ant colony optimisation and particle swarm optimisation).

*Home Department: Industrial Engineering*

*Required Modules:*

*P Operations Research (Eng) 345*

*P Computer Science E 214*

## 47902 Particle Technology

### 316 (15) Particle Technology (3L; 1P; 2T)

*1 Practical per semester*

Characteristics and mathematical description of particles and their size distributions; determination of the particular characteristics of single particles and powders; the mechanical behaviour and flow patterns of particle systems; sedimentation and thickener design; flow through packed beds; fluidisation and fluidised bed behaviour of particles; hydraulic and pneumatic transport of particles; filtration; gas cyclones; health and safety aspects of fine powders.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Chemical Engineering 254*

*P Chemical Engineering 264*

## 65609 Philosophy and Ethics

### 314 (4) Philosophy and Ethics (3L)

Applied ethics; the code of conduct for professional persons of the Engineering Council of SA (ECSA); case studies of typical situations from engineering practice, including the social, workplace and physical environments.

Offered for one term in the semester.

The quality assurance of Philosophy and Ethics is handled jointly by the Department of Philosophy and the Faculty of Engineering. Consult the module framework for further information.

*Home Department: Philosophy*

### 414 (4) Philosophy and Ethics (3L)

Applied ethics; the code of conduct for professional persons of the Engineering Council of SA (ECSA); case studies of typical situations from engineering practice, including the social, workplace and physical environments.

Offered for one term in the semester.

The quality assurance of Philosophy and Ethics is handled jointly by the Department of Philosophy and the Faculty of Engineering. Consult the module framework for further information.

*Home Department: Philosophy*

## 12998 Physics

### 176 (32) Preparatory Physics (3L; 3P)

Students follow this module in the BSc (Extended Curriculum Programmes) in AgriSciences and Science and for the BEng. The module focuses on the nature of physics with the following themes as content: mechanics, electromagnetism, modern physics.

*Home Department: Physics*

## 40142 Practical Workshop Training

### 211 (0) Practical Workshop Training

After their first year of study, students receive training in workshop practice at a workshop appointed by the University. Students may complete such training at other institutions that have suitable facilities and staff, provided that prior written permission is obtained from the relevant departmental chair. Such permission must be obtained prior to the commencement of the module.

*Home Department: Mechanical and Mechatronic Engineering*

*Method of Assessment: Attendance*

## 241 (0) Practical Workshop Training

Students receive, after their first study year, training in workshop practice in a workshop appointed by the University. Students may complete such training at other organisations which have the necessary facilities and personnel, provided that written permission is obtained from the relevant departmental chair. Such permission must be obtained prior to the commencement of the module.

*Home Department: Mechanical and Mechatronic Engineering*

*Method of Assessment: Attendance*

## 12201 Preparatory Technical Drawings

### 146 (16) Preparatory Technical Drawings (3L; 3P)

Principles of first- and third-angle projection. Linework and lettering. Isometric projections and drawings. Drawing layouts. Full section views. Geometric constructions and tangency. True lengths and auxiliary views. Introduction to descriptive geometry: points and lines in space; new projection planes. Introduction to parametric geometric modelling in computer-aided design (CAD).

*Home Department: Mechanical and Mechatronic Engineering*

## 56820 Probability Theory and Statistics

### 114 (16) Probability Theory and Statistics (3L; 3T)

Combinatorial analysis; the basic counting principles; permutations and combinations. Random phenomena; sample spaces and events; the probability axioms; the probability of an event; random selection; probability rules; conditional probability; the rule of Bayes; stochastic independence. Discrete and continuous stochastic variables; expected value and variance of a stochastic variable; important discrete distributions: binomial, Poisson, geometric, hyper-geometric, negative binomial; important continuous distributions: uniform, exponential, normal.

*Please note:* This module is identical to Probability Theory and Statistics 144(16), which is offered in the second semester by the Department of Statistics and Actuarial Science for BCom students.

*Home Department: Mathematical Sciences*

## 23256 Production Management

### 212 (8) Production and Operational Management (2L; 2T)

Introduction to operations management; strategy and sustainability; process analysis and manufacturing processes; lean supply chains; sales and operations planning; materials requirements planning (dependent inventory).

*Home Department: Industrial Engineering*

### 314 (15) Operations Facilities and Management (3L; 1P; 2T)

Process analysis and improvement by combining Lean and Theory of Constraints approaches; facility design with regard to facility location, facility layout and production line design; demand forecasting and capacity planning; integrated production planning from an aggregate to operational level; inventory planning and control; scheduling, execution and control of production.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Production Management 212*

*C Engineering Statistics 314*

### 444 (12) Financial and Production Management (3L; 2T)

Introduction to operations management, productivity and competitiveness; the funds flow cycle and the accounting equation; process flow analysis; cost accounting; quality management and statistical process control; budgets and capital expenditure including discounted cash flow techniques; inflation and tax; just-in-time management (JIT), theory of constraints scheduling (TOC); inventory control and MRP; supply chain management (SCM).

*Home Department: Industrial Engineering*

## 30279 Project (Civil Engineering)

### 418 (30) Project (Civil) (1L; 20P)

Each student must complete an approved design or research project during the final year, after which a comprehensive report on the project is submitted. The project must be of an investigative nature and the ability of the student to work independently will be assessed. Each student will deliver an oral and poster presentation on the project. This module may be done only instead of Project (Civil) 458 in the semester that the students can complete their programme.

*Home Department: Civil Engineering*

*Required Modules:*

*Departmental approval*

### 458 (30) Project (Civil) (1L; 20P)

Each student must complete an approved design or research project during their final year, after which a comprehensive report on the project is submitted. The project must be of an investigative nature and the ability of the student to work independently will be assessed. Each student will deliver an oral and poster presentation on the project.

*Home Department: Civil Engineering*

*Required Modules:*

*Departmental approval*

## 46795 Project (E)

### 448 (45) Project (E) (20P)

Thesis project: Each student must do an independent project on an approved topic and submit a full report. An oral examination is required where the professional communication skills of each student is assessed.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*Final-year Enrolment*

## 51993 Project Management

### 412 (12) Project Management (3L; 1T)

Project management framework: integration, scope, time, cost, human resources, communication, risk, safety and procurement. Project management processes: initiating, planning, execution, control and commissioning. Principles of business management and leadership. Multidisciplinary teamwork and project management.

*Home Department: Industrial Engineering*

## 46167 Quality Assurance

### 344 (15) Quality Assurance (2L; 3T)

Definition of quality, methods and techniques of quality assurance, statistical process design, sampling. Principles of robust design. Formulation of measures of system performance and quality. Identification of quality noise factors. Formulation and implementation of techniques to reduce effects of noise. Synthesis and selection of design concepts for robustness.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Engineering Statistics 314*

## 59471 Quality Management

### 444 (15) Quality Management (3L; 3T)

Definition of reliability and maintainability; reliability management; methods and techniques for reliability modelling, data analysis, prediction and maintainability assurance; quality management; methods and techniques for quality management; quality improvement; quality planning; quality control; leadership for quality management; cost of (poor) quality.

*Home Department: Industrial Engineering*

*Required Modules:*

*P Engineering Statistics 314*

## 64866 Scientific Communication Skills

### 116 (12) Scientific Communication Skills (3L; 3T)

For students in the BSc (Extended Curriculum Programmes). This module focuses on the development of speaking, listening, and reading skills in the academic environment in general and specifically in the natural sciences. Aspects such as engaging with and understanding relevant academic and natural science texts, understanding text components, the use of fluent, correct and proper language, and the interpretation of graphic data, will be addressed.

*Home Department: Language Centre*

### 146 (6) Scientific Communication Skills (3L)

For BSc students in the BSc (Extended Curriculum Programmes). This module focuses on the development of writing skills in the academic environment in general and specifically in the natural sciences. Aspects such as engaging with and understanding relevant academic and natural science texts, understanding text components, presenting data in an edited and coherent text, the use of correct and proper language, the employment of accurate language, correct referencing technique and using graphics to clarify data will be addressed.

*Home Department: Language Centre*

## 53945 Simulation

### 442 (12) Simulation (3L; 1P; 2T)

Principles of discrete-event simulation of stochastic processes; generation of random numbers and values for random variables; Monte-Carlo principle; simulation methodology; concept models; theory, techniques and resources required for the analysis of input- and output data of simulation models; applications with a software package.

*Home Department: Industrial Engineering*

*Required Modules:*

*PP Engineering Statistics 314*

## 19658 Statistics

### 214 (16) Applied Statistics (3L, 2T)

*Descriptive statistics:* Various data types; frequency distributions; contingency tables; graphical representation of different data types; measures of location and spread; box-and-whisker plot.

*Discrete stochastic variables and probability distributions:* Expected value, variance and standard deviation of a discrete stochastic variable; correlation between discrete stochastic variables; joint, marginal and conditional distributions; distribution of the sum of variables; binomial and Poisson distributions.

*Continuous stochastic variables and probability distributions:* Expected value, variance and standard deviation of a continuous stochastic variable.

*Distributions:* Uniform, normal, exponential, gamma, t, F, chi square and beta.

*Sampling distributions:* The central limit theorem; sampling distributions of one mean; one proportion and one variance; sampling distributions of the difference between two means and the difference between two proportions; sampling distributions of the ratio of two variances.

*Inferential statistics:* Interval estimation and hypothesis testing for one mean, one proportion and one variance; Interval estimation and hypothesis testing for the difference between two means, the difference

between two proportions and the ratio of two variances; concept and calculation of p values in above cases; determining sample sizes; calculation of power and the effect of sample size on it.

*Categorical data analysis:* Hypothesis testing for the difference between two or more proportions; tests for independence; the goodness of fit test.

**Note:**

Application of statistical techniques using Microsoft® Excel is emphasised throughout.

*Home department: Statistics and Actuarial Science*

*Required Modules:*

*PP Statistics and Data Science 188 or PP Probability Theory and Statistics 114 or PP Probability Theory and Statistics 144*

*C Statistics 224 (If you passed Mathematics 114 or Mathematics 144 or Engineering Mathematics 115 or Engineering Mathematics 145, you are exempt from this requirement.)*

## **244 (16) Statistical Inference (3L, 2T)**

*Sampling techniques:* Simple random sampling; stratified sampling; systematic sampling; cluster sampling; probability proportional to size sampling.

*Properties of estimators:* Unbiasedness; efficiency; consistency; sufficiency; robustness.

*Estimation methods:* Maximum likelihood and optimisation of linear models.

*Simple linear regression analysis:* The simple linear regression model; method of least squares estimation; Inference on the model parameters and the correlation coefficient; residual analysis; prediction intervals and confidence intervals.

*Multiple linear regression analysis:* The multiple linear regression model; residual analysis; inference on the parameters of the model; regression models with dummy variables and interaction terms; polynomial regression; transformations; collinearity; variable selection.

*Linear models for classification:* Methods of estimation; inference on the model parameters; evaluation of model performance; prediction intervals and confidence intervals.

*Analysis of variance:* One- and two-factor ANOVA; multiple comparisons testing.

*Non-parametric techniques for analysis of variance:* Wilcoxon's rank sum test; the sign test; Wilcoxon's signed-rank test; Kruskal-Wallis test.

**Note:**

Application of statistical techniques using Microsoft® Excel and R are emphasised throughout.

*Home department: Statistics and Actuarial Science*

*Required Modules:*

*PP Statistics 214*

*P Statistics 224 (If you passed Mathematics 114 or Mathematics 144 or Engineering Mathematics 115 or Engineering Mathematics 145, you are exempt from this requirement.)*

## **318 (24) Linear and Econometric Models (4L, 2T)**

*Regression analysis:* The multiple linear regression model. Maximum likelihood estimators; residual analysis; outliers and influential observations; unequal variances; multicollinearity; power transformations; variable selection; weighted least squares; logistic regression; ridge regression; robust regression; principal component regression; dummy variables and ANOVA; log-linear model; econometric models.

*Multivariate methods:* Presentation of multivariate data; the multivariate normal distribution; tests for normality; hypothesis testing for one and two population mean vectors; confidence regions and simultaneous confidence intervals; multivariate control charts; multivariate analysis of variance; linear discriminant analysis; The use of the software R, STATISTICA and SAS to apply regression analysis and multivariate methods to datasets.

*Home department: Statistics and Actuarial Science*

*Required Modules:*

*PP (Statistics 214 and Statistics 224 and Statistics 244) or PP (Mathematical Statistics 214 and Mathematical Statistics 245 and Mathematical Statistics 246) (If you passed Mathematics 114 or Mathematics 144 or Engineering Mathematics 115 or Engineering Mathematics 145, you are exempt from PP Statistics 224.)*

### 348 (24) Statistical Practice (4L, 2T)

*Probability theory:* Discrete probability distributions (the binomial, geometric, negative binomial, hypergeometric and Poisson distributions); moments and moment generating functions; continuous probability distributions (the normal, gamma and beta distributions); functions of random variables (the method of transformations, the method of moment generating functions, and order statistics).

*Advanced statistical inference:* Properties of estimators (unbiasedness, efficiency, consistency, sufficiency, robustness); method-of-moments estimation; maximum likelihood estimation; likelihood ratio tests.

*Time series analysis:* Time series decomposition methods; single exponential smoothing; Holt's method; Holt-Winter's method; multiple regression in time series analysis; Box-Jenkins methodology for ARIMA models; Using the R and STATISTICA software to apply time series models.

*Stochastic simulation:* Generating random numbers from different distributions using R; inverse transform method; acceptance-rejection method; practical applications of simulation using R.

*Bayesian inference:* Bayes' theorem; Bayesian priors, posteriors and estimators; Bayesian credibility intervals; Bayes hypothesis testing.

*Home department:* Statistics and Actuarial Science

*Required Module:*

*P Statistics 318*

## 19712 Strength of Materials

### 143 (12) Introduction: Mechanics of Deformable Bodies (3L; 2T)

Introduction to mechanics, internal forces and stresses, deformations and strain, material response: material law, axially loaded elements, torsion elements with circular cross section, symmetrical bending of beams, thin-walled pressure vessels.

*Home Department:* Civil Engineering

*Required Modules:*

*C Engineering Mathematics 115*

*C Applied Mathematics B 124*

### 224 (15) Stress Analysis (3L; 2,5T)

Stress and strain analysis; relation between stress and strain for materials; transformation of stress and strain, principal stress and principal strain; elastic and plastic material behaviour for axially loaded members, stability of axially loaded members (Euler theory), torsion, bending and skew bending elements with solid and thin-walled sections; shear stress in bending; composite stress – axial, torsion, shear and bending; stress concentrations, failure theories and fatigue; elastic design of members.

*Home Department:* Civil Engineering

*Required Modules:*

*P Strength of Materials 143*

### 254 (15) Structural Analysis (3L; 2,5T)

Theory and application of classic structural analysis techniques. Energy methods and virtual work. Flexibility, stiffness and matrix methods. Equilibrium, reactions and section forces in structures with axial, torsional and bending members. Linear elastic constitutive relation and differential equations for strain and displacement.

*Home Department:* Civil Engineering

*Required Modules:*

*P Strength of Materials 224*

## 19739 Strength of Materials W

### 244 (15) Displacements, Failure Criteria, Stress and Strain Transformations (3L; 1P; 2T)

Displacements and deflection of beams. Energy methods. Stress and strain transformations. Mohr circles. Von Mises, Tresca and Mohr-Coulomb failure theories. The relationship between stress and strain and the application to thick-walled cylinders, curved beams, press and shrink fits, rotating discs and rings, etc. Experimental stress analysis using strain gauges.

*Home Department:* Mechanical and Mechatronic Engineering

*Required Modules:*

*P Engineering Mathematics 214*

*P Strength of Materials 224*

### 334 (15) Strength of Materials (3L; 1P; 2T)

Complex strains and stresses; generalised Hook's law, anisotropic materials (composites); failure criterions; introduction to plasticity; fracture mechanics (stress singularities); time dependent failure (material creep); non-destructive testing (NDT) and failure analysis.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Engineering Mathematics 242*

*P Strength of Materials W 244*

## 36307 Structural Design

### 354 (15) Concrete Construction (3L; 2,5T)

Conceptual understanding of reinforced concrete structures: limit states approach and loads according to the relevant design codes of practice (gravitational loads). Material behaviour of concrete (shrinkage, creep and applications according to the relevant codes of practice). Short column analysis: stresses, areas of steel and concrete, basic detailing. Slender columns (uni-axial and bi-axial bending). Beam analysis: bending, redistribution of moments, shear forces, basic detailing, displacement control ( $L/d$  ratio according to design codes of practice). Slab design: beam and slab with application of tables in codes of practice, flat slab design and punching shear, basic detailing. Simplified frames as allowed by codes of practice (application of commercial frame analysis software packages). Introduction to pre-stressed concrete (statically determinate beams): choice of tendon force and tendon profile, losses, details (anchor zone). Anchorage of reinforcement: laps and bond of reinforced concrete. Furthermore, continuously as part of the above: quality control during design and construction, specifications, representation of a physical structure by theoretical modelling.

*Home Department: Civil Engineering*

*Required Modules:*

*C Building Materials 254*

*P Strength of Materials 254*

### 424 (15) Steel Construction (3L; 2,5T)

Description of the basis of design. Determination of structural loading according to the relevant code of practice: review of general prescriptions, focus on wind loading as applied to steel structures. Conceptual design of steel structures. Determination of the response of steel structures in terms of function, stability and load effects (element forces and deflections). Determination of the function, response and capacity of structural steel elements, tension elements, compression elements, beams, beam-columns, connections and foot plates in terms of the relevant code of practice. Design of basic steel structure.

*Home Department: Civil Engineering*

*Required Modules:*

*P Strength of Materials 254*

*C Structural Design 354*

## 46779 Systems and Signals

### 214 (15) Introduction to Systems and Signals (3L; 1P; 2T)

Sinusoidal steady-state analysis; phasors; sinusoidal power and energy concepts; transient and phasor analysis of second-order RLC circuits; instantaneous and average power; ideal operational amplifiers; two-port parameters.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electrotechnique 143*

**244 (15) Frequency Domain Techniques (3L; 1,5P; 1,5T)**

The Laplace transform and its application to dynamic circuits; impulse and step response; convolution; transfer functions; Bode plots; basic passive filters; basic active filters; Fourier series and its application to circuits; Fourier transform and its applications to circuits; filters.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Electrotechnique 143*

*C Engineering Mathematics 214*

*C Engineering Mathematics 242*

**315 (15) Signal Theory and Analogue Modulation (3L; 1,5P; 1,5T)**

Time/frequency transformations as underlying principle; the Fourier transform and the discrete Fourier transform (DFT); LTI systems; modulation as building block for telecommunication systems; application of transforms in AM, SSB, FM, FDM and TDM; (de)modulation circuits with theoretical verification.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Systems and Signals 214*

*C Systems and Signals 244*

**344 (15) Stochastic Signals (3L; 1P; 2T)**

One- and multi-dimensional random variables; expected values, moments, distribution functions and probability density functions; operations on and transformations of random variables; random signals, auto- and cross-correlation, stationary and spectral characteristics; behaviour with linear systems.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Systems and Signals 315*

**414 (15) Digital Signal Processing (3L; 1P; 1T)**

Sampling and time/frequency duality; Fourier transforms and series of discrete-time signals, the discrete Fourier transform (DFT), the fast Fourier transform (FFT), convolution by means of the FFT; describing and characterising discrete-time systems using the z-transform, impulse responses, frequency responses; difference equations; elementary filters, FIR and IIR filter design; using auto-correlations and cross-correlations.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Systems and Signals 344*

**14215 Technical Communication****311 (4) Technical Communication (2L)**

Effective communication in a professional environment, specifically in the form of technical reports and correspondence. Text skills, such as coherence, appropriate style and structure. Appropriate referencing methods. Appropriate assimilation of information from various sources of knowledge to create a literature review. Presentation skills.

Offered for half of the semester in tandem with Philosophy and Ethics 314

*Home Department: Engineering (Admin)*

## 20419 Telecommunication

### 414 (15) Introduction to Telecommunications (3L; 1P; 1T)

Channel capacity; baseband data transmission: intersymbol interference and error probabilities; signal-to-noise ratios; probability of error for digital modulation schemes (ASK, PSK, FSK); digital transmission of analogue signals (PCM) and quantisation noise; forward error correction codes.

*Home Department: Electrical and Electronic Engineering*

*Required Modules:*

*C Systems and Signals 344*

## 19984 Theory of Structures

### 354 (15) Implementation of the Finite Element Method (3L; 2,5T)

Computer implementation of the finite element method for structural components, membranes, thin plates and frames. Building information models (BIM) for digital twinning in construction.

*Home Department: Civil Engineering*

*Required Modules:*

*P Strength of Materials 254*

*P Engineering Informatics 314*

## 33863 Thermodynamics A

### 244 (15) Applied Thermodynamics A (3L; 3T)

Specific heat,  $C_p$  and  $C_v$ ; vapours; gas-vapour mixtures, saturation; use of steam tables, phase diagrams; ideal and non-ideal gases; compressibility charts, improvements to the state equation; mass balances (steady and unsteady); energy, mechanical work, first law of thermodynamics; applications to closed and open systems; processes and cycles; method of problem solving; state changes for ideal gases; isochoric, isobaric, isothermal, adiabatic and polytropic changes; enthalpy and technical work; entropy and the second law; temperature-entropy diagram; maximum available energy. Applications of thermodynamics; technical cycle processes; power generation; cooling cycles.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Engineering Mathematics 145*

*C Applied Mathematics B 154*

### 224 (15) Applied Chemical Thermodynamics A (3L; 1P; 2,5T)

*1 Practical per semester*

Specific heat,  $C_p$  and  $C_v$ ; vapours; gas-vapour mixtures, saturation; use of steam tables and phase diagrams; ideal and non-ideal gases; compressibility charts; inter-molecular forces and potential functions; basic equations of state; energy, mechanical work and first law of thermodynamics; applications to closed and open systems; state changes for ideal gases; isochoric, isobaric, isothermal, adiabatic and polytropic changes; enthalpy and technical work; entropy and the second law; temperature entropy diagram; maximum available energy; irreversible processes; basic cycles and refrigeration.

*Home Department: Chemical Engineering*

*Required Modules:*

*P Engineering Mathematics 145*

*C Applied Mathematics B 154*

*P Engineering Chemistry 123 or P Engineering Chemistry 143*

## 59544 Thermofluid Dynamics

### 244 (15) Introductory Thermofluid Dynamics (3L; 1P; 2T)

Engineering approach to problem solving; thermodynamic properties of water and an ideal gas; conservation of mass, momentum and energy; entropy; thermodynamic processes in closed and open systems; ideal thermodynamics cycles; pump and pipe systems; fans; ducts; steady conduction, convection and radiation heat transfer; air-vapour mixtures and air-conditioning processes.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*C Engineering Chemistry 123 or C Engineering Chemistry 143*

### 254 (15) Introductory Thermodynamics and Fluid Mechanics A (3L; 1P; 2T)

Thermodynamic properties; liquid-vapour mixtures; phase diagrams and the use of steam tables; ideal and real gases; compressibility charts; steady and unsteady mass balances; energy (work and heat), mechanical work, first law of thermodynamics; applications to closed and open systems: processes and cycles; isobaric, isothermal, adiabatic and polytropic changes; enthalpy; entropy and the second law of thermodynamics; temperature-entropy diagram; maximum available energy.

Physical properties of liquids and gases; fluid statics and manometers, forces on and stability of buoyant bodies, pressure centre and centre of gravity; fluid dynamics; integral description for a control volume; continuity, momentum and energy equations; friction losses; the Bernoulli equation and its application to pipe and duct flows; Moody chart; flow measurement.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*C Applied Mathematics B154*

*C Engineering Mathematics 145*

### 314 (15) Introductory Fluid Dynamics and Heat Transfer B (3L; 1P; 2T)

Similarity theory and dimensional analysis; differential equations for a control volume; Navier-Stokes equations; pipe networks; basic theory of turbomachines; centrifugal pumps; characteristic curves of pumps; pump systems. External flow: introduction to fluid flow over bodies; Reynolds number and geometric effects; momentum integral approach; boundary layer equations; lift and drag forces on submerged bodies.

Steady and unsteady heat conduction; convection: boundary layers, laminar and turbulent flow, natural convection, boiling and condensation; heat exchangers: overall transfer coefficients; parallel, counter and crossflow heat exchangers; logarithmic mean temperature difference; effectiveness-NTU calculations, types of heat exchangers and design principles.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Thermofluid Dynamics 254 or Thermodynamics A 244*

### 344 (15) Thermodynamics and Fluid Dynamics (3L; 1P; 2T)

External flow: introduction to fluid flow over bodies; Reynolds number and geometric effects; momentum-integral approach; boundary layer equations: flat plate with and without pressure gradients; lift and drag forces. Compressible flow: compressibility and the Mach number; stagnation conditions; isentropic flow; flow with heat addition and with friction; shock wave phenomena; the application of compressible flow; the effect of area change. Introduction to turbomachinery, pumps, axial fans; compressible flow through fluid machinery, dimensional analysis; rothalpy; centrifugal and axial compressors; gas turbines; steam turbines. Introduction to Numerical Fluid Dynamics (NFD).

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Thermodynamics A 244 or Thermofluid Dynamics 254*

*P Fluid Mechanics 314*

## 21040 Transport Science

### 324 (15) Transportation Engineering (3L; 1P; 1,5T)

Traffic flow theory: travel patterns, traffic flow variables and their relationships (speed, volume, density, travel time, delay). Traffic engineering: speed studies, parking, capacity and level of service, intersection control. Transportation planning: stakeholders, travel demand forecasting. Traffic impact assessments. Public transport: modes and intermodal transport, operational planning, rail transport. Transport economics: evaluation of projects, user pricing and payment.

*Home Department: Civil Engineering*

*Required Modules:*

*C Civil Engineering 224*

### 364 (15) Transportation Engineering (3L; 1P; 1,5T)

Urban transport networks: network development, road classification, access management and universal accessibility. Road geometric design: human factors and vehicle movements, movement equations; alignment design; route determination; intersection design; international standards. Transport safety; safety standards; forgiving road; safe systems approach. Sustainability: transport justice; sustainable transport; public transport and mini-bus taxis. Non-motorised traffic; NMT facilities. Smart Engineering: ITS applications; infrastructure; communications; trends. Traffic analysis using floating car data; data visualisation.

*Home Department: Civil Engineering*

*Required Modules:*

*P Civil Engineering 224*

*P Data Analytics (Eng) 324*

*P Transport Science 324*

*PP Applied Mathematics B 154*

### 434 (15) Pavement Design (3L; 1P; 1,5T)

Overview of pavements; elastic layer theory; stresses and strain development; behaviour of granular, asphaltic and cementitious materials, as well as transfer functions. Alternative pavement design methods including CBR design, mechanistic design and low-volume road design. Flexible and rigid pavements. Sustainability: environmental influences; designing for climate change; use of recycled and secondary materials. Construction, rehabilitation and maintenance. Present worth of costs for roads.

*Home Department: Civil Engineering*

*Required Modules:*

*P Transport Science 324*

## 64007 University Practice in the Natural Sciences

### 176 (8) University Practice in the Natural Sciences (3L)

*Study load: 78 lectures in total, presented as 5L per week in the first semester and 1L per week in the second semester.*

For students in the BSc (Extended Curriculum Programmes). It is followed up during the second semester in the different subject-specific modules of Mathematics 176, Physics 176, Chemistry 176 and Biology 146. Basic terminology and concepts are addressed. Study and life skills receive attention. The natural sciences and specifically the subjects taken by the students serve as a context.

*Home Department: Mathematical Sciences*

## 40150 Vacation Training

### 241 (0) Vacation Training (Civil)

A block of a minimum of four weeks' vacation training must be completed. A report, complying with the Department's requirements, must be submitted as examination script. The student must make his/her own arrangements for vacation training. The Department is willing to assist with the arrangements. Students that do not succeed in arranging vacation work must, before the particular holiday, formulate a project of equivalent scope and submit it to the Chair of the Department for approval. Vacation Training 241 may be done at any time after the commencement of the second academic year, but students may only submit a report from the commencement of the third year of study.

*Home Department: Civil Engineering*

*Method of Assessment: Attendance*

### **341 (O) Vacation Training (Mechanical and Mechatronic)**

Students must complete at least four uninterrupted weeks, or six weeks with no more than one interruption of up to four weeks, of vacation training on which a report that complies with the Department's requirements is submitted as examination script. Students must make their own arrangements for vacation training. The Department is prepared to assist them in this regard. In cases where employment cannot be found, students must formulate a project of equivalent scope and submit it to the Chair of the Department for approval. Vacation Training 341 may be done at any time after commencement of the second year of study, but students may only submit a report from the commencement of the third year of study.

*Home Department: Mechanical and Mechatronic Engineering*

*Method of Assessment: Attendance*

### **342 (O) Vacation Training (Civil)**

A block of a minimum of four weeks' vacation training must be completed. A report, complying with the Department's requirements, must be submitted as examination script. The student must make his/her own arrangements for vacation training. The Department is willing to assist with the arrangements. Students that do not succeed in arranging vacation work must, before the particular holiday, formulate a project of equivalent scope and submit it to the Chair of the Department for approval. Vacation Training 342 may be done at any time after the commencement of the second academic year, but students may only submit a report from the commencement of the fourth year of study.

*Home Department: Civil Engineering*

*Method of Assessment: Attendance*

### **351 (O) Vacation Training (Industrial)**

A period of at least three weeks of vacation training must be completed, supported by a report in accordance with departmental requirements. The report will be subject to examination. While students are expected to arrange their own vacation employment, the Department is prepared to provide assistance in this regard. In cases where employment cannot be found, students are required to complete a project or task as agreed upon with the Chair of the Department. Vacation training (Industrial) 351 may be completed at any time after the start of the second academic year of study. Students may also apply for permission to do a single session of vacation training. This session must be of at least six weeks duration (uninterrupted), and a single report is required which must cover the complete session. This alternative allows the student to complete Vacation Training 351 (Industrial) as well as Vacation Training 451 (Industrial) simultaneously, and may be done at any time after the start of the third academic year.

*Home Department: Industrial Engineering*

*Method of Assessment: Attendance*

### **361 (O) Vacation Training (Chemical)**

At least six weeks' vacation training should be done in total, of which at least three weeks must be uninterrupted. Preferably the students should do work in the chemical and mineral process industries and gain exposure to the large-scale equipment used in industry which is not available at the University. The work should be of engineering or scientific nature, and preferably be done under the guidance of a graduate chemical or metallurgical engineer.

*Home Department: Chemical Engineering*

*Method of Assessment: Attendance*

### **441 (O) Vacation Training (Mechanical and Mechatronic)**

The same particulars as Vacation Training 341, except that Vacation Training 441 can be completed any time after the start of the third academic year, but students may only submit a report from the commencement of the fourth year of study.

*Home Department: Mechanical and Mechatronic Engineering*

*Method of Assessment: Attendance*

### **451 (O) Vacation Training (Industrial)**

Refer to Vacation Training (Industrial) 351 for details. Vacation Training (Industrial) 451 may be completed at any time after the start of the third academic year of study, but students may only submit a report from the commencement of the fourth year of study.

*Home Department: Industrial Engineering*

*Method of Assessment: Attendance*

## **23477 Vibration and Noise**

### **354 (12) Vibration and Noise of Mechanical Systems (3L; 1P; 1T)**

Vibration of systems with a single degree of freedom: formulation of mathematical models, free and forced vibration of undamped and damped systems. Systems with two and more degrees of freedom: natural frequencies and modes of undamped systems, free and forced vibrations, and frequency response functions. Vibration of continuous systems. Control of vibration: balancing, isolation, absorbers, and vibration measurement. Vibration monitoring for maintenance purposes. Fundamentals of sound and noise; measuring and standards of industrial noise; influence of noise on the environment. The control of noise by damping and shielding.

*Home Department: Mechanical and Mechatronic Engineering*

*Required Modules:*

*P Applied Mathematics B 224*

*P Modelling 333 or P Modelling 334*

## **13184 Water Treatment**

### **324 (15) Fundamentals of Wastewater Treatment (3L; 2,5T)**

Objectives of wastewater treatment: laboratory testing methods; physical characterisation of wastewater, including settleable, non-settleable and dissolved constituents; wastewater-treatment-plant unit operations (processes such as settling, filtration, coagulation, and flocculation; aerobic and anaerobic treatment; disinfection; sewer networks; and sanitation systems); biodegradability of organics; biological growth and decay kinetics; the steady-state activated sludge model; oxygen demand and sludge production. Basic water chemistry, microbiology and water quality parameters.

*Home department: Civil Engineering*

*Required modules:*

*PP Engineering Chemistry 123 or PP Engineering Chemistry 143*

*P Engineering Mathematics 115*

*C Hydraulics 324*

# Appendix A: Faculty-wide Awards

## A.1 Chancellor's Medal

|      |                 |              |                                        |
|------|-----------------|--------------|----------------------------------------|
| 1965 | JH Gouws        | BScBEng      | Electrical and Electronic              |
| 1977 | JB Neethling    | BEngHons     | Civil                                  |
| 1986 | AF Conradie     | MEng, BEng   | Mechanical and Mechatronic, Industrial |
| 1987 | WD Rencken      | BEng         | Electrical and Electronic              |
| 1988 | P Meyer         | MEng         | Electrical and Electronic              |
| 1992 | TJ van der Walt | PhD          | Process/Chemical                       |
| 2001 | CAW Vale        | PhD          | Electrical and Electronic              |
| 2003 | M Schoeman      | MScEng, BEng | Electrical and Electronic              |
| 2006 | C Barnardo      | PhD          | Civil                                  |
| 2007 | DIL de Villiers | PhD          | Electrical and Electronic              |
| 2010 | L Auret         | PhD          | Process/Chemical                       |
| 2016 | RM Swanepoel    | BEng         | Process/Chemical                       |
| 2017 | J Kazmaier      | BEng         | Industrial                             |
| 2020 | M Baas          | BEng         | Electrical and Electronic              |

## A.2 Dean's Award for Outstanding Achievement

|      |            |     |                  |
|------|------------|-----|------------------|
| 1996 | DW Moolman | PhD | Process/Chemical |
| 2004 | M du Rand  | PhD | Process/Chemical |

## A.3 ECSA Merit Medal

|      |                           |                                        |
|------|---------------------------|----------------------------------------|
| 1982 | PJ de Bruyn               | Mechanical and Mechatronic, Industrial |
| 1984 | AF Conradie               | Mechanical and Mechatronic             |
| 1985 | GJJ van Zyl               | Electrical and Electronic              |
| 1986 | P Meyer                   | Electrical and Electronic              |
| 1987 | WD Rencken                | Electrical and Electronic              |
| 1988 | K van der Westhuizen      | Mechanical and Mechatronic             |
| 1989 | IP Theron                 | Electrical and Electronic              |
| 1990 | R de Villiers             | Electrical and Electronic              |
| 1991 | TR Niesler                | Electrical and Electronic              |
| 1992 | JC van Rooyen             | Electrical and Electronic              |
| 1993 | A van Zyl                 | Electrical and Electronic              |
| 1994 | SWJ Esterhuyse            | Mechanical and Mechatronic             |
| 1995 | LC Schwardt               | Electrical and Electronic              |
| 1996 | P Poolman                 | Civil                                  |
| 1997 | MO Vermeulen              | Mechanical and Mechatronic             |
| 1998 | CAW Vale                  | Electrical and Electronic              |
| 1999 | PleR Herselman            | Electrical and Electronic              |
| 2000 | T Stehmann                | Electrical and Electronic              |
| 2001 | C Barnardo                | Civil                                  |
| 2002 | T Sickel                  | Electrical and Electronic              |
| 2003 | P Joubert                 | Electrical and Electronic              |
| 2004 | DIL de Villiers           | Electrical and Electronic              |
| 2005 | C Dorfling                | Process/Chemical                       |
| 2006 | G Hardie                  | Electrical and Electronic              |
| 2007 | L Loots                   | Electrical and Electronic              |
| 2008 | R le Roux, P van der Spuy | Civil                                  |
| 2009 | H Kamper                  | Electrical and Electronic              |

|      |                    |                            |
|------|--------------------|----------------------------|
| 2010 | MH Volkmann        | Electrical and Electronic  |
| 2011 | HJ Gadinger        | Electrical and Electronic  |
| 2012 | W Burger           | Process/Chemical           |
| 2013 | RP Theart          | Electrical and Electronic  |
| 2014 | CB Roelofse        | Civil                      |
| 2015 | GT Hawkridge       | Mechanical and Mechatronic |
| 2016 | RM Swanepoel       | Process/Chemical           |
| 2017 | M Louw             | Industrial                 |
| 2018 | RM Viljoen         | Civil                      |
| 2019 | MPL Ribeiro        | Electrical and Electronic  |
| 2020 | MB Baas            | Electrical and Electronic  |
| 2021 | CD du Toit         | Electrical and Electronic  |
| 2022 | RJ McDougal        | Electrical and Electronic  |
| 2023 | SC Carstens        | Electrical and Electronic  |
| 2024 | Daniel Alwyn Gouws | Electrical and Electronic  |

## A.4 Engineering – Lecturer of the Year

|      |                          |                                                         |
|------|--------------------------|---------------------------------------------------------|
| 1992 | JB Uys                   | Applied Mathematics                                     |
| 1993 | J Rossouw                | Civil                                                   |
| 1994 | G Geldenhuys             | Applied Mathematics                                     |
| 1995 | A Rooseboom              | Civil                                                   |
| 1996 | JJ du Plessis            | Electrical and Electronic                               |
| 1996 | DG Kröger                | Mechanical and Mechatronic                              |
| 1997 | AH Basson                | Mechanical and Mechatronic                              |
| 1998 | E Terblanche             | Mechanical and Mechatronic                              |
| 1999 | L Lorenzen               | Process/Chemical                                        |
| 2000 | JB de Swardt             | Electrical and Electronic                               |
| 2001 | A Schoonwinkel           | Electrical and Electronic                               |
| 2002 | PJ Bakkes                | Electrical and Electronic                               |
| 2003 | JL van Niekerk           | Mechanical and Mechatronic                              |
| 2004 | PE Dunaiki<br>JH Knoetze | Civil<br>Process/Chemical                               |
| 2005 | TW von Backström         | Mechanical and Mechatronic                              |
| 2006 | J Bekker                 | Industrial                                              |
| 2007 | WJ Perold                | Electrical and Electronic                               |
| 2008 | MJ Kamper                | Electrical and Electronic                               |
| 2009 | CJ Bester                | Civil                                                   |
| 2011 | KD Palmer                | Electrical and Electronic                               |
| 2012 | GPAG van Zijl            | Civil                                                   |
| 2013 | MM Blanckenberg          | Electrical and Electronic                               |
| 2014 | HC Reader                | Electrical and Electronic                               |
| 2015 | AJ Burger<br>K Jenkins   | Process/Chemical<br>Civil                               |
| 2016 | SM Bradshaw              | Process/Chemical                                        |
| 2017 | CSL Schutte              | Industrial                                              |
| 2018 | WH Steyn<br>G Venter     | Electrical and Electronic<br>Mechanical and Mechatronic |
| 2019 | JH van Vuuren            | Industrial                                              |
| 2020 | RS Walls                 | Civil                                                   |
| 2021 | DC Blaine                | Mechanical and Mechatronic                              |
| 2022 | N Gule                   | Electrical and Electronic                               |
| 2023 | K Schreve                | Mechanical and Mechatronic                              |
| 2024 | JAA Engelbrecht          | Electrical and Electronic                               |
| 2025 | T Louw                   | Process/Chemical                                        |

## A.5 Engineering – Researcher of the Year

|      |                  |                            |
|------|------------------|----------------------------|
| 1987 | DG Kröger        | Mechanical and Mechatronic |
| 1988 | JH Cloete        | Electrical and Electronic  |
| 1989 | HJ Viljoen       | Process/Chemical           |
| 1990 | JSJ van Deventer | Process/Chemical           |
| 1991 | JP du Plessis    | Applied Mathematics        |
| 1992 | TW von Backström | Mechanical and Mechatronic |
| 1993 | JHR Enslin       | Electrical and Electronic  |
| 1994 | A Rooseboom      | Civil                      |
| 1995 | C Aldrich        | Process/Chemical           |
| 1995 | DB Davidson      | Electrical and Electronic  |
| 1996 | L Lorenzen       | Process/Chemical           |
| 1997 | WJ Perold        | Electrical and Electronic  |
| 1998 | DG Kröger        | Mechanical and Mechatronic |

## A.6 Engineering – Upcoming Researcher of the Year

|      |                           |                                                         |
|------|---------------------------|---------------------------------------------------------|
| 1999 | I Nieuwoudt               | Process/Chemical                                        |
| 1999 | P Meyer                   | Electrical and Electronic                               |
| 2000 | MJ Kamper                 | Electrical and Electronic                               |
| 2001 | C van Niekerk             | Electrical and Electronic                               |
| 2002 | JA van Vuuren             | Applied Mathematics                                     |
| 2003 | JJ Eksteen                | Process/Chemical                                        |
| 2004 | CJ Fourie                 | Electrical and Electronic                               |
| 2005 | C Scheffer                | Mechanical and Mechatronic                              |
| 2006 | JF Görgens                | Process/Chemical                                        |
| 2006 | GPAG van Zijl             | Civil                                                   |
| 2007 | M Botha                   | Electrical and Electronic                               |
| 2008 | MJ Kamper                 | Electrical and Electronic                               |
| 2009 | Y Kim                     | Mechanical and Mechatronic                              |
| 2011 | C Schwarz                 | Process/Chemical                                        |
| 2012 | D de Villiers             | Electrical and Electronic                               |
| 2013 | C Dorfling                | Process/Chemical                                        |
| 2014 | WP Boshoff                | Civil                                                   |
| 2015 | MJ Booysen<br>C Coetzee   | Electrical and Electronic<br>Mechanical and Mechatronic |
| 2016 | SJ van der Spuy           | Mechanical and Mechatronic                              |
| 2017 | NJ Goossen<br>RS Walls    | Process/Chemical<br>Civil                               |
| 2018 | TM Louw<br>WG Bam         | Process/Chemical<br>Industrial                          |
| 2019 | H Kamper<br>AFA Chimpango | Electrical and Electronic<br>Process/Chemical           |
| 2020 | R Combrinck               | Civil                                                   |
| 2021 | AJ Babafemi               | Civil                                                   |
| 2022 | R Pott                    | Process/Chemical                                        |
| 2023 | M Tadie                   | Process/Chemical                                        |
| 2024 | BI Ramatsetse             | Mechanical and Mechatronic                              |
| 2025 | J Cripwell                | Process/Chemical                                        |

## A.7 Engineering – Teaching Excellence Award

|      |                              |                                                |
|------|------------------------------|------------------------------------------------|
| 2017 | MM Bruwer<br>JC Bekker       | Civil<br>Electrical and Electronic             |
| 2018 | DC Blaine<br>L Auret         | Mechanical and Mechatronic<br>Process/Chemical |
| 2019 | RWM Pott<br>K Kruger         | Process/Chemical<br>Mechanical and Mechatronic |
| 2020 | TM Louw<br>M Venter          | Process/Chemical<br>Mechanical and Mechatronic |
| 2021 | MJ Booysen<br>E van Rensburg | Electrical and Electronic<br>Process/Chemical  |
| 2022 | H Kamper<br>AP van Wyk       | Electrical and Electronic<br>Process/Chemical  |
| 2023 | M Tadie<br>M Owen            | Process<br>Mechanical and Mechatronic          |
| 2024 | JF Bekker<br>M Neaves        | Industrial<br>Mechanical and Mechatronic       |
| 2025 | C McGregor<br>J Cripwell     | Mechanical and Mechatronic<br>Chemical         |

## A.8 Engineering – Exceptional Performance by Administrative and Technical staff

|      | Administrative                          | Technical                             |
|------|-----------------------------------------|---------------------------------------|
| 2021 | J Booysen                               | J Stanfliet                           |
| 2022 | M de Jager                              | J Kruger                              |
| 2023 | A de Wet<br>F Layman<br>M Oberholzer    | B Lindoor<br>K Neaves<br>A Petersen   |
| 2024 | A Layman<br>M Meyer<br>M Rust           | Q Hendrikse<br>P Petzer<br>F Zietsman |
| 2025 | A Engelbrecht<br>D Mentoer<br>D Mashigo | G Nel<br>C Samuels<br>E Williams      |

## A.9 Honorary Members of the Faculty

|      |                                                                                                           |
|------|-----------------------------------------------------------------------------------------------------------|
| 1998 | SA Grobbelaar<br>HB van der Walt<br>AJO van der Westhuizen                                                |
| 1999 | AC Britten<br>MP Cilliers<br>A Dippenaar                                                                  |
| 2001 | WJ Barnard<br>G Pretorius<br>J Rall<br>I Smit<br>C van der Merwe<br>D Wright                              |
| 2004 | R de Villiers<br>J Gosling<br>R Reinecke<br>PW van der Walt<br>HC Viljoen<br>F Hugo<br>P Uys<br>W Barnard |

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