University of Pretoria Yearbook 2023

BEng (Chemical Engineering) (12130002)

Department	Chemical Engineering
Minimum duration of study	4 years
Total credits	611
NQF level	08

Programme information

All fields of study of the BEng degree have been accredited by the Engineering Council of South Africa (ECSA), and comply with the academic requirements for registration as a professional engineer. The programmes are designed in accordance with the outcomes-based model as required by the South African Qualifications Authority (SAQA). The learning outcomes and contents of the programmes have been compiled in accordance with the latest accreditation standards (PE-60 and PE-61) of ECSA, which also comply with the SAQA requirements, and which are summarised as follows:

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

Important information for all prospective students for 2023

The admission requirements below apply to all who apply for admission to the University of Pretoria with a **National Senior Certificate (NSC) and Independent Examination Board (IEB) qualifications. Click here for this Faculty Brochure.**

Minimum requirements: 4-year programme			
Achievement level English Home Language or English First Additional Language	**Mathematics**	**Physical Sciences**	**APS**
NSC/IEB	NSC/IEB	NSC/IEB	
5	6	6	**35**

The suggested second-choice programmes for BEng (Chemical Engineering) are BSc (Chemistry), BSc (Mathematics) and BSc (Physics) if your APS and subject requirements of your first-choice programme are not obtained.

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Minimum requirements: ENGAGE 5-year programme			
Achievement level English Home Language or English First Additional Language	**Mathematics**	**Physical Sciences**	**APS**
NSC/IEB	NSC/IEB	NSC/IEB	
5	5	5	**30**

Life Orientation is excluded when calculating the APS.

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 "Minimum requirements: 4-year programme".

Admission to the Engineering Augmented Degree Programme (ENGAGE) in the School of Engineering will be determined by the NSC results, achievement levels of 5 for Mathematics, Physical Sciences and English, and an APS of 30.

Students may apply directly to be considered for the ENGAGE programme.

You will be considered for final admission to degree studies if space allows, and if you have a National Senior Certificate (NSC) or equivalent qualification with admission to bachelor's degree studies, and comply with the minimum subject requirements as well as the APS requirements of your chosen programme.

Applicants with qualifications other than the abovementioned should refer to the Brochure: Undergraduate Programme Information 2023: Qualifications other than the NSC and IEB, available at click here.

International students: Click here.

Transferring students

A transferring student is a student who, at the time of applying at the University of Pretoria (UP) is/was a registered student at another tertiary institution. A transferring student will be considered for admission based on NSC or equivalent qualification and previous academic performance. Students who have been dismissed from other institutions due to poor academic performance will not be considered for admission to UP.

Closing dates: Same as above.

Returning students

A returning student is a student who, at the time of application for a degree programme is/was a registered student at UP, and wants to transfer to another degree at UP. A returning student will be considered for admission based on NSC or equivalent qualification and previous academic performance.

Note:

- Students who have been excluded/dismissed from a faculty due to poor academic performance may be considered for admission to another programme at UP, as per faculty-specific requirements.
- Only ONE transfer between UP faculties and TWO transfers within a faculty will be allowed.
- Admission of returning students will always depend on the faculty concerned and the availability of space in the programmes for which they apply.

Closing date for applications from returning students

Unless capacity allows for an extension of the closing date, applications from returning students must be submitted before the end of August via your UP Student Centre.

Other programme-specific information

With a few exceptions, most modules offered at the School of Engineering are semester modules having credit values of either 8 or 16.
A student may be permitted by the Dean, on recommendation of the relevant head of department, to register for an equivalent module in an alternate semester, although the module is normally offered to the student's group in another semester, and providing that no timetable clashes occur.

Please note:

1. All students are 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.
2. Students registered for Chemical Engineering who have passed CBI 311 or CBI 410, receive credit for CBI 310.
3. Mechanical Engineering: For the Aeronautical Option, the themes of both the Design and the Project must be aeronautical-related.
4. Offering of electives depends on the availability of resources and industry support.

Promotion to next study year

Promotion to the second semester of the first year and to the second year of study

a. 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.
b. A student who complies with all the requirements of the first year of study, is promoted to the second year of study.
c. 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.
d. 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.
e. 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 enrol 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.
f. 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.

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 enrol 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.

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% (not rounded) was obtained in one year in all the modules of the final year of study; and
ii. the degree programme was completed within the prescribed four years for the four-year programme and within the prescribed five years of the ENGAGE programme.

b. Exceptional cases to the above will be considered by the Dean.

General information

University of Pretoria Programme Qualification Mix (PQM) verification project

The higher education sector has undergone an extensive alignment to the Higher Education Qualification Sub-Framework (HEQF) across all institutions in South Africa. In order to comply with the HEQSF, all institutions are legally required to participate in a national initiative led by regulatory bodies such as the Department of Higher Education and Training (DHET), the Council on Higher Education (CHE), and the South African Qualifications Authority (SAQA). The University of Pretoria is presently engaged in an ongoing effort to align its qualifications and programmes with the HEQSF criteria. Current and prospective students should take note that changes to UP qualification and programme names, may occur as a result of the HEQSF initiative. Students are advised to contact their faculties if they have any questions.

Curriculum: Year 1

Minimum credits: 161

Fundamental modules

Academic orientation 112 (UPO 112)

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

Core modules

General chemistry 171 (CHM 171)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Admission to relevant programme.
Contact time	1 discussion class per week, 1 practical per week, 1 web-based period per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	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.

General chemistry 181 (CHM 181)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	CHM 171
Contact time	1 discussion class per week, 1 practical per week, 1 web-based period per week, 4 lectures per week

Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	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)

Module credits	8.00
NQF Level	05
Prerequisites	Admission to relevant programme.
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 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^3. Material balances where gases are involved. Fuels and combustion: coal analysis, combustion calculations.

Electricity and electronics 122 (EBN 122)

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 2

Module content

The general objective of this module is to develop expertise in solving electric and electronic circuits. The topics covered in the course are Ohm's law, Kirchoff's current and voltage laws, voltage and current division, mesh current and node voltage methods, linearity, Thevenin and Norton equivalent circuits, source transformation, power transfer, energy storage elements in circuits (inductors and capacitors), and operational amplifiers and applications. Although circuits will mostly be solved using direct current (DC) sources, the final part of the course will consider methods to solve circuits using alternating current sources (AC).

Physics 116 (FSK 116)

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

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, Archaeology and Development Studies
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.
Contact time	2 lectures per week
Language of tuition	Module is presented in English

Department	Afrikaans
Period of presentation	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.

Graphical communication 110 (MGC 110)

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

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

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	60% for Mathematics in Grade 12
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 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)

Module credits	16.00
NQF Level	05
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114 or WTW 158
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

*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	1.00
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: 160

Core modules

Engineering statistics 220 (BES 220)

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

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

Module content

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

Chemistry 226 (CHM 226)

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

Contact time	2 lectures per week, 6 ppw
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	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)

Module credits	8.00
NQF Level	06
Prerequisites	CHM 181
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 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)

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

Module content

PVT properties of real gases, PVT-diagrams of pure compounds. Vapour pressure, Vapour liquid equilibrium of pure components. Vapour/gas equilibrium; Vapour liquid equilibrium for ideal mixtures (Raoult's law). Henry's law. Enthalpy changes for pure components upon heating and phase change. Energy balance for steady state systems with or without reaction. Heat of reaction. Combustion; Adiabatic flame temperature. Simultaneous mass and energy balances for steady state systems with no external work.

Thermodynamics 223 (CTD 223)

Module credits	16.00
NQF Level	06
Prerequisites	CIR 211, MPR 212/213, (WTW 258)
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

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)

Module credits	16.00
NQF Level	06
Prerequisites	EBN 111 or EBN 122 and WTW 161/164
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 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.

Community-based project 203 (JCP 203)

Module credits	8.00
NQF Level	06
Prerequisites	No prerequisites.
Contact time	1 lecture per week
Language of tuition	Module is presented in English
Department	Informatics
Period of presentation	Year

Module content

The Joint Community Project module is a credit-bearing educational experience where students are not only actively engaging in interpersonal skills development but also participate in service activities in collaboration with community partners. Students are given the opportunity to practice and develop their interpersonal skills formally taught in the module by engaging in teamwork with fellow students from different disciplines and also with non-technical members of the community. The module intends for the student to develop through reflection, understanding of their own experience in a team-based workspace as well as a broader understanding of the application of their discipline knowledge and its potential impact in their communities, in this way also enhancing their sense of civic responsibility. Compulsory class attendance 1 week before Semester 1 classes commence.

Programming and information technology 213 (MPR 213)

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

Module credits	16.00
NQF Level	06

Service modules	Faculty of Natural and Agricultural Sciences
Prerequisites	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.
Contact time	2 tutorials per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Civil Engineering
Period of presentation	Semester 1

Module content

Concept of Stress: Stresses in structural members, stress on oblique plane and stress under general loading, components of stress, design considerations. Stress and Strain: statically indeterminate problems, thermal effects, Poisson's ratio, generalised Hookes Law, shearing strain, stress-strain relationships. Torsion: Torsion of circular bars, stresses and strains in pure shear, power transmission, and statically indeterminate torsional members. Pure Bending: symmetric members in pure bending, stresses and deformations, deformations in transverse cross-sections, members made of composite materials, eccentric axial loading. Analysis and Design of Beams for Bending: shear and bending moment diagrams, relationships between load, shear and bending moments, design of prismatic beams for bending. Shearing stresses in Beams and Thin-Walled Members: Horizontal shearing stresses in beams, shearing stresses in Thin-Walled members. Transformation of Stress and Strain: Plane stress transformation, Mohr's circle, principal stresses, maximum values and stress variation in prismatic beams; Plane strain transformation, Mohr's circle, principal strains, maximum values, general state of stress, stresses in Thin-Walled pressure vessels. Principal Stresses under a given Loading: Principal stresses in beams, design of transmission shafts, stresses under combined loads. Deflection of Beams: Deformation under transverse loading, statically indeterminate beams, method of superposition. Energy Methods: Strain energy, elastic strain energy, strain energy for a general state of stress.

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.

Calculus 258 (WTW 258)

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

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)

Module credits	8.00
NQF Level	06

Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	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 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: 145

Core modules

Engineering management 310 (BSS 310)

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

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

Module content

Characterisation and taxonomy of biological material. Biochemistry and the chemistry of life. Biological growth requirements, metabolism and growth kinetics. Elemental modelling of the human system, agriculture and livestock. Kinetic modelling of aerobic and anaerobic digestion/digester. Understanding of sustainability and food-water-energy nexus from a chemical element perspective (e.g. recycle of nutrients, water pollution, food and energy security, and responsible recycling of chemical elements).

Chemical engineering design 320 (CIO 320)

Module credits	16.00

NQF Level	07
Prerequisites	(CTD 223), SWK 210, COP 311 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 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)

Module credits	8.00
NQF Level	07
Prerequisites	(CTD 223), CHM 215
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 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)

Module credits	8.00
NQF Level	07
Prerequisites	CIR 123
Contact time	2 lectures per week
Language of tuition	Module is presented in English

Department	Chemical Engineering
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)

Module credits	16.00
NQF Level	07
Prerequisites	(CTD 223), COP 311#
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

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)

Module credits	16.00
NQF Level	07
Prerequisites	WTW 238, (WTW 263)
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

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)

Module credits	16.00
NQF Level	07
Prerequisites	CIO 310#, CKN 321#
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

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)

Module credits	1.00
NQF Level	07
Prerequisites	(CIR 211)
Contact time	1 other contact session per week
Language of tuition	Module is presented in English
Department	Chemical Engineering
Period of presentation	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)

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

Module content

Two exit-level Graduate Attributes (GAs) of ECSA are addressed and each must be passed in the same semester. GA7: 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. GA8: 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 teamwork: 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-worker’s 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-worker’s discipline. Students communicate between disciplinary boundaries.

Curriculum: Final year

Minimum credits: 145

Additional information

Students must choose a specialisation by selecting one of the following four 16- credit module codes:

- CSS 420 for specialisation in Analytical techniques
- CSS 421 for specialisation in Environmental engineering
- CSS 422 for specialisation in Polymer processing
- CSS 423 for specialisation in Sustainable chemical engineering practices

Core modules

Particle technology 410 (CPA 410)

Module credits	16.00
NQF Level	08
Prerequisites	(COP 311)
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

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)

Module credits	16.00
NQF Level	08
Prerequisites	CPN 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

Dynamic properties of equipment, instruments, and processes. Mathematical modelling and computer simulation of processes in the time, Laplace, and frequency domains. Analysis and control of linear and non-linear processes. Stability of control systems. Controller tuning. Methods for process identification. Digital process control. Use of computers and microprocessors. Applied process control. Choice of control instrumentation. Plantwide control strategy. Development of P and IDs.

Design project 421 (CPJ 421)

Module credits	24.00
NQF Level	08
Prerequisites	(CPB 410), (CRO 410), BIE 310/BSS 310, CIO 320, CPS 420#, CPR 420#
Contact time	1 tutorial per week
Language of tuition	Module is presented in English
Department	Chemical Engineering
Period of presentation	Semester 2

Module content

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

Chemical engineering practice 420 (CPR 420)

Module credits	8.00
NQF Level	08
Prerequisites	CLB 321, CPJ 421#
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

Design economics and process evaluation. Cost estimation and time-value of money. 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 graduate attributes, ECSA process and reasons for registration as PrEng. Develops understanding of the system of professional development.

Process synthesis 410 (CPS 410)

Module credits	8.00
NQF Level	08
Prerequisites	CLB 321, CIR 310 GS
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 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
Optimisation techniques, with an assignment to use the optimisation tool in Aspen Plus. Thermal pinch analysis: hot, cold and composite curves, problem table, heat exchange network design, removing heat exchangers from a network, threshold problems and the grand composite curve.

Practical training 411 (CPY 411)

Module credits	1.00
NQF Level	08
Prerequisites	(CMO 320), CPY 311
Contact time	1 other contact session per week
Language of tuition	Module is presented in 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

Modelling of various reactor types for design purposes using Python. Semi-batch reactors, pressure drop in packed bed reactors, non-isothermal reactors, energy balance for adiabatically and non-adiabatically operated CSTR reactors, energy balance for adiabatic and non-adiabatic PFR reactors, External and internal diffusion effects on reactor performance, particle effectiveness factor for isothermal, adiabatic and non-adiabatic 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: Analytical techniques 420 (CSS 420)

Module credits	16.00
NQF Level	08

Prerequisites	CPJ 421#
Contact time	4 lectures per week
Language of tuition	Module is presented in English
Department	Chemical Engineering
Period of presentation	Semester 2

Module content

Understand the different types of analytical techniques. Distinguish between numerous analytical techniques and their applications. Apply the theory to real analytical data. Techniques covered are:

- Imaging (SEM, TEM, EDX/WDX, EELS, EBSD and FIB, confocal microscopy, optical microscopy, AFM)
- Spectroscopy (FTIR, UV-Vis, Raman, etc.)
- Chromatography (LC, GC, ICP, and the corresponding hyphenated techniques)
- Thermal analysis (TG, DSC, DTA, DMA, Thermomat, etc.)
- XRD, XRF, etc.
- Miscellaneous (Particle size, density, porosity and BET surface area, rheology, etc.

Specialisation: Environmental engineering 421 (CSS 421)

Module credits	16.00
NQF Level	08
Prerequisites	CPJ 421#
Contact time	4 lectures per week
Language of tuition	Module is presented in English
Department	Chemical Engineering
Period of presentation	Semester 2

Module content

Environmental Systems, Drinking Water Treatment, Wastewater Treatment, Water Quality Parameters, Activated Sludge Process, Anaerobic Digestion, System Optimisation, Global Warming Mechanisms, GHG Emission Reduction. The study objectives of this module are to:

- provide information on the principles of Environmental Engineering/Management
- provide an update of the legal framework for environmental systems
- facilitate application of life cycle assessment principles – the “cradle to grave” approach – in human enterprises.
- provide an overview of technologies for water and effluent treatment
- introduce the student to the design of unit operation and unit process in environmental engineering, and
- evaluate effect of pollution on receiving water bodies, and the effects in air and land.

Specialisation: Polymer processing 422 (CSS 422)

Module credits	16.00
NQF Level	08
Prerequisites	CPJ 421#

Contact time	4 lectures per week
Language of tuition	Module is presented in English
Department	Chemical Engineering
Period of presentation	Semester 2

Module content

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

Specialisation: Sustainable chemical engineering practices 423 (CSS 423)

Module credits	16.00
NQF Level	08
Prerequisites	CPJ 421#
Contact time	4 lectures per week
Language of tuition	Module is presented in English
Department	Chemical Engineering
Period of presentation	Semester 2

Module content

The purpose of this module is to introduce chemical engineering students to the concepts of sustainable chemical engineering practices and their roles in circular economy and sustainable development. Topics to explore include:

- Introduction to sustainable chemical engineering and circular economy
- Nanotechnology and its applications in sustainable energy and environment
- Advanced and applied materials in sustainable energy and environment
- Biotechnology and its role in sustainable development
- Waste treatment and valorisation into value-added commodities
- 4th industrial revolution and its role in sustainable chemical engineering practices
- Modelling and simulation as a tool in sustainable chemical engineering practices
- Sustainable development, EIA, DfE, MIfCA
- Safety process engineering and loss prevention and control in industry
- Hydrogen economy

Regulations and rules

The regulations and rules for the degrees published here are subject to change and may be amended after the publication of this information.

The General Academic Regulations (G Regulations) and General Student Rules apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations.

University of Pretoria Programme Qualification Mix (PQM) verification project

The higher education sector has undergone an extensive alignment to the Higher Education Qualification Sub-Framework (HEQF) across all institutions in South Africa. In order to comply with the HEQSF, all institutions are legally required to participate in a national initiative led by regulatory bodies such as the Department of Higher Education and Training (DHET), the Council on Higher Education (CHE), and the South African Qualifications Authority (SAQA). The University of Pretoria is presently engaged in an ongoing effort to align its qualifications and programmes with the HEQSF criteria. Current and prospective students should take note that changes to UP qualification and programme names, may occur as a result of the HEQSF initiative. Students are advised to contact their faculties if they have any questions.