



# University of Pretoria Yearbook 2020

## BSc Engineering and Environmental Geology (02133043)

**Minimum duration of study** 3 years

**Total credits** 420

**NQF level** 07

### Admission requirements

- The following persons will be considered for admission: a candidate who is in possession of a certificate that is deemed by the University to be equivalent to the required Grade 12 certificate with university endorsement, a candidate who is a graduate from another tertiary institution or has been granted the status of a graduate of such an institution, and a candidate who is a graduate of another faculty at the University of Pretoria.
- Life Orientation is excluded in the calculation of the Admission Point Score (APS).
- Grade 11 results are used for the conditional admission of prospective students. Final admission is based on the Grade 12 results.

#### Minimum requirements

##### Achievement level

##### English Home

##### Language or

##### English First

##### Additional

##### Language

##### Mathematics

##### Physical Science

##### APS

NSC/IEB	AS Level	NSC/IEB	AS Level	NSC/IEB	AS Level	APS
5	C	5	C	5	C	<b>34</b>

\* Cambridge A level candidates who obtained at least a D in the required subjects, will be considered for admission. International Baccalaureate (IB) HL candidates who obtained at least a 4 in the required subjects, will be considered for admission.

Candidates who do not comply with the minimum admission requirements for BSc (Engineering and Environmental Geology), may be considered for admission to the BSc - Extended programme - Physical Sciences. This programme takes a year longer than the normal programmes to complete.

#### BSc - Extended Programme - Physical Sciences

##### Minimum requirements

##### Achievement level



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

**Mathematics**

**Physical Science**

**APS**

NSC/IEB	AS Level	NSC/IEB	AS Level	NSC/IEB	AS Level
4	D	4	D	4	D

**28**

## Other programme-specific information

A student must pass all the minimum prescribed and elective module credits as set out at the end of each year within a programme as well as the total required credits to comply with the particular degree programme. Please refer to the curricula of the respective programmes. At least 144 credits must be obtained at 300-/400-level, or otherwise as indicated by curriculum. The minimum module credits needed to comply with degree requirements is set out at the end of each study programme. Subject to the programmes as indicated a maximum of 150 credits will be recognised at 100-level. A student may, in consultation with the relevant head of department and subject to the permission by the Dean, select or replace prescribed module credits not indicated in BSc three-year study programmes to the equivalent of a maximum of 36 module credits.

It is important that the total number of prescribed module credits is completed during the course of the study programme. The Dean may, on the recommendation of the relevant head of department, approve deviations in this regard. Subject to the programmes as indicated in the respective curricula, a student may not register for more than 75 module credits per semester at first-year level subject to permission by the Dean. A student may be permitted to register for up to 80 module credits in a the first semester during the first year provided that he or she obtained a final mark of no less than 70% for grade 12 Mathematics and achieved an APS of 34 or more in the NSC.

Students who are already in possession of a bachelor's degree, will not receive credit for modules of which the content overlap with modules from the degree that was already conferred. Credits will not be considered for more than half the credits passed previously for an uncompleted degree. No credits at the final-year or 300- and 400-level will be granted.

The Dean may, on the recommendation of the programme manager, approve deviations with regard to the composition of the study programme.

Please note: Where elective modules are not specified, these may be chosen from any modules appearing in the list of modules.

It remains the student's responsibility to ascertain, prior to registration, whether they comply with the prerequisites of the modules they want to register for.

The prerequisites are listed in the Alphabetical list of modules.



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## Promotion to next study year

A student will be promoted to the following year of study if he or she passed 100 credits of the prescribed credits for a year of study, unless the Dean on the recommendation of the relevant head of department decides otherwise. A student who does not comply with the requirements for promotion to the following year of study, retains the credit for the modules already passed and may be admitted by the Dean, on recommendation of the relevant head of department, to modules of the following year of study to a maximum of 48 credits, provided that it will fit in with both the lecture and examination timetable.

### **General promotion requirements in the faculty**

All students whose academic progress is not acceptable can be suspended from further studies.

- A student who is excluded from further studies in terms of the stipulations of the abovementioned regulations, will be notified in writing by the Dean or Admissions Committee at the end of the relevant semester.
- A student who has been excluded from further studies may apply in writing to the Admissions Committee of the Faculty of Natural and Agricultural Sciences for re-admission.
- Should the student be re-admitted by the Admissions Committee, strict conditions will be set which the student must comply with in order to proceed with his/her studies.
- Should the student not be re-admitted to further studies by the Admissions Committee, he/she will be informed in writing.
- Students who are not re-admitted by the Admissions Committee have the right to appeal to the Senate Appeals Committee.
- Any decision taken by the Senate Appeals Committee is final.

## Pass with distinction

A student obtains his or her degree with distinction if all prescribed modules at 300-level (or higher) are passed in one academic year with a weighted average of at least 75%, and obtain at least a subminimum of 65% in each of the relevant modules.



## Curriculum: Year 1

### Minimum credits: 140

Fundamental = 12

Core = 128

### Additional information:

Students who do not qualify for AIM 102 must register for AIM 111 and AIM 121.

Student wishing to take second-year Mathematics or Applied Mathematics modules to complement the Mechanics modules, must take WTW 114 and WTW 124 instead of WTW 158 and WTW 164

Students who wishes to register **GIS 220** in the second year have to register **GMC 110** in the first year

## Fundamental modules

### Academic information management 102 (AIM 102)

**Module credits** 6.00

#### Service modules

Faculty of Education  
Faculty of Economic and Management Sciences  
Faculty of Humanities  
Faculty of Law  
Faculty of Health Sciences  
Faculty of Natural and Agricultural Sciences  
Faculty of Theology and Religion  
Faculty of Veterinary Science

**Prerequisites** No prerequisites.

**Contact time** 2 lectures per week

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

**Department** Information Science

**Period of presentation** Semester 2

#### Module content

Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology. Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

### Academic information management 111 (AIM 111)

**Module credits** 4.00



<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	2 lectures per week
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<b>Language of tuition</b>	Module is presented in English
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<b>Department</b>	Information Science
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<b>Period of presentation</b>	Semester 1
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**Module content**  
Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology.

### Academic information management 121 (AIM 121)

<b>Module credits</b>	4.00
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<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion Faculty of Veterinary Science
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<b>Prerequisites</b>	No prerequisites.
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<b>Contact time</b>	2 lectures per week
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<b>Language of tuition</b>	Module is presented in English
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<b>Department</b>	Informatics
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<b>Period of presentation</b>	Semester 2
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**Module content**  
Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

### Language and study skills 110 (LST 110)

<b>Module credits</b>	6.00
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<b>Service modules</b>	Faculty of Natural and Agricultural Sciences Faculty of Veterinary Science
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<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Unit for Academic Literacy
<b>Period of presentation</b>	Semester 1

#### Module content

The module aims to equip students with the ability to cope with the reading and writing demands of scientific disciplines.

### Academic orientation 102 (UPO 102)

<b>Module credits</b>	0.00
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Natural and Agricultural Sciences Deans Office
<b>Period of presentation</b>	Year

### Core modules

#### General chemistry 117 (CMY 117)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
<b>Prerequisites</b>	A candidate must have Mathematics for at least 60% and 60% for Physical Sciences.
<b>Contact time</b>	1 practical 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. Atomic structure and periodicity. Molecular structure and chemical bonding using the VSEOR model. Nomenclature of inorganic ions and compounds. Classification of reactions: precipitation, acid-base, redox reactions and gas-forming reactions. Mole concept and stoichiometric calculations concerning chemical formulas and chemical reactions. Principles of reactivity: energy and chemical reactions. Physical behaviour gases, liquids, solids and solutions and the role of intermolecular forces. Rate of reactions: Introduction to chemical kinetics.

#### General chemistry 127 (CMY 127)

<b>Module credits</b>	16.00
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<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
<b>Prerequisites</b>	Natural and Agricultural Sciences students: CMY 117 GS or CMY 154 GS Health Sciences students: none
<b>Contact time</b>	1 practical 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

Theory: General physical-analytical chemistry: Chemical equilibrium, acids and bases, buffers, solubility equilibrium, entropy and free energy, electrochemistry. Organic chemistry: Structure (bonding), nomenclature, isomerism, introductory stereochemistry, introduction to chemical reactions and chemical properties of organic compounds and biological compounds, i.e. carbohydrates and aminoacids. Practical: Molecular structure (model building), synthesis and properties of simple organic compounds.

## Introduction to geology 155 (GLY 155)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	A candidate must have passed Mathematics with at least 60% in the Grade 12 examination.
<b>Contact time</b>	1 practical per week, 4 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Geology
<b>Period of presentation</b>	Semester 1

### Module content

Solar system; structure of solid matter; minerals and rocks; introduction to symmetry and crystallography; important minerals and solid solutions; rock cycle; classification of rocks. External geological processes (gravity, water, wind, sea, ice) and their products (including geomorphology). Internal structure of the earth. The dynamic earth - volcanism, earthquakes, mountain building - the theory of plate tectonics. Geological processes (magmatism, metamorphism, sedimentology, structural geology) in a plate tectonic context. Geological maps and mineral and rock specimens. Interaction between man and the environment, and nature of anthropogenic climate change.

## Earth history 163 (GLY 163)

<b>Module credits</b>	16.00
<b>Prerequisites</b>	GLY 155
<b>Contact time</b>	1 practical per week, 4 lectures per week



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

**Department** Geology

**Period of presentation** Semester 2

### Module content

This module will give an overview of earth history, from the Archaean to the present. Important concepts such as the principles of stratigraphy and stratigraphic nomenclature, geological dating and international and South African time scales will be introduced. A brief introduction to the principles of palaeontology will be given, along with short descriptions of major fossil groups, fossil forms, ecology and geological meaning. In the South African context, the major stratigraphic units, intrusions and tectonic/metamorphic events will be detailed, along with related rock types, fossil contents, genesis and economic commodities. Anthropogenic effects on the environment and their mitigation. Practical work will focus on the interpretation of geological maps and profiles.

## First course in physics 114 (PHY 114)

**Module credits** 16.00

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

**Prerequisites** A candidate must have passed Mathematics and Physical Science with at least 60% in the Grade 12 examination

**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

SI-units. Significant figures. Waves: intensity, superposition, interference, standing waves, resonance, beats, Doppler. Geometrical optics: Reflection, refraction, mirrors, thin lenses, instruments. Physical optics: Young-interference, coherence, diffraction, polarisation. Hydrostatics and dynamics: density, pressure, Archimedes' principle, continuity, Bernoulli. Heat: temperature, specific heat, expansion, heat transfer. Vectors. Kinematics of a point: Relative, projectile, and circular motion. Dynamics: Newton's laws, friction. Work: point masses, gasses (ideal gas law), gravitation, spring, power. Kinetic energy: Conservative forces, gravitation, spring. Conservation of energy. Conservation of momentum. Impulse and collisions. System of particles: Centre of mass, Newton's laws. Rotation: torque, conservation of angular momentum, equilibrium, centre of gravity.

## Mechanics 122 (SWK 122)

**Module credits** 16.00

**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

**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

**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.



## Curriculum: Year 2

**Minimum credits: 142**

Core = 94

Elective = 48

### Additional information:

**Students who do not intend to continue with Mathematics on third year level may replace WTW 220 with WTW 224**

**A block of 48 elective credits must be selected from the following-**

**Chemistry:** CMY 282, CMY 283, CMY 284, CMY 285 (48 credits)

**Mathematics:** WTW 211, WTW 218, WTW 220, WTW 221 (48 credits)

**Applied Mathematics:** WTW 211, WTW 218, WTW 248, WTW 264 (48 credits)

**GIS/Geomorphology:** GGY 252, GIS 220, GGY 201 (36 credits)

## Core modules

### Geographic information systems introduction 221 (GIS 221)

**Module credits** 12.00

**Prerequisites** Prohibited combination GGY 283

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

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

**Department** Geography Geoinformatics and Meteorology

**Period of presentation** Semester 2

#### Module content

\*GIS 221 does not lead to admission to any module at 300 level.

Introduction to Geographic Information Systems (GIS), theoretical concepts and applications of GIS. The focus will be on the GIS process of data input, data analysis, data output and associated technologies. This module teaches students to use GIS as a tool. Examples used throughout the course are drawn from South African case studies.

### Introductory soil science 250 (GKD 250)

**Module credits** 12.00

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

**Prerequisites** CMY 117 GS

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

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

**Department** Department of Plant and Soil Sciences

**Period of presentation** Semester 1



## Module content

Origin and development of soil, weathering and soil formation processes. Profile differentiation and morphology. Physical characteristics: texture, structure, soil water, atmosphere and temperature. Chemical characteristics: clay minerals, ion exchange, pH, buffer action, soil acidification and salinisation of soil. Soil fertility and fertilisation. Soil classification. Practical work: Laboratory evaluation of simple soil characteristics. Field practicals on soil formation in the Pretoria area.

## Sedimentology 253 (GLY 253)

<b>Module credits</b>	12.00
<b>Prerequisites</b>	CMY 117, CMY 127, GLY 155, GLY 163, WTW 114/WTW 158 and PHY 114
<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>	Geology
<b>Period of presentation</b>	Quarter 2

## Module content

Introduction to sedimentology; grain studies; composition and textures of sedimentary rocks; flow dynamics and behaviour of sediment particles in transport systems; description and genesis of sedimentary structures; diagenesis; depositional environments and their deposits, modern and ancient; chemical sedimentary rocks; economic sedimentology; field data acquisition from sedimentary rocks and writing of reports; sieve analysis; Markov analysis; analysis of palaeocurrent trends; interpretation of sedimentary profiles.

## Fundamental and applied mineralogy 255 (GLY 255)

<b>Module credits</b>	12.00
<b>Prerequisites</b>	CMY 117, CMY 127, GLY 155, GLY 163, WTW 158 and PHY 114
<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>	Geology
<b>Period of presentation</b>	Quarter 1

## Module content

Fundamental concepts in mineralogy, and practical applications of mineralogy, including: the basics of crystal structure; the crystallographic groups; the rules of atomic substitution; phase transitions and phase diagrams; the structure and uses of olivine, pyroxene, feldspar, amphibole, mica, aluminosilicates, garnet, cordierite, and more uncommon mineral groups such as oxides, sulphides and carbonates; the calculation of mineral formulae from chemical analyses using various methods. Practical sessions: the basics of optical mineralogy and the use of transmitted light microscopy for thin section examination of minerals and rocks; the practicals will develop mineral identification skills for the minerals covered in the lectures, and cover basic textural identification.

## Igneous and Metamorphic Petrology 263 (GLY 263)

<b>Module credits</b>	24.00
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<b>Prerequisites</b>	GLY 255
<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>	Geology
<b>Period of presentation</b>	Semester 2

### Module content

Classification and nomenclature of igneous rocks. The nature of silicate melts; physical and chemical factors influencing crystallisation and textures of igneous rocks. Phase diagrams, fractional crystallisation and partial melting. Trace elements and isotopes, and their use in petrogenetic studies. Global distribution of magmatism and its origin. Mid-oceanic ridges, active continental margins, intraplate magmatism. Classification of metamorphic rocks. Anatexis, migmatite and granite; eclogite. Metamorphic textures. PT-time loops. Metamorphism in various plate tectonic environments.

## Geological field mapping 266 (GLY 266)

<b>Module credits</b>	6.00
<b>Prerequisites</b>	GLY 253
<b>Contact time</b>	7 days full-time block week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Geology
<b>Period of presentation</b>	Semester 2

### Module content

Introduction to field mapping techniques.

## Strength of materials 210 (SWK 210)

<b>Module credits</b>	16.00
<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.

## Elective modules

### Physical chemistry 282 (CMY 282)

**Module credits** 12.00

**Service modules** Faculty of Education

**Prerequisites** CMY 117 and CMY 127

**Contact time** 1 tutorial per week, 2 practicals per week, 4 lectures per week

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

**Department** Chemistry

**Period of presentation** Quarter 2

#### Module content

Theory: Classical chemical thermodynamics, gases, first and second law and applications, physical changes of pure materials and simple compounds. Phase rule: Chemical reactions, chemical kinetics, rates of reactions.

### Analytical chemistry 283 (CMY 283)

**Module credits** 12.00

**Service modules** Faculty of Education

**Prerequisites** CMY 117 and CMY 127

**Contact time** 1 tutorial per week, 2 practicals per week, 4 lectures per week

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

**Department** Chemistry

**Period of presentation** Quarter 3



## Module content

Statistical evaluation of data in line with ethical practice, gravimetric analysis, aqueous solution chemistry, chemical equilibrium, precipitation-, neutralisation- and complex formation titrations, redox titrations, potentiometric methods, introduction to electrochemistry. Examples throughout the course demonstrate the relevance of the theory to meeting the sustainable development goals of clean water and clean, affordable energy.

## Organic chemistry 284 (CMY 284)

**Module credits** 12.00

**Service modules** Faculty of Education

**Prerequisites** CMY 117 and CMY 127

**Contact time** 1 tutorial per week, 2 practicals per week, 4 lectures per week

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

**Department** Chemistry

**Period of presentation** Quarter 1

## Module content

Resonance, conjugation and aromaticity. Acidity and basicity. Introduction to  $^{13}\text{C}$  NMR spectroscopy. Electrophilic addition: alkenes. Nucleophilic substitution, elimination, addition: alkyl halides, alcohols, ethers, epoxides, carbonyl compounds: ketones, aldehydes, carboxylic acids and their derivatives. Training in an ethical approach to safety that protects self, others and the environment is integral to the practical component of the course.

## Inorganic chemistry 285 (CMY 285)

**Module credits** 12.00

**Service modules** Faculty of Education

**Prerequisites** CMY 117 and CMY 127

**Contact time** 1 tutorial per week, 2 practicals per week, 4 lectures per week

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

**Department** Chemistry

**Period of presentation** Quarter 4

## Module content

Atomic structure, structure of solids (ionic model). Coordination chemistry of transition metals: Oxidation states of transition metals, ligands, stereochemistry, crystal field theory, consequences of d-orbital splitting, chemistry of the main group elements, electrochemical properties of transition metals in aqueous solution, industrial applications of transition metals. Fundamentals of spectroscopy and introduction to IR spectroscopy. During practical training students learn to acquire and report data ethically. Practical training also deals with the misuse of chemicals and appropriate waste disposal to protect the environment and meet the UN sustainable development goals.



## City, structure, environment and society 201 (GGY 201)

<b>Module credits</b>	12.00
<b>Prerequisites</b>	GGY 156
<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>	Geography Geoinformatics and Meteorology
<b>Period of presentation</b>	Quarter 3

### Module content

The module introduces students to urban settlement patterns, processes and structures. Using a series of case studies, it aims to develop an understanding of the challenges facing urban areas both in South Africa and globally.

## Process geomorphology 252 (GGY 252)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Education Faculty of Humanities
<b>Prerequisites</b>	GGY 166 or GLY 155
<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>	Geography Geoinformatics and Meteorology
<b>Period of presentation</b>	Quarter 2

### Module content

Physical processes that influence the earth's surface and management. Specific processes and their interaction in themes such as weathering; soil erosion; slope, mass movement and periglacial processes. Practical laboratory exercises and assignments are based on the themes covered in the module theory component.

## Geographic data analysis 220 (GIS 220)

<b>Module credits</b>	14.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	GMC 110 and (STK 110 OR BME 120)
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Geography Geoinformatics and Meteorology
<b>Period of presentation</b>	Semester 2





## Module content

The nature of geographical data and measurement. Application of statistics in the geographical domain. Probability, probability distributions and densities, expected values and variances, Central Limit theorem. Sampling techniques. Exploratory data analysis, descriptive statistics, statistical estimation, hypothesis testing, correlation analysis and regression analysis. Examples used throughout the course are drawn from South African and African case studies and taught within the framework of the UN Sustainable Development Goals.

## Linear algebra 211 (WTW 211)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 124

**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

This is an introduction to linear algebra on  $\mathbb{R}^n$ . Matrices and linear equations, linear combinations and spans, linear independence, subspaces, basis and dimension, eigenvalues, eigenvectors, similarity and diagonalisation of matrices, linear transformations.

## Calculus 218 (WTW 218)

**Module credits** 12.00

**Service modules** Faculty of Engineering, Built Environment and Information Technology  
Faculty of Education  
Faculty of Economic and Management Sciences

**Prerequisites** WTW 114 and WTW 124

**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 and Lagrange multipliers. Multiple integrals, polar, cylindrical and spherical coordinates.

## Analysis 220 (WTW 220)

**Module credits** 12.00



<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
<b>Prerequisites</b>	WTW 114 and WTW 124, WTW 211 and WTW 218
<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

\*This module is recommended as an elective only for students who intend to enrol for WTW 310 and/or WTW 320. Students will not be credited for more than one of the following modules for their degree: WTW 220 and WTW 224.

Properties of real numbers. Analysis of sequences and series of real numbers. Power series and theorems of convergence. The Bolzano-Weierstrass theorem. The intermediate value theorem and analysis of real-valued functions on an interval. The Riemann integral: Existence and properties of the interval.

### Linear algebra 221 (WTW 221)

**Module credits** 12.00

<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
<b>Prerequisites</b>	WTW 211 and WTW 218
<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

Abstract vector spaces, change of basis, matrix representation of linear transformations, orthogonality, diagonalisability of symmetric matrices, some applications.

### Techniques of analysis 224 (WTW 224)

**Module credits** 12.00

<b>Prerequisites</b>	WTW 124 and WTW 211 GS and WTW 218 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>	Mathematics and Applied Mathematics
<b>Period of presentation</b>	Semester 2



## Module content

\*This module does not lead to admission to WTW 310 or WTW 320. Students will not be credited for more than one of the following modules for their degree: WTW 220 and WTW 224.

Sequences of real numbers: convergence and monotone sequences. Series of real numbers: convergence, integral test, comparison tests, alternating series, absolute convergence, ratio and root tests. Power series: representation of functions as power series, Taylor and Maclaurin series. Application to series solutions of differential equations.

## Vector analysis 248 (WTW 248)

**Module credits** 12.00

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

**Prerequisites** WTW 218

**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

Vectors and geometry. Calculus of vector functions with applications to differential geometry, kinematics and dynamics. Vector analysis, including vector fields, line integrals of scalar and vector fields, conservative vector fields, surfaces and surface integrals, the Theorems of Green, Gauss and Stokes with applications.

## Differential equations 264 (WTW 264)

**Module credits** 12.00

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

**Prerequisites** WTW 114 and WTW 124

**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

\*Students will not be credited for both WTW 162 and WTW 264 or both WTW 264 and WTW 286 for their degree.

Theory and solution methods for ordinary differential equations and initial value problems: separable and linear first order equations, linear equations of higher order, systems of linear equations. Laplace transform.



## Curriculum: Final year

**Minimum credits: 138**

Core = 122

Elective = 16

**Additional information:**

Either GLY 367 (24 credits) or SGM 323 (16 credits) must be taken in the second semester.

### Core modules

#### Soil chemistry 320 (GKD 320)

**Module credits** 14.00

**Prerequisites** GKD 250

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

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

**Department** Department of Plant and Soil Sciences

**Period of presentation** Semester 2

**Module content**

The more exact chemistry of soils systematically explained by understanding the particular chemical principles. Charge origin. Chemical equilibria. Manifestations of sorption. Ion exchange. Acidic soils, saline soils and the organic fraction of soil. The chemistry of the important plant nutrient elements P, K and N is explained.

#### Soil classification and surveying 350 (GKD 350)

**Module credits** 14.00

**Prerequisites** GKD 250 GS

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

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

**Department** Department of Plant and Soil Sciences

**Period of presentation** Semester 1

**Module content**

A taxonomic system for South Africa. USDA's Soil Taxonomy. Land suitability evaluation. Optimal resource utilization. The conservation component. Ecological aspects. Ecotype, land types. Soil maps. Practical work: Field practicals and compulsory excursion. Identification of soil horizons, forms and families. Land suitability evaluation. Elementary mapping exercise.

#### Structural geology 365 (GLY 365)

**Module credits** 18.00

**Prerequisites** GLY 263



**Contact time** 2 practicals per week, 4 lectures per week

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

**Department** Geology

**Period of presentation** Quarter 1

### Module content

Integrated theoretical and practical course dealing with the principles of rock deformation and analysis of deformed rocks. Stress, strain and rheology, joints, experimental rock deformation, fault systems and Anderson's theory of faulting. Folds and interference folding, tectonic fabrics, shear zone, progressive deformation. Stereographic projection and structural analysis.

## Groundwater 366 (GLY 366)

**Module credits** 18.00

**Prerequisites** GLY 263

**Contact time** 2 practicals per week, 4 lectures per week

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

**Department** Geology

**Period of presentation** Quarter 2

### Module content

The hydrological cycle, water resources and water usage; porosity and permeability, heterogeneity and isotropy; the occurrence of groundwater, vadose and phreatic zones; aquifer types, relations and groundwater flow; hydrostratigraphy, surface water and groundwater interaction, springs; water balance, water flow, recharge and baseflow; Darcy's Law, hydraulic conductivity and subsurface flow; capillarity, hydraulics, Bernoulli's equation and the continuity principle; hydraulic parameters and their derivation from aquifer pumping tests, including Theis, Cooper-Jacob and other modifications; water quality, solubility, natural waters, ionic balance and plotting water chemistry data; groundwater mining, aquifer compaction and subsidence; saline intrusion, dryland salinity, pollution, NAPLs; site remediation and toxicology.

## Advanced Geological field mapping 368 (GLY 368)

**Module credits** 6.00

**Prerequisites** GLY 263

**Contact time** 7 days full-time block week

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

**Department** Geology

**Period of presentation** Semester 1

### Module content

Advanced field mapping techniques.



## Engineering geology and rock mechanics 369 (GLY 369)

<b>Module credits</b>	36.00
<b>Prerequisites</b>	GLY 365
<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>	Geology
<b>Period of presentation</b>	Semester 2

### Module content

Definition and scope of engineering geology; engineering geological properties and problems of rocks and soils within different stratigraphic units and climatic regions in southern Africa. Strength and failure modes of rock material and rock failure criteria. The characteristics of joints in rock. Joint line surveys and interpretation of data. Characteristics of a rock mass, rock mass classification and determination of strength. Slope stability in surface mines. Induced seismicity due to deep mining and rock bursts. This is in support of United Nations Sustainable Development Goals dealing with clean water, sanitation, infrastructure development.

## Soil mechanics 311 (SGM 311)

<b>Module credits</b>	16.00
<b>Service modules</b>	Faculty of Natural and Agricultural Sciences
<b>Prerequisites</b>	(SWK 210)
<b>Contact time</b>	1 practical per week, 2 tutorials per week, 3 lectures per week
<b>Language of tuition</b>	Separate classes for Afrikaans and English
<b>Department</b>	Civil Engineering
<b>Period of presentation</b>	Semester 1

### Module content

Introduction to soil mechanics. Introduction to clay mineralogy. Mass, volume relationships and phases of soil. Groundwater flow and permeability. Effective stress principles. Suction pressures in saturated as well as partially saturated soil. The Mohr circle and stresses at a point. The Mohr-Coulomb strength theory and the stress-strain properties of soil. The Boussinesq theory. Consolidation theory and soil settlement.

## Elective modules

### Economic geology 367 (GLY 367)

<b>Module credits</b>	36.00
<b>Prerequisites</b>	GLY 365
<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>	Geology
<b>Period of presentation</b>	Semester 2



## Module content

This module details the genesis and exploitation of major ore deposits, with an emphasis on South African examples. The processes through which ore deposits are formed and modified will be discussed, highlighting the relevance of sedimentary, metamorphic and igneous processes in the genesis of world-class ore bodies. The module will also address the methods of mining commonly used, and the international commodity market, including a brief introduction to ore reserve estimation and the evaluation of potential ore deposits. The section of the module involving mineral exploration and mining will emphasize the need of pursuing a sustainable mineral resources development mindset, by addressing and sharing ideas on the impact that mining has on environmental, social and economic issues including community welfare, impact of mining on land use, and rehabilitation post mining.

## Geotechnical engineering 323 (SGM 323)

**Module credits** 16.00

**Prerequisites** (SGM 311)

**Contact time** 1 practical per week, 2 discussion classes per week, 3 lectures per week

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

**Department** Civil Engineering

**Period of presentation** Semester 2

## Module content

Application of consolidation theory. Bearing capacity of soil and foundation design, Terzaghi and general methods. Horizontal stresses in soil and design of retaining structures, Rankine and Couloumb's methods. Slope stability including Bishop's method of slices. Introduction to site investigation.

The information published here is subject to change and may be amended after the publication of this information. The [General Regulations \(G Regulations\)](#) apply to all faculties of the University of Pretoria. It is expected of students to familiarise themselves well with these regulations as well as with the information contained in the [General Rules](#) section. Ignorance concerning these regulations and rules will not be accepted as an excuse for any transgression.