University of Pretoria Yearbook 2018

BSc Geology (02133023)

Minimum duration of study	3 years
Total credits	426

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 provisional admission of prospective students. Final admission is based on the Grade 12 results.

Minimum requirements												
Achievement level												
Afrikaans or English				**Mathematics**				**Physical Science**				**APS**
NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
5	3	C	C	5	3	C	C	5	3	C	C	32

Candidates who do not comply with the minimum admission requirements for BSc (Geology), may be considered for admission to the BSc – Extended programme for the Physical Sciences. The BSc – Extended programme takes place over a period of four years instead of the normal three years.

BSc - Extended programme for the Physical Sciences:

Minimum requirements												
Achievement level												
	Afrikaans or English				**Mathematics**				**Physical Science**				**APS**
	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
BSc - Extended programme for the Physical Sciences	4	3	D	D	4	3	D	D	4	3	D	D	26

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 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 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 acertain, 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.

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 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 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 Senior Appeals Committee.
- Any decision taken by the Senior 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

Minimum credits:

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 select PHY 124 are able to continue with a second major in Chemistry, Mathematics, Soil Science or Physics. Students who select SWK 122 may continue with a second major in Engineering Geology, Mathematics, Chemistry, Soil Science or Mechanics.

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	Separate classes for Afrikaans and 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

Service modules	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
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Information Science
Period of presentation	Semester 1

Module content

Find, evaluate, process, manage and present information resources for academic purposes using appropriate technology.

Academic information management 121 (AIM 121)

Module credits	4.00
Service modules	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
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Informatics
Period of presentation	Semester 2

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)

Module credits	6.00
Service modules	Faculty of Natural and Agricultural Sciences Faculty of Veterinary Science

Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Unit for Academic Literacy
Period of presentation	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)

Module credits	0.00
Language of tuition	Afrikaans and English are used in one class
Department	Natural and Agricultural Sciences Deans Office
Period of presentation	Year

Core modules

General chemistry 117 (CMY 117)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
Prerequisites	A candidate must have Mathematics for at least 60% and 60% for Physical Sciences.
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Chemistry
Period of presentation	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)

Module credits	16.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
Prerequisites	Natural and Agricultural Sciences students: CMY 117 GS or CMY 154 GS Health Sciences students: none
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Chemistry
Period of presentation	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)

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

Earth history 163 (GLY 163)

Module credits	16.00
Prerequisites	GLY155; a special exemption is given to 2nd-year students registered for degrees in Plant Sciences, Entomology, Ecology and Zoology
Contact time	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. 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.

First course in physics 124 (PHY 124)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	WTW 114 GS and PHY 114 GS
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 2

Module content

Simple harmonic motion and pendulums. Coulomb’s law. Electric field: dipoles, Gauss’ law.Electric potential. Capacitance. Electric currents: resistance, resistivity, Ohm’s law, energy, power, emf, RC-circuits. Magnetic Field: Hall-effect, Bio-Savart. Faraday’s and Lenz’s laws. Oscillations: LR-circuits. Alternating current: RLC-circuits, power, transformers. Introductory concepts to modern physics. Nuclear physics: Radioactivity.

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	Separate classes for Afrikaans and 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	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 60% in the Grade 12 examination
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Separate classes for Afrikaans and 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
Prerequisites	WTW 114 GS or WTW 158 GS
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Separate classes for Afrikaans and 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: 150

Minimum credits:

Core = 54

Elective = 96

Additional information:

Students must select 2 groups of modules (normally 2x48 credits = 96 credits) from the following list, depending on the second major intended:

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 286 (48 credits)

Physics: PHY 263, PHY 255 (48 credits) and WTW 211, WTW 218, WTW 220, WTW 248 (48 credits)

Engineering Geology/Soil Science/Mechanics: GKD 250, SWK 210, GIS 221 (40 credits)

GIS/Geomorphology: GGY 252, GIS 220, GMA 220 (40 credits)

Core modules

Sedimentology 253 (GLY 253)

Module credits	12.00
Prerequisites	CMY 117, CMY 127, GLY 155, GLY 163, WTW 114/WTW 158 and PHY 114
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

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)

Module credits	12.00
Prerequisites	CMY 117, CMY 127, GLY 155, GLY 163,WTW 158 and PHY 114
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

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 petrology 261 (GLY 261)

Module credits	12.00
Prerequisites	GLY 255
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Geology
Period of presentation	Quarter 3

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.

Metamorphic petrology 262 (GLY 262)

Module credits	12.00
Prerequisites	GLY 255
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Geology
Period of presentation	Quarter 4

Module content

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)

Module credits	6.00
Prerequisites	CMY 117, CMY 127, GLY 155, GLY 161, GLY 162, WTW 158 and PHY 114
Contact time	7 days full-time block week

Language of tuition	Module is presented in English
Department	Geology
Period of presentation	Semester 2

Module content

Introduction to field mapping techniques

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

Theory: Statistical evaluation of data, gravimetric analysis, aqueous solution chemistry, chemical equilibrium, precipitation-, neutralisation- and complex formation titrations, redox titrations, potentiometric methods, introduction to electrochemistry.

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

Theory: Resonance, conjugation and aromaticity. Acidity and basicity. Introduction to ^{13}C NMR spectroscopy. Electrophilic addition: alkenes. Nucleophilic substitution, elimination, addition: alkyl halides, alcohols, ethers, epoxides, carbonyl compounds: ketones, aldehydes, carboxylic acids and their derivatives.

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

Theory: 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.

Process geomorphology 252 (GGY 252)

Module credits	12.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	GGY 166 or GLY 155
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	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 fluvial processes. Practical laboratory exercises are based on the themes covered in the module theory component.

City structure, environment and society 266 (GGY 266)

Module credits	24.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 2

Module content

An urbanising world. Urban structure and land use. Urban processes. The urban environment. Social structure and change in cities. Living in the city. Economy, society and politics in the city. Third-world cities and South African cities. Urban futures.

Geographic data analysis 220 (GIS 220)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GMC 110 and (STK 110 OR BME 120)
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

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.

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.

Introductory soil science 250 (GKD 250)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	CMY 117 GS or TDH
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Separate classes for Afrikaans and 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.

Remote sensing 220 (GMA 220)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GMC 110
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 1

Module content

This module will provide a thorough introduction to the basic scientific principles involved in remote sensing, and some of the applications to studies of the Earth’s surface. This includes examining the basic physics of electromagnetic radiation and the complex interactions of radiation with the surface and atmosphere (i.e. spectral signatures). In addition, basic concepts of photogrammetry will be discussed. The theoretical background laid out in the first half of the module will provide the tools for examining various remote sensing applications using data obtained in different parts of the electromagnetic spectrum. The applications will include uses of satellite remote sensing data for mapping and monitoring vegetation, soils and minerals, snow and ice, water resources and quality, and urban landscapes. The laboratory section will include hands-on experience with various satellite image data sets.

Waves, thermodynamics and modern physics 255 (PHY 255)

Module credits	24.00
Service modules	Faculty of Education
Prerequisites	[PHY114 and PHY124] or [PHY171] or [PHY143 and PHY153 and PHY163] and [WTW211#] and [WTW218#]
Contact time	1 practical per week, 2 discussion classes per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Physics
Period of presentation	Semester 1

Module content

Vibrating systems and waves (14 lectures)
Simple harmonic motion (SHM). Superposition (different frequencies, equal frequencies). Perpendicular vibrations (Lissajous figures). Damped SHM. Forced oscillations. Resonance. Q-value. Transverse wave motion. Plane wave solution using method of separation of variables. Reflection and transmission at a boundary. Normal and eigenmodes. Wave packets. Group velocity.
Modern physics (30 lectures)
Special relativity: Galilean and Lorentz transformations. Postulates. Momentum and energy. 4 vectors and tensors. General relativity. Quantum physics. Failure of classical physics. Bohr model. Particle-wave duality. Schrödinger equation. Piece-wise constant potentials. Tunneling. X-rays. Laser. Nuclear physics: Fission. Fusion. Radioactivity.
Heat and thermodynamics (12 lectures)
Heat. First Law. Kinetic theory of gases. Mean free path. Ideal, Clausius, Van der Waals and virial gases. Entropy. Second Law. Engines and refrigerators. Third Law. Thermodynamic potentials: Enthalpy Helmholtz and Gibbs free energies, Chemical potential. Legendre transformations (Maxwell relations). Phase equilibrium. Gibbs phase rule.
Modelling and simulation (7 practical sessions)
Introduction to programming in a high level system: Concept of an algorithm and the basic logic of a computer programme. Symbolic manipulations, graphics, numerical computations. Applications: Selected illustrative examples.
Error Analysis (7 practical sessions)
Experimental uncertainties. Propagation of uncertainties. Statistical analysis of random uncertainties. Normal distribution. Rejection of data. Least-squares fitting. Covariance and correlation.

General physics 263 (PHY 263)

Module credits	24.00
Service modules	Faculty of Education
Prerequisites	PHY 255 GS and WTW 218 GS and WTW 220# and WTW 248#
Contact time	1 practical per week, 2 discussion classes per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Physics

Period of presentation	Semester 2

Module content

Classical mechanics (28 lectures)
Fundamental concepts, energy and angular momentum, calculus of variations and Lagrangian mechanics, conservative central forces and two body problems, scattering, mechanics in rotating reference frames, many body systems.
Physical Optics (14 lectures)
Maxwell's equations, wave equation and plane wave solution, coherence, interference, diffraction, polarisation.
Physics of Materials (14 lectures)
Classification of materials. Atomic bonding. Crystallography. Defects. Material strength. Phase diagram's, Ceramics. Polymers. Composites. Fracture. Electrical and magnetic properties. Semiconductors. Smart materials Nanotechnology.
Experiments (14 sessions)

Strength of materials 210 (SWK 210)

Module credits	16.00
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	Separate classes for Afrikaans and English
Department	Civil Engineering
Period of presentation	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 ?. Design of beams from section characteristics. Deflection of beams: The elastic curve, integration method, Macaulay's method and superposition.

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 Rn. 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
Service modules	Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 114 and WTW 124, WTW 211 and 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
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
Service modules	Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 211 and 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
Abstract vector spaces, change of basis, matrix representation of linear transformations, orthogonality, diagonalisability of symmetric matrices, some applications.

Vector analysis 248 (WTW 248)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	WTW 218
Contact time	1 discussion class per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
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 286 (WTW 286)

Module credits	12.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	WTW 114, WTW 124 and WTW 162
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

*Students will not be credited for more than one of the modules for their degree: WTW 264, WTW 286
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. Application to mathematical models. Numerical methods applied to nonlinear systems.Qualitative analysis of linear systems.

Curriculum: Final year

Minimum credits: 144

Minimum credits:

Core = 78

Elective = 66

Additional information:

Students must select one group of modules (at least 66 credits each) from the following list, provided the appropriate second year modules were taken:

Chemistry: CMY382, CMY 383, CMY384, CMY385 (72 credits)

Mathematics: WTW 310, WTW 320, WTW 381, WTW 389 (72 credits)

Applied Mathematics: WTW 382, WTW 383, WTW 386, WTW 387 (72 credits)

Physics: PHY 364, PHY 356 (72 credits)

Astrophysics: PHY 300, GMS 320, GIS 320 (82credits) - Note that this option does not allow entry into Physics Honours

Engineering Geology/Soil Science/Mechanics: GKD 350, SGM 311, GLY 363, GLY 364 (66 credits)

GIS/Geomorphology: GIS 310,GIS 320, GMA 320 (72 credits)

Core modules

Structural geology 365 (GLY 365)

Module credits	18.00
Prerequisites	Three of the second-year modules: GLY 255, GLY 261, GLY 262, GLY 253; special exemption is given to 4th-year Mining Engineering students who have completed their required 1st-year Geology modules
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 princples 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, prograssive deformation. Stereographic projection and structural analysis.

Groundwater 366 (GLY 366)

Module credits	18.00
Prerequisites	Three of the second-year modules: GLY 255, GLY 261, GLY 262, GLY 253
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

Origin and classification of groundwater; classification of aquifers; groundwater movement; equations for groundwater flow into boreholes; the La Place equation and solutions for pump tests; execution and interpretation of pump tests; contaminant transport; low temperature aqueous geochemistry; groundwater exploration and management.

Economic geology 367 (GLY 367)

Module credits	36.00
Prerequisites	GLY 365 and GLY 366
Contact time	2 practicals 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 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.

Advanced Geological field mapping 368 (GLY 368)

Module credits	6.00
Prerequisites	Three of the second-year modules: GLY 255, GLY 261, GLY 262, GLY 253
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.

Elective modules

Physical chemistry 382 (CMY 382)

Module credits	18.00
Service modules	Faculty of Education

Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	1 discussion class 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

Theory: Molecular quantum mechanics. Introduction: Shortcomings of classical physics, dynamics of microscopic systems, quantum mechanical principles, translational, vibrational and rotational movement. Atomic structure and spectra: Atomic hydrogen, multiple electron systems, spectra of complex atoms, molecular structure, the hydrogen molecule ion, diatomic and polyatomic molecules, structure and properties of molecules. Molecules in motion: Viscosity, diffusion, mobility. Surface chemistry: Physisorption and chemisorption, adsorption isotherms, surface tension, heterogeneous catalytic rate reactions, capillarity.

Analytical chemistry 383 (CMY 383)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	1 discussion class 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

Theory: Separation methods: Extraction, multiple extraction, chromatographic systems. Spectroscopy: Construction of instruments, atomic absorption and atomic emission spectrometry, surface analysis techniques. Mass spectrometry. Instrumental electrochemistry.

Organic chemistry 384 (CMY 384)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	1 discussion class 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

Theory: NMR spectroscopy: applications. Aromatic chemistry, Synthetic methodology in organic chemistry. Carbon-carbon bond formation: alkylation at nucleophilic carbon sites, aldol and related condensations, Wittig and related reactions, acylation of carbanions (Claisen condensation).

Inorganic chemistry 385 (CMY 385)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	1 discussion class 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: Structure and bonding in inorganic chemistry. Molecular orbital approach, diatomic and polyatomic molecules, three-centre bonds, metal-metal bonds, transition metal complexes, magnetic properties, electronic spectra, reactivity and reaction mechanisms, reaction types, acid-base concepts, non-aqueous solvents, special topics.

Geographic information systems 310 (GIS 310)

Module credits	22.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	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 1

Module content

Advanced theory and practice of Geographic Information Systems; GIS applications; design and implementation of GIS applications. A project or assignments of at least 64 notional hours.

Spatial analysis 320 (GIS 320)

Module credits	22.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GIS 310 or TDH
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English

Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 2

Module content

Construction of Raster Geovisualisations, spatial model construction and use, multi-criteria decision analysis. Factor analysis: Principle component analysis. Geostatistics: Spatial dependence modelling, ordinary kriging. Markov chains and cellular Automata, combined models.

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	Separate classes for Afrikaans and 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.

Engineering geology 363 (GLY 363)

Module credits	18.00
Prerequisites	GLY 354
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Geology
Period of presentation	Quarter 3

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.

Rock mechanics 364 (GLY 364)

Module credits	18.00
Prerequisites	GLY 354
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Geology

Period of presentation	Quarter 4

Module content

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.

Remote sensing 320 (GMA 320)

Module credits	22.00
Prerequisites	GMA 220
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

This module aims to provide students with a working knowledge and skills to learn methods and techniques for collecting, processing and analysing remotely sensed data. Throughout the module, emphasis will be placed on image processing, image analysis, image classification, remote sensing and applications of remote sensing in geographical analysis and environmental monitoring. The module is composed of lectures, readings, laboratory exercises and research tasks.A project or assignments of at least 64 notional hours.

Soil-water relationship and irrigation 350 (PGW 350)

Module credits	14.00
Prerequisites	GKD 250
Contact time	2 lectures per week, fortnightly practicals
Language of tuition	Separate classes for Afrikaans and English
Department	Department of Plant and Soil Sciences
Period of presentation	Semester 1

Module content

Quantitative description and measurement of soil water content and potential as well as saturated and unsaturated hydraulic conductivity. Modelling water flow in soil (Darcy’s law, Richards's equation). Infiltration, redistribution, evaporation, runoff and percolation. Irrigation in South Africa. Modelling and managing the soil water balance. Plant water consumption and the soil-plant-atmosphere continuum. Irrigation scheduling (soil, plant and atmosphere approaches). Managing poor quality water. Irrigation systems. The module includes a field trip to an irrigation scheme.

Observational astronomy 300 (PHY 300)

Module credits	36.00
Prerequisites	PHY 255 and PHY 263

Contact time	2 discussion classes per week, 2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Physics
Period of presentation	Semester 1

Module content

Structure of the universe, navigation of the sky, spherical geometry, optical, radio and high energy physics and sources, instruments, practical observational skills, data recording, analysis, interpretation (signal and image processing, noise, calibration, error analysis). Project: A selected project in either optical or radio astronomy, resulting in a formal report and a presentation.

Electronics, electromagnetism and quantum mechanics 356 (PHY 356)

Module credits	36.00
Service modules	Faculty of Education
Prerequisites	PHY 255 GS and PHY 263 GS and WTW 211 GS and WTW 218 GS and WTW 248 GS
Contact time	1 practical per week, 2 discussion classes per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Physics
Period of presentation	Semester 1

Module content

Electronics (14 lectures)
Thévenin and Norton equivalent circuits, superposition principle, RC, LC and LRC circuits. Semiconductor diode. Bipolar transistor. Operational amplifiers. Computer controlled instrumentation.
Electromagnetism (21 lectures)
Electrostatics: Coulomb’s law, divergence and curl of E, Gauss’ law, Laplace’s equation, image charge problems, multipole expansion.
Magnetostatics: Lorenz force, Biot-Savart law, divergence and curl of magnetic field strength, Ampère’s law, magnetic vector potential, multipole expansion, boundary conditions.
Electrodynamics: Electromotive force, electromagnetic induction, Maxwell’s equations, wave equation.
Electric and magnetic fields in matter: Polarisation, electric displacement and Gauss’s law in dielectrics, linear dielectrics. Magnetisation (diamagnets, paramagnets, ferromagnets), auxiliary field H and Ampère’s law in magnetised materials, linear and nonlinear media.
Quantum mechanics (28 lectures)
The Schrödinger equation, the statistical interpretation of the wave function, momentum, the uncertainty principle, the time-independent Schrödinger equation, stationary states, the infinite square well potential, the harmonic oscillator, the free particle, the Delta-Function potential, the finite square well potential, Hilbert spaces, observables, eigen functions of a Hermitian operator, Dirac notation, the Schrödinger equation in spherical coordinates, the hydrogen atom, angular momentum spin.

Statistical mechanics, solid state physics and modelling 364 (PHY 364)

Module credits	36.00

Service modules	Faculty of Education
Prerequisites	PHY 356 and WTW 211 and WTW 218 and WTW 248 GS
Contact time	2 discussion classes per week, 2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Physics
Period of presentation	Semester 2

Module content

Statistical mechanics (28 lectures)
Isolated systems in thermodynamical equilibrium. Systems in equilibrium with a heat bath: the canonical ensemble, Gibbs' entropic formula, classical statistical mechanics, energy equipartition theorem, thermodynamic potentials, paramagnetism.
The classical limit of perfect gases: non-distinguishable character of quantum particles, the equation of state of the classical ideal gas. Quantum perfect gases: Black body radiation, the grand canonical ensemble, Fermi-Dirac distribution, the free electron gas in metals, the Bose-Einstein distribution, Bose-Einstein condensation.
Solid state physics (28 lectures)
Crystal structures, the reciprocal lattice, x-ray diffraction, lattice vibration, the Debye model, characteristics of solids, the free electron model, Pauli paramagnetism, electronic heat capacity, the relaxation time, electrical conduction, the classical Hall effect, thermal conduction in metals, failures of the free electron model, the independent electron model, band theory of solids.
Computational Physics and modelling. Assessment will be done through a portfolio of project reports. The topics for the projects will be selected from various sub-disciplines of Physics.

Soil mechanics 311 (SGM 311)

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

Analysis 310 (WTW 310)

Module credits	18.00

Service modules	Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	WTW 220
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Topology of finite dimensional spaces: Open and closed sets, compactness, connectedness and completeness. Theorems of Bolzano-Weierstrass and Heine-Borel. Properties of continuous functions and applications. Integration theory for functions of one real variable. Sequences of functions.

Complex analysis 320 (WTW 320)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	WTW 218 and WTW 220
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Series of functions, power series and Taylor series. Complex functions, Cauchy- Riemann equations, Cauchy's theorem and integral formulas. Laurent series, residue theorem and calculation of real integrals using residues.

Algebra 381 (WTW 381)

Module credits	18.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	WTW 114 and WTW 211
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Group theory: Definition, examples, elementary properties, subgroups, permutation groups, isomorphism, order, cyclic groups, homomorphisms, factor groups. Ring theory: Definition, examples, elementary properties, ideals, homomorphisms, factor rings, polynomial rings, factorisation of polynomials. Field extensions, applications to straight-edge and compass constructions.

Dynamical systems 382 (WTW 382)

Module credits	18.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 218 and WTW 286/264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Matrix exponential function: homogeneous and non-homogeneous linear systems of differential equations. Qualitative analysis of systems: phase portraits, stability, linearisation, energy method and Liapunov's method. Introduction to chaotic systems. Application to real life problems.

Numerical analysis 383 (WTW 383)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	WTW 114, WTW 123 WTW 124 and WTW 211
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Direct methods for the numerical solution of systems of linear equations, pivoting strategies. Iterative methods for solving systems of linear equations and eigenvalue problems. Iterative methods for solving systems of nonlinear equations. Introduction to optimization. Algorithms for the considered numerical methods are derived and implemented in computer programmes. Complexity of computation is investigated. Error estimates and convergence results are proved.

Partial differential equations 386 (WTW 386)

Module credits	18.00

Service modules	Faculty of Education
Prerequisites	WTW 248 and WTW 286/264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

Conservation laws and modelling. Fourier analysis. Heat equation, wave equation and Laplace's equation. Solution methods including Fourier series. Energy and other qualitative methods.

Continuum mechanics 387 (WTW 387)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	WTW 248 and WTW 286/264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Kinematics of a continuum: Configurations, spatial and material description of motion. Conservation laws. Analysis of stress, strain and rate of deformation. Linear constitutive equations. Applications: Vibration of beams, equilibrium problems in elasticity and special cases of fluid motion.

Geometry 389 (WTW 389)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities
Prerequisites	WTW 211
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Axiomatic development of neutral, Euclidean and hyperbolic geometry. Using models of geometries to show that the parallel postulate is independent of the other postulates of Euclid.

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.