



# University of Pretoria Yearbook 2021

## BEng Chemical Engineering ENGAGE (12136002)

**Department** Chemical Engineering

**Minimum duration of study** 5 years

**Total credits** 688

**NQF level** 08

### Programme information

**Please note:** The Engineering Augmented Degree Programme (ENGAGE) is an extended degree programme with a five-year curriculum. It is designed to enable students who show academic potential but who do not meet the normal entry requirements for the four-year degree programme, to obtain an Engineering degree. ENGAGE students spend the first three years of the programme covering the content of the first two years of the four-year degree programme. They also take compulsory augmented modules in each of the Level 1 subjects. These augmented modules provide students with background knowledge and skills needed to succeed in an engineering degree. The curriculum for years four and five of the ENGAGE programme are identical to the curriculum for years 3 and 4 of the 4-year programme, respectively. Students may apply directly for admission to the programme.

- Students must register for the entire programme, not components of it. The curriculum is fixed; there are no electives.
- Attendance at all components of years 1 to 3 of the programme is compulsory. Non-attendance will only be condoned in the case of illness (sick note required) or family crisis (e.g. a death in the family), in which case students must inform the programme administration immediately.
- Students who fail to meet the attendance requirement for any module in any semester of years 1 to 3 of the programme will be excluded from the programme.
- No augmented module may be repeated more than once.
- Selection into the programme will be based on a combination of performance in the National Senior Certificate examinations or equivalent and other selection tests approved by the faculty.
- A student who fails a mainstream module (e.g. Chemistry) but passes the associated augmented module (e.g. Additional chemistry) does not need to repeat the augmented module.
- A student who fails an augmented module (e.g. Additional chemistry) but passes the associated mainstream module (e.g. Chemistry) does not need to repeat the mainstream module.
- A student must meet the attendance requirement and obtain at least 40% for both the continuous assessment and test components as well as a final mark of 50% in order to pass an augmented module.
  - i. The curricula of the fourth and the fifth years of study are identical to those of the third and the fourth years of the four-year programme.
  - ii. JPO 110 is a prerequisite for JPO 120. Credit for JPO is obtained with a final mark of more than 50%.  
Conditional admission to JPO 120: If the final mark for JPO 110 is between 45% and 49%, a student can register for JPO 120 but credit for JPO 110 and JPO 120 will only be obtained if the final combined mark for JPO

110 and JPO 120 is above 50%.

**Please note:** All students will be required to successfully complete JCP 203, Community-based project 203, as part of the requirements for the BEng degree. A student may register for the module during any of the years of study of the programme, but preferably not during the first or the final year of study.

### **Learning outcomes of the BEng degree:**

A graduate in engineering should be able to apply the following skills on an advanced level:

- a. Engineering problem solving.
- b. Application of specialist and fundamental knowledge, with specific reference to mathematics, basic sciences and engineering sciences.
- c. Engineering design and synthesis.
- d. Investigation, experimentation and data analysis.
- e. Engineering methods, skills, tools and information technology.
- f. Professional and general communication.
- g. Awareness and knowledge of the impact of engineering activity on society and the physical environment.
- h. Work in teams and in multidisciplinary environments.
- i. An awareness and ability for lifelong learning.
- j. An awareness and knowledge of principles of professional ethics and practice.
- k. Awareness and knowledge of engineering management principles and economic decision-making.

### **Learning contents of the BEng programmes:**

Six essential knowledge areas are included in the syllabi of the programmes. The typical representation of each knowledge area as a percentage of the total contents of an undergraduate programme is given in brackets ( ) in the list below. This percentage varies for the different study directions, but conforms in all instances to the minimum knowledge area content as stipulated by ECSA.

Knowledge areas:

- a. Mathematics, including numerical methods and statistics (13%)
- b. Basic sciences: the natural sciences essential to the programme (15%)
- c. Engineering sciences (40%)
- d. Engineering design and synthesis (16%)
- e. Computing and information technology (5%)
- f. Complementary studies: communication, economy, management, innovation, environmental impact, ethics, engineering practice (11%).

## **Admission requirements**

- The closing date is an administrative admission guideline for non-selection programmes. Once a non-selection programme is full and has reached the institutional targets, then that programme will be closed for further admissions, irrespective of the closing date. However, if the institutional targets have not been met by the closing date, then that programme will remain open for admissions until the institutional targets are met.
- The following persons will be considered for admission: Candidates who are in possession of a certificate that is deemed by the University to be equivalent to the required National Senior Certificate (NSC) with university endorsement; candidates who are graduates from another tertiary institution or have been granted the status of a graduate of such an institution, and candidates who are graduates of another faculty at the University of Pretoria.
- Life Orientation is excluded when calculating the APS.

- Grade 11 results are used for the conditional admission of prospective students.
- A valid qualification with admission to degree studies is required.
- Minimum subject and achievement requirements, as set out below, are required.
- Conditional admission to the four-year programmes in the School of Engineering is guaranteed only if a prospective student complies with ALL the requirements as indicated in the table.
- Admission to ENGAGE in the School of Engineering will be determined by the NSC results, achievement levels of 5 for Mathematics and 5 for Physical Sciences, and an achievement level of 5 for English, together with an APS of 30.
- Students may apply directly to be considered for the ENGAGE programme.
- All lectures at the University of Pretoria are presented in English only.

**Note:** The Engineering Council of South Africa (ECSA) accredits our programmes and our degrees meet the requirements for Professional Engineers in SA.

### **Transferring students**

#### **Candidates previously registered for the BSc - Extended programme**

The Admissions Committee of the faculty considers applications of candidates who were previously registered for the BSc - Extended programme, on grounds of their NSC results as well as academic merit. Such students will only be considered for the four-year programme if they have passed all the prescribed modules and obtained a minimum of 65% in the Mathematics, Physics and Chemistry modules, respectively.

#### **Candidates previously registered at UP or at another university**

The faculty's Admissions Committee considers applications of candidates who have already completed the final NSC examination and/or were previously registered at UP or at another university, on grounds of their NSC results as well as academic merit. Candidates who were dismissed from other faculties or universities will not be considered.

#### **Candidates previously registered at a teacher's college or university of technology**

The faculty's Admissions Committee considers the application of these candidates on the grounds of their NSC results as well as academic merit.

### **Qualifications from countries other than South Africa**

- Citizens from countries other than South Africa and South African citizens with foreign qualifications must comply with all the other admission requirements and the prerequisites for subjects/modules.
- In addition to meeting the admission requirements, it may be expected from candidates to write the **TOEFL, IELTS or SAT**, if required.
- Candidates must have completed the National Senior Certificate with admission to degree studies or a certificate of conditional exemption on the basis of a candidate's foreign qualifications, the so-called "Immigrant" or "Foreign Conditional Exemption". The only condition for the "Foreign Conditional Exemption" that is accepted is: 'completion of the degree course'. The exemption certificate is obtainable from Universities South Africa (USAf). Detailed information is available on the website at [click here](#).

**University of Pretoria website:** [click here](#)

### **Minimum requirements**

#### **Achievement level**



**English Home  
Language or  
English First  
Additional  
Language**

**Mathematics**

**Physical Sciences**

**APS**

NSC/IEB	AS Level	NSC/IEB	AS Level	NSC/IEB	AS Level
5	C	5	C	5	C

**30**

\* Cambridge A level candidates who obtained at least a D in the required subjects, will be considered for admission. Students in the Cambridge system must offer both Physics AND Chemistry with performance at the level specified for NSC Physical Sciences in the table above.

\* International Baccalaureate (IB) HL candidates who obtained at least a 4 in the required subjects, will be considered for admission. Students in the IB system must offer both Physics AND Chemistry with performance at the level specified for NSC Physical Sciences in the table above.

## Promotion to next study year

### Promotion to the second semester of the first year and to the second year of study (Eng. 14)

- A new first-year student who has failed in all the prescribed modules of the programme at the end of the first semester, is excluded from studies in the School of Engineering. A student who is registered for the Engineering Augmented Degree Programme and has passed only 8 credits will also be excluded.
- A student who complies with all the requirements of the first year of study, is promoted to the second year of study.
- A student who has not passed at least 70% of the credits of the first year of study after the November examinations, must reapply for admission should he/she intend to proceed with his/her studies. Application on the prescribed form must be submitted to the Student Administration of the School of Engineering not later than 11 January. Late applications will be accepted only in exceptional circumstances after approval by the Dean. Should first-year students be readmitted, conditions of readmission will be determined by the Admissions Committee.
- Students who have not passed all the prescribed modules at first year level (level 100), as well as students who are readmitted in terms of Faculty Regulations must register for the outstanding first-year level (level-100) modules.
- A student who is repeating his or her first year, may, on recommendation of the relevant heads of department and with the approval of the Dean, be permitted to enroll for modules of the second-year of study in addition to the first-year modules which he or she failed, providing that he or she complies with the prerequisites for the second-year modules and no timetable clashes occur. Students on the ENGAGE programme may, following the same procedure, be permitted to enrol for level-200 modules in addition to the level-100 modules which he/she failed providing that he/she complies with the prerequisites for the modules at 200-level and no timetable clashes occur. On recommendation of the relevant head of department and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits which may be approved may not exceed the normal number of credits per semester by more than 16 credits.
- Students in Computer, Electrical and Electronic Engineering, who fail a first-year module for the second time, forfeit the privilege of registering for any modules of an advanced year of study.

### Please note:



- i. From the second year of study each student should be in possession of an approved calculator. It is assumed that each student will have easy access to a laptop computer.
- ii. Students who intend transferring to Mining Engineering, must familiarise themselves with the stipulations set out in the syllabi of PWP 121 Workshop practice 121.

**Promotion to the third year of study of the Four-year Programme, as well as to the third and the fourth years of study of the ENGAGE Programme. In case of the fourth year of study of the ENGAGE Programme, the words "first", "second" and "third" must be substituted with the words "second", "third" and "fourth" respectively. (Eng. 15)**

- a. A student who complies with all the requirements of the second year of study, is promoted to the third year of study.
- b. A student must pass all the prescribed modules at first year level (level 100) before he or she is admitted to any module at third year level (level 300).
- c. A student who is repeating his or her second year must register for all the second-year modules still outstanding. Such a student may, on recommendation of the relevant head of department and with the approval of the Dean, be permitted to enroll for modules of the third year of study in addition to the second-year modules which he or she failed, providing that he or she complies with the prerequisites for the third-year modules and no timetable clashes occur. On recommendation of the relevant head of department, and with special permission from the Dean, permission may be granted to exceed the prescribed number of credits. The total number of credits which may be approved may not exceed the normal number of credits per semester by more than 16 credits.
- d. Students in Computer, Electrical and Electronic Engineering who fail a second-year module for the second time forfeit the privilege of registering for any modules of the third year of study.
- e. Students who intend transferring to Mining Engineering must familiarise themselves with the stipulations set out in the syllabi of PWP 120 Workshop practice 120, as well as PPY 317 Practical training 317.

**Promotion to the fourth year of study of the Four-year Programme, as well as to the fifth year of study of the ENGAGE Programme. In case of the fifth year of study of the ENGAGE Programme, the words "second", "third" and "fourth" must be substituted with the words "third", "fourth" and "fifth" respectively. (Eng. 16)**

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



forfeit the privilege of registering for any modules of the fourth year of study.

## Pass with distinction

- a. A student graduates with distinction if:
  - i. no module of the third or fourth year of study of the four year programme or of the fourth or fifth year of the ENGAGE programme was repeated and a weighted average of at least 75% was obtained in one year in all the modules of the final year of study; and
  - ii. the degree programme was completed within the prescribed four years for the four year programme and within the prescribed five years of the ENGAGE programme.
- b. Exceptional cases to the above will be considered by the Dean.



## Curriculum: Year 1

Minimum credits: 128

### Fundamental modules

#### Academic orientation 112 (UPO 112)

<b>Module credits</b>	0.00
<b>NQF Level</b>	00
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Year

### Core modules

#### General chemistry 171 (CHM 171)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 discussion class per week, 1 practical per week, 1 web-based period per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemistry
<b>Period of presentation</b>	Semester 1

#### Module content

General introduction to inorganic, analytical and physical chemistry. Nomenclature of inorganic ions and compounds, stoichiometric calculations concerning chemical reactions, redox reactions, solubilities and solutions, atomic structure, periodicity. Molecular structure and chemical bonding using the VSEPR model. Principles of reactivity, electrochemistry, energy and chemical reactions, entropy and free energy. Appropriate tutorial classes and practicals.

#### Physics 176 (FSK 176)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 discussion class per week, 1 practical per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English



**Department** Physics

**Period of presentation** Semester 2

### Module content

Introductory mathematics: Symbols, exponents, logarithms, angles in degrees, radial measure, goniometry, differentiation, and integration. Motion along a straight line: position and displacement, acceleration. Vectors: adding vectors, components, multiplying vectors. Motion in two and three dimensions: projectile motion, circular motion. Force and motion: Newton's Law, force, friction. Kinetic energy and work: work, power. Potential energy: Centre of mass, linear momentum. Collisions: impulse and linear momentum, elastic collisions, inelastic collisions. Rotation: kinetic energy of rotation, torque. Oscillations and waves: Simple harmonic motion, types of waves, wavelength and frequency, interference of waves, standing waves, the Doppler effect. Temperature, heat and the first law of thermodynamics.

## Humanities and social sciences 110 (HAS 110)

**Module credits** 8.00

**NQF Level** 05

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Anthropology and Archaeology

**Period of presentation** Semester 1

### Module content

Social sciences: Perspectives on contemporary society

An introduction to long-standing questions about the nature of human societies and contemporary challenges. Topics to be discussed include globalisation and increasing connectedness; rising unemployment, inequality and poverty; rapid urbanisation and the modern city form; transformations in the nature of work; environmental degradation and tensions between sustainability and growth; shifts in global power relations; the future of the nation-state and supra-national governance structures; and possibilities for extending human rights and democracy. Critical questions are posed about modern selfhood, sociality, culture and identity against the background of new communications technologies, ever more multicultural societies, enduring gender, class and race inequities, and the emergence of new and the resurgence of older forms of social and political identity. These issues are approached from the vantage of our location in southern Africa and the continent, drawing on social science perspectives.

## Humanities and social sciences 120 (HAS 120)

**Module credits** 8.00

**NQF Level** 05

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** No prerequisites.





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<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Afrikaans
<b>Period of presentation</b>	Semester 2

### Module content

Humanities: Text, culture and communication

Successful communication of ideas, values and traditions depends on understanding both the literal and implied meanings of texts. In this module students are introduced to a variety of texts, including original literary and visual texts, with a view to developing an understanding of how textual meanings have been constructed and negotiated over time. Students are encouraged to understand themselves as products of – and participants in – these traditions, ideas and values. Appropriate examples will be drawn from, among others, the Enlightenment, Modernism, Existentialism, Postmodernism and Post-colonialism.

### Professional orientation 110 (JPO 110)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	3 lectures per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 1

### Module content

A project-based approach is followed to equip students with academic and IT skills to succeed within the School of Engineering at UP.

### Additional chemistry 1 111 (JPO 111)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 1

### Module content

Background knowledge, problem-solving skills, conceptual understanding and chemical reasoning skills required by CHM 171/172.



### Additional mathematics 1 116 (JPO 116)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 1

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 158.

### Professional orientation 120 (JPO 120)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	A mark of between 45% and 49% for JPO 110.
<b>Contact time</b>	3 lectures per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 2

#### Module content

A project-based approach is followed to equip students with academic and IT skills to succeed within the School of Engineering at UP.

### Additional physics 122 (JPO 122)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 2

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and physical reasoning skills required by FSK 116/176.



## Additional mathematics 2 126 (JPO 126)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 2

### Module content

Background knowledge, problem-solving skills, conceptual understanding and mathematical reasoning skills required by WTW 164.

## Calculus 158 (WTW 158)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	60% for Mathematics in Grade 12
<b>Contact time</b>	1 tutorial per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 1

### Module content

\*This module is designed for first-year engineering students. Students will not be credited for more than one of the following modules for their degree: WTW 158, WTW 114, WTW 134, WTW 165.

Introduction to vector algebra. Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Indefinite integrals, integration.

## Mathematics 164 (WTW 164)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	WTW 114 or WTW 158
<b>Contact time</b>	1 tutorial per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mathematics and Applied Mathematics



**Period of presentation** Semester 2

**Module content**

\*This module is designed for first-year engineering students. Students will not be credited for more than one of the following modules for their degree: WTW 146, WTW 148 and WTW 124,

Vector algebra with applications to lines and planes in space, matrix algebra, systems of linear equations, determinants, complex numbers, factorisation of polynomials and conic sections. Integration techniques, improper integrals. The definite integral, fundamental theorem of Calculus. Applications of integration. Elementary power series and Taylor's theorem. Vector functions, space curves and arc lengths. Quadratic surfaces and multivariable functions.

**Workshop practice 121 (WWP 121)**

**Module credits** 6.00

**NQF Level** 05

**Prerequisites** No prerequisites.

**Contact time** 1 other contact session per week

**Language of tuition** Module is presented in English

**Department** Mechanical and Aeronautical Engineering

**Period of presentation** Semester 2

**Module content**

\*Attendance module only

The module is offered at the end of the first year of study and lasts at least eight days, during which training is given in the following workshops: electronic projects, panel wiring, electrical motors and switch gear, general machines, welding, turning and sheet metal work. Each student's progress is assessed after each workshop.



## Curriculum: Year 2

Minimum credits: 136

### Core modules

#### General chemistry 181 (CHM 181)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	CHM 171
<b>Contact time</b>	1 discussion class per week, 1 practical per week, 1 web-based period per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemistry
<b>Period of presentation</b>	Semester 2

#### Module content

One quarter general physical-analytical chemistry: Physical behaviour of gases, intermolecular forces, solutions, liquids and solids (phase changes), chemical equilibrium, acids and bases, applications of aqueous equilibria (e.g. buffers, titrations, solubility) precipitation. One quarter organic chemistry: Structure and bonding, functional groups and drawing of structures of organic compounds, nomenclature, isomerism, introductory stereochemistry, introduction to chemical reactions and chemical properties of organic compounds. Appropriate tutorial classes and practicals. Quality theoretical and practical teaching with an ethical approach provides a broad understanding of fundamental chemistry, e.g. predicting the behaviour of specific functional groups present in organic compounds, essential for new drug development, purification of mixtures and proper waste management to protect the environment and ultimately human and animal life, thereby meeting some of the UN sustainable development goals.

#### Chemical engineering 113 (CIR 113)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	Admission to relevant programme.
<b>Contact time</b>	2 lectures per week, 2 tutorials per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1



## Module content

Dimensions, units and their conversion. The mol unit, density, concentration. Specific volume, bulk density, density of ideal mixtures. Temperatures and conversions. Pressure, absolute and gauge. Expression of concentration. Empirical formulae. Introduction to material balances: strategy for solving problems. Material balances without chemical reaction. Combinations of equipment.

## Chemical engineering 123 (CIR 123)

**Module credits** 8.00

**NQF Level** 05

**Prerequisites** CIR 113 GS, CHM 171 GS

**Contact time** 2 lectures per week, 2 tutorials per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 2

## Module content

Chemical reaction and stoichiometry, excess reactant, conversion, yield, selectivity. Material balances with recycle streams, bypass streams and purge streams. Gases, vapours and liquids: ideal gas law, SG and density of gases, Nm<sup>3</sup>. Material balances where gases are involved. Fuels and combustion: coal analysis, combustion calculations.

## Electricity and electronics 111 (EBN 111)

**Module credits** 16.00

**NQF Level** 05

**Prerequisites** Admission to relevant programme.

**Contact time** 1 practical per week, 1 tutorial per week, 3 lectures per week

**Language of tuition** Module is presented in English

**Department** Electrical, Electronic and Computer Engineering

**Period of presentation** Semester 1

## Module content

Electrical quantities, units, definitions, conventions. Electrical symbols, ideal and practical current and voltage sources, controlled sources. Ohm's law in resistive circuits, Kirchoff's current and voltage laws, resistors in series and parallel circuits, voltage and current division, mesh current and node voltage methods. Circuit theorems: Linearity, superposition, Thevenin and Norton equivalent circuits, sources transformation, power calculation, maximum power transfer. Energy storage elements: current, voltage, power and energy in inductors and capacitors, inductors and capacitors in series and parallel. Ideal operational amplifiers and applications: inverting and noninverting amplifiers, summing amplifiers, current sources, integrators.

## Community-based project 203 (JCP 203)

**Module credits** 8.00



<b>NQF Level</b>	06
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Informatics
<b>Period of presentation</b>	Year

### Module content

This module is integrated into all undergraduate academic programmes offered by the Faculty. Main objectives: execution of a community project aimed at achieving a beneficial impact on a section of a socio-economically underprivileged community located in socio-economically deprived areas our society; awareness of personal, social and cultural values and an understanding of social issues; and development of life skills.

## Additional electricity and electronics 112 (JPO 112)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 1

### Module content

Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by EBN 111/122.

## Additional graphical communication 113 (JPO 113)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	School of Engineering
<b>Period of presentation</b>	Semester 1

### Module content

Background knowledge, conceptual understanding, drawing skills and reasoning skills required by MGC 110.

## Additional chemistry 2 121 (JPO 121)



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<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	School of Engineering
<b>Period of presentation</b>	Semester 2

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and chemical reasoning skills required by CHM 181.

### Additional mechanics 125 (JPO 125)

<b>Module credits</b>	8.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	1 lecture per week, 3 tutorials per week, Foundation Course
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	EBIT Deans Office
<b>Period of presentation</b>	Semester 2

#### Module content

Background knowledge, problem-solving skills, conceptual understanding and reasoning skills required by SWK 122.

### Graphical communication 110 (MGC 110)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Prerequisites</b>	Admission to relevant programme.
<b>Contact time</b>	3 lectures per week, 3 tutorials per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mechanical and Aeronautical Engineering
<b>Period of presentation</b>	Semester 1





## Module content

Freehand sketching covering the following: perspective, isometric and orthographic drawings. Drawing conventions, graphical techniques and assembly drawings. Evaluation of drawings and error detection. True lengths of lines, projections and intersections. Practical applications of these techniques. Introduction to computer-aided drawings, including dimensioning, crosshatching and detailing. Introduction to basic manufacturing processes including primary (casting, forging and extrusion) and secondary (drilling, turning, milling, grinding, broaching and sawing) manufacturing procedures.

## Statics 122 (SWK 122)

<b>Module credits</b>	16.00
<b>NQF Level</b>	05
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	WTW 158
<b>Contact time</b>	2 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Civil Engineering
<b>Period of presentation</b>	Semester 2

## Module content

Equivalent force systems, resultants. Newton's laws, units. Forces acting on particles. Rigid bodies: principle of transmissibility, resultant of parallel forces. Vector moments and scalar moments. Relationship between scalar and vector moments. Couples. Equivalent force systems on rigid bodies. Resultants of forces on rigid bodies. Equilibrium in two and three dimensions. Hooke's law. Trusses and frameworks. Centroids and second moments of area. Beams: distributed forces, shear force, bending moment, method of sections, relationship between load, shear force and bending moment.

## Calculus 258 (WTW 258)

<b>Module credits</b>	8.00
<b>NQF Level</b>	06
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	WTW 158 and WTW 164
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 1

## Module content

Calculus of multivariable functions, directional derivatives. Extrema. Multiple integrals, polar, cylindrical and spherical coordinates. Line integrals and the theorem of Green. Surface integrals and the theorems of Gauss and Stokes.



## Numerical methods 263 (WTW 263)

<b>Module credits</b>	8.00
<b>NQF Level</b>	06
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	WTW 164
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 2

### Module content

Numerical integration. Numerical methods to approximate the solution of non-linear equations, systems of equations (linear and non-linear), differential equations and systems of differential equations. Direct methods to solve linear systems of equations.



## Curriculum: Year 3

Minimum credits: 138

### Core modules

#### Engineering statistics 220 (BES 220)

<b>Module credits</b>	8.00
<b>NQF Level</b>	06
<b>Prerequisites</b>	WTW 158 GS, WTW 164 GS
<b>Contact time</b>	3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Industrial and Systems Engineering
<b>Period of presentation</b>	Semester 2

#### Module content

Engineering systems are often subjected to variation, uncertainty and incomplete information. Mathematical statistics provides the basis for effectively handling and quantifying the effect of these factors. This module provides an introduction to the concepts of mathematical statistics and will include the following syllabus themes: data analysis, probability theory, stochastic modelling, statistical inference and regression analysis.

#### Chemistry 215 (CHM 215)

<b>Module credits</b>	12.00
<b>NQF Level</b>	06
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	CHM 171 or CHM 172 and CHM 181
<b>Contact time</b>	1 practical per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemistry
<b>Period of presentation</b>	Semester 1

#### Module content

Organic chemistry. Chemical properties of organic (including aromatic) compounds. Functional group transformation and synthesis.

#### Chemistry 226 (CHM 226)

<b>Module credits</b>	8.00
<b>NQF Level</b>	06
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	CHM 171 or CHM 172 and CHM 181



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<b>Contact time</b>	2 lectures per week, 6 ppw
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemistry
<b>Period of presentation</b>	Semester 2

#### Module content

Theory: Introduction to instrumental chemical analysis. Integration of electronic, chemical, optical and computer principles for the construction of analytical instrumentation. Detail discussion of principles and some instrumental methods from three disciplines within analytical chemistry, namely electrochemistry, spectroscopy and chromatography. This includes potentiometry, (AA) atomic absorption-, (ICP) atomic emission-, ultraviolet (UV)-, and infrared (IR) spectroscopy, potentiometric and photometric titrations, gas chromatography, liquid chromatography as well as combinations of these techniques. Practical: IR spectroscopy, UV spectroscopy, AA spectroscopy, potentiometric titration, gas chromatography.

### Chemical engineering materials 210 (CIM 210)

<b>Module credits</b>	8.00
<b>NQF Level</b>	06
<b>Prerequisites</b>	CHM 181
<b>Contact time</b>	2 lectures per week, 2 tutorials per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Introduction to the synthesis, processing, structure, physical properties, and technical performance of important engineering materials: metals, ceramics, polymers and composites. Structural, mechanical, thermodynamic, and design related issues important to chemical engineering applications. Materials specification with emphasis on the corrosion of metals and life time estimation for polymer components.

### Chemical engineering 211 (CIR 211)

<b>Module credits</b>	12.00
<b>NQF Level</b>	06
<b>Prerequisites</b>	CIR 123
<b>Contact time</b>	3 lectures per week, 3 tutorials per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1



## Module content

Vapour pressure, phase changes, equilibrium. Vapour/gas equilibrium; Henry's law. Enthalpy and enthalpy balances. Heat of reaction. Data and data sources, steam tables. Enthalpy and combustion; flame temperature. Heats of solution and mixing. Miscible and immiscible liquid mixtures; dew point, bubble point. Simultaneous mass and enthalpy balances. PVT properties of real gases, PVT-diagrams of pure compounds. Vapour liquid equilibrium for ideal mixtures (Raoult's law).

## Thermodynamics 223 (CTD 223)

<b>Module credits</b>	16.00
<b>NQF Level</b>	06
<b>Prerequisites</b>	CIR 211, MPR 212/213, (WTW 258)
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 2

## Module content

Simple applications of the first and second laws of thermodynamics. The concepts of work, heat, enthalpy and entropy. The calculation of internal energy, enthalpy and entropy using the equations of state. Simple heat engine cycles. Refrigeration and gas liquefaction. Process efficiency by means of energy. Introduction to non-ideality in VLE and mixing behaviour.

## Electrical engineering 221 (EIR 221)

<b>Module credits</b>	16.00
<b>NQF Level</b>	06
<b>Prerequisites</b>	EBN 111 or EBN 122 and WTW 161/164
<b>Contact time</b>	1 practical per week, 1 tutorial per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Electrical, Electronic and Computer Engineering
<b>Period of presentation</b>	Semester 2

## Module content

Transient response phenomena in RC, RL and RLC circuits: Natural response and step response. Alternating current (AC) circuits: Phasors, impedances, and power in AC circuits. The application of Ohm's law, Kirchoff's circuit theorems, matrix methods, and Thevenin and Norton equivalents to sinusoidal steady-state analysis. Three-phase circuits: Balanced three-phase circuits, star/delta configurations, and three-phase power transfer calculations. Magnetically coupled circuits: Mutual inductance, coupling factor, transformers, ideal transformers and autotransformers. Application of circuit theory to induction motors: basic principles of induction motors, equivalent circuit and analysis thereof, calculation of power and torque through application of Thevenin's theorem. Synoptic introduction to other types of motors.



## Programming and information technology 213 (MPR 213)

<b>Module credits</b>	16.00
<b>NQF Level</b>	06
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 practicals per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mechanical and Aeronautical Engineering
<b>Period of presentation</b>	Semester 1

### Module content

Spreadsheet applications: Formulas and calculations, named ranges, plotting and trend lines, goal seek, linear programming, importing and exporting data, data navigation and filtering. Programming fundamentals: Names and objects, conditional and unconditional looping, branching, functions, modules, packages, reading and writing data files, graphical output (plotting). Solving simple problems using a high level programming language to develop, code and debug programs. Solving complex problems by breaking it down into a number of simple problems using concepts such as functions, modules and available packages. Programming principles are developed through solving mathematics and physics problems.

## Strength of materials 210 (SWK 210)

<b>Module credits</b>	16.00
<b>NQF Level</b>	06
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	Faculty of Engineering, Built Environment and Information Technology: SWK 122 and WTW 164 OR SWK 122, WTW 161 and WTW 168. Faculty of Natural and Agricultural Sciences: SWK 122 and WTW 124 OR SWK 122, WTW 126 and WTW 128.
<b>Contact time</b>	2 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Civil Engineering
<b>Period of presentation</b>	Semester 1



## Module content

Stresses, strains and the mechanical properties of materials: Normal stress and shear stress, tension and compression, equilibrium in shear, factor of safety, design, shear strain, stress/strain diagram, Hooke's Law, Poisson's Ratio and the shear stress/strain diagram. Axial loads: Elastic deformation, displacements, statically determinate and indeterminate structures and thermal effects. Torsion: Torsion of circular bars and power transmission bending of straight members and composite beams. Transverse shear: Shear in straight members and shear flow. Combined loads: Thin walled pressure vessels and stresses as a result of combined loads. Stress transformation: Plane stress transformation, principle stresses, maximum values and stress variation in prismatic beams. Strain transformation: Plane strain transformation, principle strains, maximum values, strain gauges and rosettes and the relationship between  $E$ ,  $G$  and  $\mu$ . Design of beams from section characteristics. Deflection of beams: The elastic curve, integration method, Macaulay's method and superposition.

## Mathematics 238 (WTW 238)

**Module credits** 16.00

**NQF Level** 06

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** WTW 256 and WTW 258 GS

**Contact time** 1 tutorial per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 2

## Module content

Linear algebra, eigenvalues and eigenvectors with applications to first and second order systems of differential equations. Sequences and series, convergence tests. Power series with applications to ordinary differential equations with variable coefficients. Fourier series with applications to partial differential equations such as potential, heat and wave equations.

## Differential equations 256 (WTW 256)

**Module credits** 8.00

**NQF Level** 06

**Service modules** Faculty of Engineering, Built Environment and Information Technology

**Prerequisites** WTW 158 and WTW 164

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Mathematics and Applied Mathematics

**Period of presentation** Semester 1



## **Module content**

Theory and solution methods for linear differential equations as well as for systems of linear differential equations. Theory and solution methods for first order non-linear differential equations. The Laplace transform with application to differential equations. Application of differential equations to modelling problems.





## Curriculum: Year 4

Minimum credits: 144

### Core modules

#### Engineering management 310 (BSS 310)

<b>Module credits</b>	8.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Industrial and Systems Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

The purpose of this module is to develop knowledge and understanding of engineering management principles and economic decision-making so that students can design, manage, evaluate and participate in engineering projects in the workplace. As such elements from engineering economics, project management and systems engineering are combined.

This module develops and assesses the students' competence in terms of ECSA Exit Level Outcome 11 relating to Engineering Management.

#### Biochemical engineering 310 (CBI 310)

<b>Module credits</b>	16.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	(CIR 211), (CHM 215) ,(WTW 256), MPR 213
<b>Contact time</b>	3 practicals per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Characterisation and taxonomy of biological material. Biochemistry and the chemistry of life. Biological growth requirements, metabolism, growth kinetics and product formation. Enzyme chemistry and kinetics, basic stoichiometry of biological reactions as well as mass - and energy balances for these processes using a chemical engineering approach. Biological reactor, operation and downstream processing.

#### Chemical engineering design 320 (CIO 320)

<b>Module credits</b>	16.00
<b>NQF Level</b>	07



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<b>Prerequisites</b>	(CTD 223), SWK 210, COP 311 GS
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 2

#### Module content

Steady and unsteady state conductive heat transfer in one to three dimensions. Temperature distributions. Convective heat transfer. Application of boundary layer theory. Determination of film coefficients. Design of heat transfer equipment. Radiant heat transfer. Application of the mechanical energy balance to single phase Newtonian fluids in steady state systems. Adjustment for multiphase, non-Newtonian as well as pulsating systems. Orifice design. Optimal economic choice of pipe diameters, pumps and control valves.

### Chemical engineering 310 (CIR 310)

<b>Module credits</b>	8.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	(CTD 223), CHM 215
<b>Contact time</b>	2 lectures per week, 2 tutorials per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Fundamentals of phase and chemical equilibrium with emphasis on vapour/liquid systems leading to the study of separations and reacting systems. Concepts and formalism of thermodynamics. Postulates and laws of thermodynamics. Thermodynamic functions (enthalpy, entropy, Gibbs free energy). Thermochemistry and Ellingham diagrams. Phase Equilibria: Phase diagrams of single substances, phase boundaries, the Phase Rule. Phase diagrams of mixtures, steam distillation, eutectic mixtures. Solution thermodynamics: Ideal and non-ideal solutions, excess properties and activity coefficient models. The equations of state of ideal and real gases, residual properties and fugacity. Vapour-liquid equilibrium from equations of state and the approach. Application of thermodynamics to equilibrium between fluid- (gas and liquid) and condensed (liquid and solid) phases. Chemical reaction equilibrium.

### Professional and technical communication 310 (CJJ 310)

<b>Module credits</b>	8.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	CIR 123
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering

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**Period of presentation** Semester 1

### Module content

Effective communication with engineering and technical audiences, as well as with the community at large, is taught. The emphasis is on written documentation. Formal communication is characterised by: the use of appropriate language and style; effective structuring of information; the use of modern electronic communication technologies, with emphasis on word processing, spreadsheets, appropriate email protocols, effective use of graphic information, effective and correct presentation of numerical data, correct referencing methods, seamless inclusion of mathematics expressions, tables, diagrams and appendices in written work; appropriate methods for levelling communication to the requirements of the target audience.

### Kinetics 321 (CKN 321)

**Module credits** 16.00

**NQF Level** 07

**Prerequisites** (CTD 223)

**Contact time** 3 tutorials per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 2

### Module content

Batch reactors; basic reaction kinetics; fitting of experimental reaction data; flow reactor basics.

### Laboratory 321 (CLB 321)

**Module credits** 16.00

**NQF Level** 07

**Prerequisites** CJJ 310/CJJ 210, CHM 226, CPN 321#, CKN 321#, (CMO 310), CIO 320#

**Contact time** 2 lectures per week, 8 practicals per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 2

### Module content

Laboratory safety and general industrial safety practices. Techniques for planning of experiments. Experimental work illustrating: Analysis: Composition of coal and gas, heat of combustion, viscosity. Mass transfer: Gas absorption, batch distillation, azeotropic distillation, fractional distillation and liquid-liquid extraction. Heat transfer: Condenser, shell and tube heat exchanger, heat loss from insulated pipes. Piping system design: Frictional energy loss through pipes and fittings. Measuring equipment: Rate of flow, temperature. Reporting of laboratory results.

### Mass transfer 310 (CMO 310)



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<b>Module credits</b>	16.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	(CTD 223), COP 311#
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Separation by means of equilibrium stages. Design of flash distillation systems, distillation columns, absorbers and strippers by hand and computer calculations. Design of membrane separation systems.

### Transfer processes 311 (COP 311)

<b>Module credits</b>	16.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	WTW 238, (WTW 263)
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Momentum transfer. Fluid statics. Control volume approach for conservation of mass, energy, and momentum. Application to pumps and turbines. Navier-Stokes equations, derivation and applications. Laminar and turbulent boundary layer theory. Heat transfer: fundamentals of heat transfer. Differential equations of heat transfer. Steady state conduction. Introduction to unsteady state conduction. Convection heat transfer and the thermal boundary layer. Radiation heat transfer. Mass transfer: fundamentals of mass transfer. Diffusion and the diffusion coefficient. Differential equations of mass transfer. Steady state molecular diffusion in one or more dimensions.

### Process dynamics 321 (CPN 321)

<b>Module credits</b>	16.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	CIO 310#, CKN 321#
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 2



## Module content

Application of the continuity equations, transport equations and phase relationships to describe time-dependent behaviour of processes. Linearisation and use of transfer functions. Stability analysis, effect of dead time and inverse response. Elements of a control loop. Control principles and mechanisms.

### Practical training 311 (CPY 311)

<b>Module credits</b>	16.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	(CIR 211)
<b>Contact time</b>	1 other contact session per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

## Module content

\*Attendance module only

At the end of the second year of study, students in Chemical Engineering undergo at least six weeks of prescribed practical training in the industry. The student must also attend all excursions organised during the year by the department. A satisfactory report on the practical training must be submitted to the Faculty Administration within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the Chairman of the School of Engineering.

### Engineering activity and group work 320 (MIA 320)

<b>Module credits</b>	8.00
<b>NQF Level</b>	07
<b>Prerequisites</b>	(CJJ 310) or (EJJ 210) or (BJJ 210) or (MJJ 210) or (NJJ 210) or (PJJ 210)
<b>Contact time</b>	1 other contact session per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Mechanical and Aeronautical Engineering
<b>Period of presentation</b>	Semester 2



## Module content

Two exit learning outcomes (ELO) of ECSA are addressed and each must be passed in the same semester. ELO7: Demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment. The history of engineering globally and in South Africa. Most important engineering projects globally and in South Africa. The impact of technology on society. Occupational and public health and safety. Occupational Health and Safety Act. Impacts on the physical environment. The personal, social, cultural values and requirements of those affected by engineering activity. The combination of social, workplace (industrial) and physical environmental factors are appropriate to the discipline of the qualification. ELO8: Demonstrate competence to work effectively on a small project as an individual, in teams and in multidisciplinary environments. Identifies and focuses on objectives. Works strategically. Executes tasks effectively. Delivers completed work on time. Effective team work: Makes individual contribution to team activity; performs critical functions; enhances work of fellow team members; benefits from support of team members; communicates effectively with team members; delivers completed work on time. Multidisciplinary work by the following: Acquires a working knowledge of co-workers' discipline; uses a systems engineering approach; communicates across disciplinary boundaries. Report and presentation on team project. Tasks require co-operation across at least one disciplinary boundary. Students acquire a working knowledge of co-workers discipline. Students communicate between disciplinary boundaries.



## Curriculum: Final year

Minimum credits: 144

### Core modules

#### Particle technology 410 (CPA 410)

<b>Module credits</b>	16.00
<b>NQF Level</b>	08
<b>Prerequisites</b>	(COP 311)
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Humidification and dehumidification of air. Water cooling, drying, crystallisation, ion exchange, particle technology, particle movement in a fluid, sedimentation. Hydrocyclones, flotation, filtration. Centrifuges. Fluidised bed technology. Mixing. Comminution. Pneumatic transport.

#### Process control 410 (CPB 410)

<b>Module credits</b>	16.00
<b>NQF Level</b>	08
<b>Prerequisites</b>	CPN 321 GS
<b>Contact time</b>	3 tutorials per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1

#### Module content

Dynamic properties of equipment, instruments and processes. Mathematical modelling and computer simulation of processes in the time, Laplace and frequency domains. Linearisation and non-linear processes. Stability of control systems. Controller tuning. Methods for process identification. Digital process control. Z-transforms. Use of computers and microprocessors. Introduction to modern control theory: state-space approach. Applied process control. Choice of control instrumentation. Plantwide control strategy. Development of P and ID's.

#### Design project 421 (CPJ 421)

<b>Module credits</b>	24.00
<b>NQF Level</b>	08
<b>Prerequisites</b>	(CPB 410), (CRO 410), BIE 310/BSS 310, CIO 320, CPS 420#, CPR 420#



<b>Contact time</b>	1 tutorial per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 2

#### Module content

Application of chemical engineering principles for the complete design of a chemical plant.

### Chemical engineering practice 420 (CPR 420)

<b>Module credits</b>	8.00
<b>NQF Level</b>	08
<b>Prerequisites</b>	CLB 321, CPJ 421#
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 2

#### Module content

Design economics and process evaluation. Cost estimation and time-value of money. Control applications, choice of instrumentation and development of a plantwide control strategy. Development of P&ID's. Safety: Site plan and layout, area classification, hazard and operability analysis (HAZOP). Occupational Safety and Health Act, Engineering Profession of South Africa Act. Requirements to maintain continued competence and to keep abreast of up-to date tools and techniques. ECSA code of conduct, Continuing Professional Development, ECSA outcomes, ECSA process and reasons for registration as PrEng. Displays understanding of the system of professional development. Accepts responsibility for own actions. Displays judgment in decision making during problem solving and design. Limits decision making to area of current competence. Reason about and make judgment on ethical aspects in case study context. Discerns boundaries of competence in problem solving and design. Case studies typical of engineering practice situations in which the graduate is likely to participate.

### Process synthesis 410 (CPS 410)

<b>Module credits</b>	8.00
<b>NQF Level</b>	08
<b>Prerequisites</b>	CLB 321, CIR 310 GS
<b>Contact time</b>	1 tutorial per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Chemical Engineering
<b>Period of presentation</b>	Semester 1





### Module content

Development of new processing plants; Evaluating process alternatives; Developing a process flowsheet using a process synthesis approach. Applying thermodynamic principles to obtain an optimal synthesis route. Applications using computer packages.

### Process analysis 420 (CPS 420)

**Module credits** 8.00

**NQF Level** 08

**Prerequisites** CPS 410

**Contact time** 1 tutorial per week, 2 lectures per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 2

### Module content

Pinch analysis and exergy analysis. Optimisation techniques. Flowsheet optimisation. Economic evaluation of processes. Applications using computer packages.

### Practical training 411 (CPY 411)

**Module credits** 16.00

**NQF Level** 08

**Prerequisites** (CMO 320), CPY 311

**Contact time** 1 other contact session per week

**Language of tuition** Separate classes for Afrikaans and English

**Department** Chemical Engineering

**Period of presentation** Semester 1

### Module content

\*Attendance module only

At the end of the third year of study, students in chemical engineering undergo at least six weeks of prescribed practical training in the industry. The student must also attend all excursions organised during the year by the department. A satisfactory report on the practical training must be submitted to the department within one week of registration. In exceptional circumstances the prescribed minimum period can be reduced, as approved by the chairman of the School of Engineering.

### Reactor design 410 (CRO 410)

**Module credits** 16.00

**NQF Level** 08

**Prerequisites** CKN 321 GS



**Contact time** 3 tutorials per week, 4 lectures per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 1

#### Module content

Heterogeneous catalysis: diffusion in reaction for catalyst pores and different catalyst geometries. Inter and intraparticle heat and mass transfer processes. Reactor design: energy and continuity equation for different types of reactor: stirred tank, pipe, radial flow, slurry and fluidised. Modelling of non-ideal flow in reactors.

### Research project 411 (CSC 411)

**Module credits** 16.00

**NQF Level** 08

**Prerequisites** CLB 321, CPB 410 # and CRO 410 #

**Contact time** 1 tutorial per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 1

#### Module content

The execution of a complete literature study and research project on a chosen subject.

### Research project 421 (CSC 421)

**Module credits** 16.00

**NQF Level** 08

**Prerequisites** CSC 411

**Contact time** 1 tutorial per week

**Language of tuition** Module is presented in English

**Department** Chemical Engineering

**Period of presentation** Semester 2

#### Module content

Interpretation of the research results of CSC 411. The writing of a project report and scientific article.

### Specialisation 420 (CSS 420)

**Module credits** 16.00

**NQF Level** 08

**Prerequisites** CPJ 421#

**Contact time** 4 lectures per week



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**Language of tuition**      Module is presented in English

**Department**              Chemical Engineering

**Period of presentation**    Semester 2

**Module content**

A module to be selected from the list of available specialisation topics, including Process Control, Chemical Product Design, Environmental Engineering, Nuclear Engineering, Polymer Processing, Reactor Design, and Water Utilisation Engineering.

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