University of Pretoria Yearbook 2016

BSc Geography (02133385)

Duration of study	3 years
Total credits	428

Admission requirements

- In order to register NSC/IEB/Cambridge candidates must comply with the minimum requirements for degree studies as well as the minimum requirements for the relevant study programme.
- 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 for 2016												
Achievement level												
Afrikaans or English				**Mathematics**				**Physical Sciences**				**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 may be considered for admission to the BSc or the BSc (Four-year Programme) based on the results of the NBT.

Other programme-specific information

Students can take WTW 114 instead of WTW 134 if they meet the entry requirement.

Students may enrol for AIM 111 and AIM 121 instead of AIM 102 (the same content presented over 2 semesters).

BSc (Geography) and BSc (Environmental Sciences) students may register for WKD 155. Students are not allowed to earn credits for both WKD 155 and WKD 164.

Electives can be chosen from modules in the following departments: Geography, Geoinformatics and Meteorology, Plant Production and Soil Science, Chemistry, Plant Science, Physics, Zoology and Entomology, Geology, Mathematics and Applied Mathematics, Computer Science, Anthropology and Archaeology, Economics, History, Psychology, Sociology, Political Sciences.

Electives are chosen as follows:

First year – 68 credits

Second year – 84 credits

Third year – 24 credits

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.

Transitional measures

Transitional measures for Mathematics modules for 2016

- Students who would have registered for any of the degrees BSc in Environmental Sciences, Geography, Geoinformatics, BCom, BCom in Economics/Statistics or BScIT Information and Knowledge Systems prior to 2016, and not successfully completed WTW 114, WTW 126 or WTW 128 will be allowed to register for WTW 134, WTW 146 and WTW 148, respectively.
- Students who would have registered for BSc in Geology prior to 2016, and not successfully completed WTW 114, WTW 126 or WTW 128 will be allowed to register for WTW 158, WTW 164 or WTW 124 or WTW 148, respectively.
- Students who registered prior to 2016, and who failed both WTW 126 and WTW 128 will register for WTW 124 in 2016 if they wish to continue with mathematics at 200 level, or if WTW 126 and WTW 128 are required for

their respective degree programmes.
- Students who do not qualify for WTW 146 and WTW 148 in terms of their degree programmes, and failed one of WTW 126 or WTW 128, will be allowed to register for the respective module in 2016, and will attend the relevant lectures and tutorials of WTW 124. They will write separate semester tests and exams, covering just the relevant material from WTW 124.
- Students who registered prior to 2016 and passed WTW 126 but not WTW 128, will be allowed to continue with WTW 211 and COS 344 in 2016.
- Students who registered prior to 2016 and passed WTW 128 but not WTW 126, will be allowed to continue with the modules WTW 220, IAS 211 and GLY 265 in 2016, if they also meet the additional entry requirements.
- Students who registered prior to 2016, and who failed both WTW 161 and WTW 168 will register for WTW 164 in 2016.
- Students who failed one of WTW 161 or WTW 168, will be allowed to register for the respective module in 2016, and will attend the relevant lectures and tutorials of WTW 164. They will write separate semester tests and exams, covering just the relevant material from WTW 164.

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

Programme-specific information

Minimum credits:

Fundamental = 12 credits

Core = 60 credits

Electives = 68 credits

Additional information:

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

Fundamental modules

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
Prerequisites	No prerequisites.
Contact time	MAMELODI, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	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 Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week, MAMELODI
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
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	English
Academic organisation	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	Double Medium
Academic organisation	Natural + Agric Sciences Dean
Period of presentation	Year

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 Faculty of Veterinary Science
Contact time	2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	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.

Core modules

Aspects of human geography 156 (GGY 156)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Health Sciences
Prerequisites	No prerequisites.
Contact time	1 tutorial per week, 3 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 2

Module content

This module begins by fostering an understanding of human geography. Then follows with the political ordering of space; cultural diversity as well as ethnic geography globally and locally; population geography of the world and South Africa: and four economic levels of development. The purpose is to place South Africa in a world setting and to understand the future of the country.

Southern African geomorphology 166 (GGY 166)

Module credits	8.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Health Sciences
Prerequisites	No prerequisites.
Contact time	4 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 3

Module content

Investigating southern African landscapes and placing them in a theoretical and global context. The geomorphological evolution of southern Africa. Introduction to the concepts of Geomorphology and its relationships with other physical sciences (e.g. meteorology, climatology, geology, hydrology and biology). The processes and controls of landform and landscape evolution. Tutorial exercises cover basic techniques of geomorphological analysis, and topical issues in Geomorphology.

Cartography 110 (GMC 110)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 1 practical per week
Language of tuition	Double Medium
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

History, present and future of cartography. Introductory geodesy: shape of the earth, graticule and grids, datum definition, elementary map projection theory, spherical calculations. Representation of geographical data on maps: Cartographic design, cartographic abstraction, levels of measurement and visual variables. Semiotics for cartography: signs, sign systems, map semantics and syntactics, explicit and implicit meaning of maps (map pragmatics).

Climate and weather of Southern Africa 164 (WKD 164)

Module credits	8.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	4 lectures per week
Language of tuition	English

Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 4

Module content

An introduction to the climate and general seasonal climatic circulation patterns of Southern Africa. Basic weather types and weather processes within the Southern African context. Interpretation of synoptic maps and synoptic station reports. Impacts of climate change and extreme climate events on society.
*BSc (Geography) and BSc (Environmental Sciences) students may register for WKD 155. Students are not allowed to earn credits for both WKD 155 and WKD 164.

Mathematics 134 (WTW 134)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Veterinary Science
Prerequisites	Refer to Regulation 1.2: At least 50% for Mathematics in the Grade 12 examination .
Contact time	4 lectures per week, 1 tutorial per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

**Students will not be credited for more than one of the following modules for their degree: WTW 134, WTW 165, WTW 114, WTW 158. WTW 134 does not lead to admission to Mathematics at 200 level and is intended for students who require Mathematics at 100 level only. WTW 134 is offered as WTW 165 in the second semester only to students who have applied in the first semester of the current year for the approximately 65 MBChB, or the 5-6 BChD places becoming available in the second semester and who were therefore enrolled for MGW 112 in the first semester of the current year.* Functions, derivatives, interpretation of the derivative, rules of differentiation, applications of differentiation, integration, interpretation of the definite integral, applications of integration. Matrices, solutions of systems of equations. All topics are studied in the context of applications.

Introduction to environmental sciences 101 (ENV 101)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor

Period of presentation	Quarter 1

Module content

Introducing the basic concepts and interrelationships required to understand the complexity of natural environmental problems, physical and human environment, human induced environmental problems, the ways in which the natural environment affects human society and biodiversity, an introduction to major environmental issues in Southern Africa and sustainable development in the context of environmental issues.

Elective modules

Biometry 120 (BME 120)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences Faculty of Veterinary Science
Prerequisites	At least 4 (50-59%) in Mathematics in the Grade 12 examination, or at least 50% in both Statistics 113, 123
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Statistics
Period of presentation	Semester 2

Module content

Simple statistical analysis: Data collection and analysis: Samples, tabulation, graphical representation, describing location, spread and skewness. Introductory probability and distribution theory. Sampling distributions and the central limit theorem. Statistical inference: Basic principles, estimation and testing in the one- and two-sample cases (parametric and non-parametric). Introduction to experimental design. One- and twoway designs, randomised blocks. Multiple statistical analysis: Bivariate data sets: Curve fitting (linear and non-linear), growth curves. Statistical inference in the simple regression case. Categorical analysis: Testing goodness of fit and contingency tables. Multiple regression and correlation: Fitting and testing of models. Residual analysis. Computer literacy: Use of computer packages in data analysis and report writing.

Plant biology 161 (BOT 161)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	MLB 111 GS
Contact time	fortnightly practicals, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 2

Module content

Basic plant structure and function; introductory plant taxonomy and plant systematics; principles of plant molecular biology and biotechnology; adaptation of plants to stress; medicinal compounds from plants; basic principles of plant ecology and their application in natural resource management.

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	Final Grade 12 marks of at least 60% for Mathematics and 60% for Physical Sciences.
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	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 iorganic 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	Both Afr and Eng
Academic organisation	Chemistry
Period of presentation	Semester 2

Module content

Theory: General physical-analytical chemistry: Physical behaviour of gases, liquids and solids, intermolecular forces, solutions. Principles of reactivity: energy and chemical reactions, 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 amino acids. Practical: Molecular structure (model building), synthesis and properties of simple organic compounds.

Historical geology 161 (GLY 161)

Module credits	8.00
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
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 4

Module content

Principles of stratigraphy and stratigraphic nomenclature; geological dating and international and South African time scales; Africa framework and tectonic elements of South Africa; introduction to depositional environments. Overview of the historical geology of South Africa, from the Archaean to the present: major stratigraphic units, intrusions and tectonicmetamorphic events - their rock types, fossil contents, genesis and economic commodities. Principles of palaeontology and short description of major fossil groups: fossil forms, ecology and geological meaning. Geological maps and profiles; rock samples.

Environmental and hazard geology 162 (GLY 162)

Module credits	8.00
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
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 3

Module content

Hazardous exogenic and endogenic geological processes and their influence on the human environment; impact of human activities on the geological environment; natural resource utilisation including materials for construction; natural and mine-induced seismicity; waste disposal; groundwater and environmental pollution. Geological maps; geological profiles; rock specimens; fossil specimens.

Informatics 112 (INF 112)

Module credits	10.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	Refer to Regulation 1.2(e): A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination; or STK 113 60%, STK 123 60% or STK 110
Contact time	2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 1

Module content

Introduction to information systems, information systems in organisations, hardware: input, processing, output, software: systems and application software, organisation of data and information, telecommunications and networks, the Internet and Intranet. Transaction processing systems, management information systems, decision support systems, information systems in business and society, systems analysis, systems design, implementation, maintenance and revision.

Informatics 154 (INF 154)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	Refer to Regulation 1.2(f): A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination
Contact time	2 practicals per week, 1 lecture per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 1

Module content

Introduction to programming.

Informatics 164 (INF 164)

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	INF 154; Regulation 1.2(f): A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination; AIM 101 or AIM 102 or AIM 111 and AIM 121

Contact time	1 lecture per week, 2 practicals per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 2

Module content

Advanced programming, use of a computer-aided software engineering tool.

Molecular and cell biology 111 (MLB 111)

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	Refer to Regulation 1.2: A candidate who has passed Mathematics with at least 50% in the Grade 12 examination
Contact time	4 lectures per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Genetics
Period of presentation	Semester 1

Module content

Introductory study of the ultra structure, function and composition of representative cells and cell components. General principles of cell metabolism, molecular genetics, cell growth, cell division and differentiation.

Exploring the universe 154 (SCI 154)

Module credits	16.00
Prerequisites	Prohibited combination SCI 164
Contact time	4 lectures per week
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 1

Module content

The content of this course is the same as SCI 164 and students are not allowed to register for both SCI 154 and SCI 164.
Students from all faculties are welcome to join us in our exploration of the universe from an earth-bound perspective. We reflect on the whole universe from the sub microscopic to the vast macroscopic and mankind's modest position therein. To what degree is our happiness determined by stars? Echo's from ancient firmaments - the astronomy of old civilisations. The universe is born with a bang. Stars, milky ways and planets are formed. Life is breathed into the landscape on earth, but is there life elsewhere? The architecture of the universe – distance measurements, structure of our solar system and systems of stars. How does it look like on neighbouring planets? Comets and meteorites. Life cycles of stars. Spectacular exploding stars! Exotica like pulsars and black holes.

Exploring the universe 164 (SCI 164)

Module credits	16.00
Prerequisites	Probited combination SCI 154
Language of tuition	Afrikaans
Academic organisation	Physics
Period of presentation	Semester 2

Module content

*This module is presented in Afrikaans only. See SCI 154 for a summary of the module content. The content of this module is the same as SCI 154 and students are not allowed to register for both SCI 154 and SCI 164.
Studente uit alle fakulteite is welkom om saam met ons die heelal vanuit 'n aardgebonde perspektief te verken. Ons besin oor die ganse kosmos van die submikroskopiese tot die asemrowende, uitgestrekte makroskopiese en die mens se beskeie posisie daarin. Tot watter mate bepaal sterre ons lewensgeluk? Eggo's van antieke uitspansels – die sterrekunde van vervloeë beskawings. Die heelal word gebore met 'n knal. Sterre, die Melkweg en planete word gevorm. Lewe word in die aardse landskap geplaas, maar is daar lewe elders? Die agitektuur van die heelal – afstandmetings, struktuur van ons sonnestelsel en sterrestelsels. Hoe lyk ons buurplanete? Komete en meteoriete. Lewenssiklusse van sterre. Ontploffende sterre. Eksotiese voorwerpe soos pulsare en swart gate.

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	Both Afr and Eng
Academic organisation	Civil Eng
Period of presentation	Semester 1 or 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.

Discrete structures 115 (WTW 115)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 50% in the Grade 12 examination
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Propositional logic: truth tables, logical equivalence, implication, arguments. Mathematical induction and well-ordering principle. Introduction to set theory. Counting techniques: elementary probability, multiplication and addition rules, permutations and combinations, binomial theorem, inclusion-exclusion rule.

Numerical analysis 123 (WTW 123)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114 GS
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

Non-linear equations, numerical integration, initial value problems for differential equations, systems of linear equations. Algorithms for elementary numerical techniques are derived and implemented in computer programmes. Error estimates and convergence results are treated.

Mathematical modelling 152 (WTW 152)

Module credits	8.00

Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Introduction to the modelling of dynamical processes using difference equations. Curve fitting. Introduction to linear programming. Matlab programming. Applications to real-life situations in, among others, finance, economics and ecology.

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	4 lectures per week, 1 tutorial per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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.

Dynamical processes 162 (WTW 162)

Module credits	8.00
Prerequisites	WTW 114 GS
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

*Students will not be credited for more than one of the following modules for their degree: WTW 162 and WTW 264.
Introduction to the modelling of dynamical processes using elementary differential equations. Solution methods for first order differential equations and analysis of properties of solutions (graphs). Applications to real life situations.

Animal diversity 161 (ZEN 161)

Module credits	8.00
Service modules	Faculty of Education Faculty of Veterinary Science
Prerequisites	MLB 111 GS or TDH
Contact time	2 lectures per week, fortnightly practicals
Language of tuition	Both Afr and Eng
Academic organisation	Zoology and Entomology
Period of presentation	Semester 2

Module content

Animal classification, phylogeny, organization and terminology. Evolution of the various animal phyla, morphological characteristics and life cycles of parasitic and non-parasitic animals. Structure and function of reproductive, respiratory, excretory, circulatory and digestive systems.

Geoinformatics 120 (GIS 120)

Module credits	12.00
Prerequisites	GMC110
Language of tuition	Both Afr and Eng
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 2

Module content

The importance of geographical data and an overview of geoinformatics. Cartographic analysis to geoinformatics – a historical perspective. Application fields of geoinformatics. Introduction to geographical information systems (GIS): Components, structure and functionality, GIS visualisation and cartography. Data sources and evaluation: fitness for purpose, factors affecting suitability, quality and uncertainty, sources of analogue and digital data. Map projection choice. Analysis of GIS output.

Introduction to geology 155 (GLY 155)

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 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	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.

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	Refer to Regulation 1.2: A candidate must have passed Mathematics and Physical Science with at least 60% in the Grade 12 examination
Contact time	4 lectures per week, 1 discussion class per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	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	4 lectures per week, 1 discussion class per week, 1 practical per week
Language of tuition	Both Afr and Eng

Academic organisation	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.

Atmospheric structure and processes 155 (WKD 155)

Module credits	16.00
Prerequisites	At least 50% for mathematics in grade 12.
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

*Students are not allowed to earn credits for WKD 155 and WKD 164

Introduction to weather and climate. Climate of South Africa. Urban and rural climate. Meteorological instruments. Motion of the earth. Atmospheric mass and pressure. Energy and heat budget. Moisture in the atmosphere. Cloud development. Climate change. ENSO. Electromagnetic spectrum and remote sensing in meteorology. Synoptic weather systems of South Africa.

Informatics 171 (INF 171)

Module credits	20.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	Regulation 1.2: A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination
Contact time	2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Year

Module content

General systems theory, creative problem solving, soft systems methodology. The systems analyst, systems development building blocks, systems development, systems analysis methods, process modelling.

Curriculum: Year 2

Minimum credits: 144

Programme-specific information

Minimum credits:

Core = 60 credits

Elective = 84 credits

Additional information:

Core modules

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	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
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.

Introductory geographic information systems 283 (GGY 283)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities
Prerequisites	Only available to students studying the following:12132022, 12132002, 12132004, 02133312, 02133383, 02133361, 02133385, 09133040 and 01130001
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

*This is a closed module, only available to students studying [BTandRP] (12132022), [BSc(Arch)] (12132002), [BSc(LArch)] (12132004), BSc Meteorology (02133312), BSc Geoinformatics (02133383), BSc Environmental Science (02133361), BSc Geography (02133385), BEd Further Education and Training (General) (09133040), BA (01130001) or as approved by the head of department. The content of this module is the same as GIS 221 and students are not allowed to earn credits for both GGY 283 and GIS 221.
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.

Geographic data analysis 220 (GIS 220)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 2

Module content

The nature of geographical data and measurement. 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.

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	English
Academic organisation	Geography, Geoinf + Meteor
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.

Elective modules

South African flora and vegetation 251 (BOT 251)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	BOT 161 or TDH
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 1

Module content

Origin and affinity of South African flora and vegetation types; principles of plant geography; plant diversity in southern Africa; characteristics, environments and vegetation of South African biomes and associated key ecological processes; centra of plant endemism; rare and threatened plant species; biodiversity conservation and ecosystem management; invasion biology; conservation status of South African vegetation types.

Plant physiology and biotechnology 261 (BOT 261)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	BOT 161, CMY 117, CMY 127 or TDH
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 2

Module content

Nitrogen metabolism in plants; nitrogen fixation in Agriculture; plant secondary metabolism and natural products; photosynthesis and carbohydrate metabolism in plants; applications in solar energy; plant growth regulation and the Green Revolution; plant responses to the environment; developing drought tolerant and disease resistant plants.

Physical chemistry 282 (CMY 282)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	CMY 117 and CMY 127
Contact time	4 lectures per week, 1 tutorial per week, 2 practicals per week
Language of tuition	English
Academic organisation	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	2 practicals per week, 4 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	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	2 practicals per week, 4 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	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	2 practicals per week, 1 tutorial per week, 4 lectures per week
Language of tuition	English
Academic organisation	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. Introduction to IR spectroscopy.

Geomorphology of the built environment 265 (GGY 265)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.
Contact time	4 lectures per week
Language of tuition	Double Medium
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 3

Module content

*This module is for Architecture and Landscape Architecture students only.
The theory component covers geomorphological aspects of the built environment including landscape identification; weathering or deterioration of natural stone and application to design and preservation of buildings and monuments; slope hydrology and stability conditions; soil erosion processes and construction impacts; drainage modification in urban areas; wetland identification, human impacts and rehabilitation; recreational impacts and management. In addition to the theory a field-based project is undertaken.

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	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 2

Module content

*The content of this module is the same as GGY 283 and students are not allowed to earn credits for both GGY 283 and GIS 221.
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.

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	Both Afr and Eng
Academic organisation	Plant Production and Soil Sc
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)

Module credits	12.00
Prerequisites	CMY 117, CMY 127, GLY 155, GLY 161, GLY 162, WTW 114/WTW 158 and PHY 114
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 3

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.

Structural geology 254 (GLY 254)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GLY 151, GLY 161, WTW 114/WTW 158 and FSK 116/FSK 176
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 2

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 zones, progressive deformation. Stereographic projection and structural analysis.

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	English
Academic organisation	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	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	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.

Groundwater 265 (GLY 265)

Module credits	12.00
Prerequisites	CMY 117, CMY 127, GLY 155, GLY 161, GLY 162, WTW 114/WTW 158 and PHY 114
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 3

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. Groundwater flow modelling; classification of aquifers in southern Africa; groundwater exploration and management. Mapping techniques.

Remote sensing 220 (GMA 220)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
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.

Informatics 214 (INF 214)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	AIM 101 or AIM 111 and AIM 121
Contact time	2 practicals per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 1

Module content

Database design: the relational model, structured query language (SQL), entity relationship modelling, normalisation, database development life cycle; practical introduction to database design. Databases: advanced entity relationship modelling and normalisation, object-oriented databases, database development life cycle, advanced practical database design.

Informatics 225 (INF 225)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	INF 164 and INF 171; AIM 101 or AIM 102 or AIM 111 and AIM 121
Contact time	1 practical per week, 1 lecture per week, 2 discussion classes per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 2

Module content

An overview of systems infrastructure and integration.

Informatics 261 (INF 261)

Module credits	7.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	INF 214
Contact time	1 lecture per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 2

Module content

Database management: transaction management, concurrent processes, recovery, database administration: new developments: distributed databases, client-server databases: practical implementation of databases.

Informatics 264 (INF 264)

Module credits	8.00
Prerequisites	INF 112, AIM 101 or AIM 102 or AIM 111 and AIM 121
Contact time	1 lecture per week, 2 practicals per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 2

Module content

Application of spreadsheets and query languages in an accounting environment.

Informatics 271 (INF 271)

Module credits	14.00
Service modules	Faculty of Education
Prerequisites	AIM 101 or AIM 102 or AIM 111 and AIM 121, INF 163, 164
Contact time	1 practical per week, 1 lecture per week, 2 discussion classes per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Year

Module content

Systems analysis. Systems design: construction; application architecture; input design; output design; interface design; internal controls; program design; object design; project management; system implementation; use of computer-aided development tools.

Informatics 272 (INF 272)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	AIM 101 or AIM 102 or AIM 111 and AIM 121, INF 163 and INF 164, Regulation IT.3(g)
Contact time	2 practicals per week, 1 discussion class per week, 5 web-based periods per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Year

Module content

Use of computer-aided development tools; advanced programming.

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, 4 lectures per week, 2 discussion classes per week
Language of tuition	English
Academic organisation	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)

Surveying 210 (SUR 210)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	No prerequisites.
Contact time	4 practicals per week, 3 lectures per week
Language of tuition	Double Medium
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

Adjustment and use of following instruments: Plane table, level, compass and theodolite. Elementary site surveying and levelling, tachometry. Definition of survey. Co-ordinate systems and bearing. Connections and polars. Methods of determining points. Elevation. Tachometry.

Surveying 220 (SUR 220)

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 114 GS/WTW 134
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 2

Module content

Adjustment and use of following instruments: Plane table, level, compass and theodolite. Elementary site surveying and leveling, tachometry. Definition of survey. Co-ordinate systems and bearing. Connections and polars. Methods of determining points. Elevation. Tachometry.

Site surveying 213 (TRN 213)

Module credits	12.00
Prerequisites	No prerequisites.
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

General surveying; instruments, their handling and adjusting; surveying systems and simple calculations; determining of levels; setting out of the works; tacheometry and plotting; scales, planimetry; areas and volumes; construction surveying; aerial photography.

Physical meteorology 261 (WKD 261)

Module credits	14.00
Prerequisites	WTW 114
Contact time	4 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 1

Module content

Conservative forces and conservation laws. Basic thermodynamic laws for dry and humid air. The equation of state. Adiabatic processes and temperature lapse rates. The Clausuis-Claperon equation. Calculation of the wet adiabat.

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	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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

Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
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.

Numerical methods 263 (WTW 263)

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	WTW 164
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

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

Discrete structures 285 (WTW 285)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	WTW 115
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

Setting up and solving recurrence relations. Equivalence and partial order relations. Graphs: paths, cycles, trees, isomorphism. Graph algorithms: Kruskal, Prim, Fleury. Finite state automata.

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	English
Academic organisation	Mathematics and Applied Maths
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.

Invertebrate biology 251 (ZEN 251)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	ZEN 161 GS or TDH
Contact time	4 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 1

Module content

Origin and extent of modern invertebrate diversity; parasites of man and domestic animals; biology and medical importance of arachnids; insect life styles; the influence of the environment on insect life histories; insect phytophagy, predation and parasitism; insect chemical, visual, and auditory communication; freshwater invertebrates and their use as biological indicators.

African vertebrates 261 (ZEN 261)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	ZEN 161 GS or TDH
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 3

Module content

Introduction to general vertebrate diversity; African vertebrate diversity; vertebrate structure and function; vertebrate evolution; vertebrate relationships; aquatic vertebrates; terrestrial ectotherms; terrestrial endotherms; vertebrate characteristics; classification; structural adaptations; habits; habitats; conservation problems; impact of humans on other vertebrates.

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	4 lectures per week, 1 practical per week, 2 discussion classes per week
Language of tuition	English
Academic organisation	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.

Informatics 281 (INF 281)

Module credits	3.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	FRK 111, FRK 121 or FRK 100 or FRK 101
Contact time	2 practicals per week
Language of tuition	English
Academic organisation	Informatics
Period of presentation	Semester 1 or Semester 2

Module content

Computer processing of accounting information.

Fundamental and applied mineralogy 255 (GLY 255)

Module credits	24.00
Prerequisites	CMY 117, CMY 127, GLY 155, GLY 161, GLY 162, WTW 114/WTW 158 and PHY 114
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	Geology
Period of presentation	Semester 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.

Basic principles of pasture science 253 (WDE 253)

Module credits	18.00
Service modules	Faculty of Veterinary Science
Prerequisites	No prerequisites.
Language of tuition	English
Academic organisation	Plant Production and Soil Sc
Period of presentation	Semester 1

Module content

The influence of biotic and abiotic factors on the productivity of different strata and components of natural and planted pastures. This will enable the student to understand the management, production, appropriate and optimal utilisation as well as the conservation of these pastures. These principles can be used to ensure sustainable animal production and health.

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	Double Medium
Academic organisation	Mathematics and Applied Maths
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.

Introduction to dynamic meteorology 263 (WKD 263)

Module credits	14.00
Prerequisites	WTW 126 and WTW 128 (students should simultaneously be enrolled for WTW 218).
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 2

Module content

Vector algebra, curl of a vector, total and partial derivatives, second law of motion. Spherical coordinates Acceleration in rotating co-ordinates, fundamental forces, momentum equation. Three dimensional flow balance, conservation of mass, heat equation, thermodynamic energy equation. Introduction to finite difference methods. Numerical estimation of the geostrophic wind, vorticity and divergence. Advection of temperature. Development of a two-dimensional temperature advection model.

Curriculum: Final year

Minimum credits: 144

Programme-specific information

Minimum credits:

Core = 120 credits

Elective = 24 credits

Additional information:

Core modules

Environmental geomorphology 361 (GGY 361)

Module credits	18.00
Service modules	Faculty of Humanities
Prerequisites	GGY 252 and only for students studying BSc (Geography) or BSc (Environmental Sciences).
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 4

Module content

*Note: The module is available for BSc (Geography) and BSc (Environmental Sciences) students only. The theory content of this module is the same as GGY 363 and students are not allowed to earn credits for both GGY 361 and GGY 363.

Interactions of geomorphic processes within the physical and built environments; themes such as geomorphology and environmental change, slope processes and the environment, geomorphic risks and hazards, soil erosion and conservation, geomorphology in environmental management, applied weathering. Practicals involve fieldwork including sampling and mapping and subsequent laboratory analysis.

Geographic information systems 310 (GIS 310)

Module credits	24.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GGY 283 or GIS 221
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

Advanced theory and practice of Geographic Information Systems; GIS applications; design and implementation of GIS applications.

Spatial analysis 320 (GIS 320)

Module credits	24.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GIS 310 or TDH
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
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.

Sustainable development 356 (GGY 356)

Module credits	18.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 1

Module content

The module conceptually integrates environmental, economic, and social components of sustainable development. Other topics covered include changing perceptions on development and environment, development paradigms, challenges of sustainable development, actors and actions in sustainable development, rural and urban livelihoods, and a Third World assessment of sustainable development in the developing world.

Development frameworks 366 (GGY 366)

Module credits	18.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 1 practical per week

Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 3

Module content

Classic development frameworks. Spatial development history and legacy in South Africa. Overview of contemporary environmental legislation in South Africa. Rural development strategy. Rural and agricultural reconstruction. Land reform. Urban development and strategy. Urban spatial reconstruction. National spatial development frameworks.

Human environmental interactions 301 (ENV 301)

Module credits	18.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 2

Module content

The module focuses on contemporary environmental issues in southern Africa. Recent and future impacts of human pressures on natural resources, the state of the environment in South Africa, management of critical resources, population trends, biodiversity loss, pollution, water scarcity, desertification, climate change, waste accumulation and management, environmental management tools, environmental education and environmental management legislation.

Elective modules

Plant ecophysiology 356 (BOT 356)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	BOT 161 or TDH
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 1

Module content

The emphasis is on the efficiency of the mechanisms whereby C3-, C4 and CAM-plants bind CO2 and how it impacted upon by environmental factors. The mechanisms and factors which determine the respiratory conversion of carbon skeletons and how production is affected thereby will be discussed. Insight into the ecological distribution and manipulation of plants for increased production is gained by discussing the internal mechanisms whereby carbon allocation, hormone production, growth, flowering and fruitset are influenced by external factors. To understand the functioning of plants in diverse environments, the relevant structural properties of plants, and the impact of soil composition, water flow in the soil-plant air continuum and long distance transport of assimilates will be discussed. Various important techniques will be used in the practicals to investigate aspects such as water-use efficiency, photosynthesis and respiration of plants.

Plant ecology 358 (BOT 358)

Module credits	18.00
Prerequisites	BOT 161 and BOT 251 or TDH
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 1

Module content

Theory of plant community concepts, floristic and structural composition, plant diversity, ecological succession, landscape ecology. Data processing techniques. Species interactions and an evaluation of their effects on interacting species. Fundamentals of plant population biology: life tables; plant breeding systems and pollination; population dynamics; life history strategies; intraspecific competition; interspecific competition and co-existence.

Phytomedicine 365 (BOT 365)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	BOT 161 or TDH
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 2

Module content

The module will include a review on the discovery and use of plant medicines and phyto-therapeutically important molecules obtained from plants. Certain aspects of natural product chemistry i.e. the biosynthesis, ecological role and toxicity of the three main classes of secondary compounds; terpenoids, phenolics, and alkaloids are discussed. An introduction to the principles and applications of metabolomics are presented. The role of these natural products in defence against microorganisms and herbivores is reviewed during the module. The basics of alternative medicines such as homeopathy, ayurvedic medicine, acupuncture etc. are also discussed. Practical sessions on drug discovery approaches using chromatographic techniques for phytochemical analysis of secondary metabolites such as tannins, alkaloids, sterols and saponins are conducted. Bioassays on micro-organisms are also done during the practical sessions in order to develop the skills for the potential discovery of new antibiotics. Visits to several pharmaceutical laboratories are arranged.

Plant diversity 366 (BOT 366)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	BOT 161 or TDH
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant and Soil Sciences
Period of presentation	Semester 2

Module content

Basic principles and methods of plant classification. Sources of plant variation. Modern methods to ascertain evolutionary relationships among plants. The extent and significance of vascular plant diversity. General structural and biological characteristics of evolutionary and ecologically important plant groups. Botanical nomenclature. Plant identification in practice; identification methods, keys, herbaria and botanical gardens. Diagnostic characters for the field identification of trees, wild flowers and grasses. Family recognition of southern African plants. Available literature for plant identification. Methods to conduct floristic surveys. Nature and significance of voucher specimens.

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	2 practicals per week, 4 lectures per week, 1 discussion class per week
Language of tuition	English
Academic organisation	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	2 practicals per week, 1 discussion class per week, 4 lectures per week
Language of tuition	English
Academic organisation	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	2 practicals per week, 1 discussion class per week, 4 lectures per week
Language of tuition	English
Academic organisation	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	2 practicals per week, 4 lectures per week, 1 discussion class per week
Language of tuition	English
Academic organisation	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.

Applied geomorphology 363 (GGY 363)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	GGY 252
Contact time	4 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 4

Module content

*Note: The content of this module is the same as GGY 361 and students are not allowed to earn credits for both GGY 361 and GGY 363.
Interactions of geomorphic processes within the physical and built environments; themes such as geomorphology and environmental change, slope processes and the environment, geomorphic risks and hazards, soil erosion and conservation, geomorphology in environmental management, applied weathering.

Soil chemistry 320 (GKD 320)

Module credits	14.00
Prerequisites	GKD 250
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant Production and Soil Sc
Period of presentation	Semester 2

Module content

The more exact chemistry of soils systematically explained by understanding the particular chemical principles. Charge origin. Chemical equilibriums. 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	Both Afr and Eng
Academic organisation	Plant Production and Soil Sc
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.

Ore deposits 361 (GLY 361)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Five of the second year modules: GLY 253, GLY 254, GLY 255, GLY 261, GLY 262, GLY 265
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 2

Module content

Systematic review of major metallic and non-metallic ore types and examples in South Africa and world-wide; ore type models (grades, tonnages); geometry of ore bodies; mining. Ore samples and ore mineralogy. Mapping techniques.

Geostatistics and ore reserve calculations 362 (GLY 362)

Module credits	18.00
Prerequisites	GLY 253, GLY 254, GLY 255, GLY 261, GLY 262, GLY 265
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 1

Module content

Review of classical geostatistical methods; problem evaluation; descriptive statistics, normal-, lognormal, three parameter lognormal distributions; confidence intervals; t-test. Sampling; cut-off values; grid generation and trend surface analysis. Semivariogram; error estimation; Kriging (BLUE) techniques. Ore reserve calculations.

Engineering geology 363 (GLY 363)

Module credits	18.00
Prerequisites	GLY155 and GLY265 and 4 of the second year modules: GLY253, GLY254, GLY255, GLY261, GLY262
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	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.

Remote sensing 320 (GMA 320)

Module credits	24.00
Prerequisites	GMA 220 or TDH
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
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.

Geometrical and space geodesy 310 (GMC 310)

Module credits	24.00
Prerequisites	GMC110 and WTW114/WTW 134
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Double Medium
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 1

Module content

Spherical trigonometry. Geometrical Geodesy: Datum surfaces and coordinate systems in Geodesy, Calculations on the ellipsoid, Datum transformations. Map projections: Projection principles, distortion determination, construction of conformal, equivalent and equidistant projections, the Transverse Mercator projection and UTM projection of an ellipsoidal earth, projection transformations. Space Geodesy: Time systems, Celestial and observer coordinate systems, Global Navigation Satellite Systems (GNSS), Satellite orbits and orbital parameters, 3¬ D positioning.

Soil-water relationship and irrigation 350 (PGW 350)

Module credits	16.00
Prerequisites	GKD 250
Contact time	fortnightly practicals, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Plant Production and Soil Sc
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.

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 220 GS and WTW 248 GS
Contact time	2 discussion classes per week, 4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	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	3 lectures per week, 2 practicals per week, 1 tutorial per week
Language of tuition	Both Afr and Eng
Academic organisation	Civil Eng
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.

Principles of veld management 310 (WDE 310)

Module credits	14.00
Prerequisites	No prerequisites.
Contact time	fortnightly practicals, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Plant Production and Soil Sc
Period of presentation	Semester 1

Module content

The influence of biotic and abiotic factors on the productivity of different strata and components of natural pastures. This will enable the student to advise users, with the necessary motivation, on the appropriate use of these strata and components and will form a basis for further research on this system. The principles of veld management s and the influence of management practices on sustainable animal production from natural pastures. This will enable the student to advise users on veld management and veld management principles. It will also form a basis for further research on veld management.

Planted pastures and fodder crops 320 (WDE 320)

Module credits	14.00
Prerequisites	WDE 310
Contact time	2 lectures per week, fortnightly practicals
Language of tuition	Double Medium
Academic organisation	Plant Production and Soil Sc
Period of presentation	Semester 2

Module content

The establishment and use of planted pastures species and fodder crops and the
conservation of fodder. This will enable students to advise users on establishment and utilization of planted pastures species as well as farmers on the production,
conservation and optimum use of fodder. This will also form a basis for further research on planted pastures.

Atmospheric vorticity and divergence 352 (WKD 352)

Module credits	18.00
Prerequisites	WKD 263 GS and WTW 248 GS
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Quarter 3

Module content

Scale analyses and simplification of the basic equations. The geostrophic, thermal and gradient wind. The vorticity equation and divergence.

Quasi-geostrophic analysis 361 (WKD 361)

Module credits	18.00
Prerequisites	WKD 352 GS and WKD 254
Contact time	4 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor

Period of presentation	Quarter 4

Module content

Tendency and Omega equations. Model of a boroclinic system. Introduction to numerical models. Application in meteorological display and analysis software.

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	2 lectures per week, 1 tutorial per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
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	2 lectures per week, 1 tutorial per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
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.

Financial engineering 354 (WTW 354)

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	WST 211, WTW 211 and WTW 218

Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Module content

Mean variance portfolio theory. Market equilibrium models such as the capital asset pricing model. Factor models and arbitrage pricing theory. Measures of investment risk. Efficient market hypothesis. Stochastic models of security prices

Financial engineering 364 (WTW 364)

Module credits	18.00
Prerequisites	WST 211, WTW 126, WTW 218 and WTW 286 or WTW 264
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Module content

Discrete time financial models: Arbitrage and hedging; the binomial model. Continuous time financial models: The Black-Scholes formula; pricing of options and the other derivatives; interest rate models; numerical procedures.

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	Double Medium
Academic organisation	Mathematics and Applied Maths
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 or WTW 264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
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 124 and WTW 211
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
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 or WTW 264
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Double Medium

Academic organisation	Mathematics and Applied Maths
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 or WTW 264
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
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	2 lectures per week, 1 tutorial per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
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.

Population ecology 351 (ZEN 351)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.

Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 1

Module content

Scientific approach to ecology; evolution and ecology; the individual and its environment; population characteristics and demography; competition; predation; plant-herbivore interactions; regulation of populations; population manipulation.

Mammalogy 352 (ZEN 352)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 1

Module content

Mammalian origins and their characteristics: evolution of African mammals; structure and function: integument, support and movement; foods and feeding; environmental adaptations; reproduction; behaviour; ecology and biogeography; social behaviour; sexual selection; parental care and mating systems; community ecology; zoogeography. Special topics: parasites and diseases; domestication and domesticated mammals; conservation.

Community ecology 353 (ZEN 353)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 2

Module content

The scientific approach; characteristics of the community; the community as a superorganism; community changes; competition as a factor determining community structure; disturbance as a determinant of community structure; community stability; macroecological patterns and mechanisms.

Evolutionary physiology 354 (ZEN 354)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 2

Module content

This module focuses on the integration of physiological systems in the context of animal form and function, and the ways in which evolution shapes the physiological processes that determine the energy, water and nutrient fluxes between animals and their environments. Topics covered include: (i) circulation, gas exchange and excretion; (ii) nutritional ecology; (iii) osmoregulation and thermoregulation; and (iv) reproductive physiology. The major focus of this module is to understand the major sources of physiological diversity, namely scaling, phylogenetic inertia, adaptation and phenotypic plasticity, and applying this knowledge to conceptually link physiological processes at the cellular level to macrophysiological patterns at a global scale.

Insect diversity 355 (ZEN 355)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	ZEN 251 GS or TDH
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 1

Module content

The extent and significance of insect diversity. Functional insect morphology. The basic principles of taxonomy and the classification of taxa within the Insecta. Insect orders and economically and ecologically important Southern African insect families. Identification of insect orders and families using distinguishing characteristics. General biological and behavioural characteristics of each group. Grouping of insects into similar life-styles and habitats.

Physiological processes 361 (ZEN 361)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 2 practicals per week

Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 3

Module content

This module focuses on the means by which animals can sense and respond to the external and internal environment. Topics covered include: (i) the structure and function of biological membranes; (ii) neurons and nervous systems; (iii) sensing the environment; (iv) glands, hormones and regulation of development and growth; (v) muscles and animal movement and (vi) the initiation and control of behaviour. The implications of these physiological processes for animal conservation and management will be emphasised. A comparative approach will be adopted throughout the module to highlight the commonalities as well as the ways in which animal lineages have achieved similar functional outcomes from different structural adaptations.

Evolution and phylogeny 362 (ZEN 362)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 3

Module content

Evolution as a process and pattern, prime movers in evolution: Selection, drift, general population genetics. Population differentiation, clines, subspecies and species, adaptation as a major force in evolution and the panglossian paradigm, molecular evolution. Phylogeography, phylogenetic reconstruction. Evolutionary biogeography. Adaptation, Darwin's formulation, proximate and ultimate causation, genetic and developmental constraints, optimality. Phenotypic models, the comparative method, convergent evolution. Evolution of complex biological systems, origin of life and sex, macro-evolution, punctuated equilibrium, human evolution. Levels of selection. Species concepts.

Behavioural ecology 363 (ZEN 363)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 4

Module content
The history of behavioural ecology. A causal, developmental, evolutionary and adaptive approach. Sensory systems and communication. Sexual selection, mate choice and sperm competition. Kin selection and group living. Special reference to social insects. The behavioural ecology of humans. Phylogenetic basis of behavioural analysis. The role of behavioural ecology in conservation planning.

Conservation ecology 364 (ZEN 364)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 4

Module content

This module is intended to provide students with skills to undertake field surveys that are essential for research and planning in the conservation of biodiversity. The module has a large fieldwork component. A field trip will be conducted over a ten-day period during the September vacation in the Sani Pass region of the Drakensberg (including South Africa and Lesotho).
The students will be actively involved in planning and executing the field surveys, and will be responsible for analysing and presenting the results. The students will gain valuable practical experience in the field by applying a number of survey techniques and focusing on several different taxa that are relevant to conservation ecology.

Applied entomology 365 (ZEN 365)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	Zoology and Entomology
Period of presentation	Quarter 4

Module content

*It is strongly recommended that students first complete ZEN 355: Insect diversity 355
Impact of insects on economies, human health and well-being. Protection of corps from insect herbivores through monitoring, forecasting and application of the principles of integrated pest management; epidemiology and modern developments in the control of insect vectors of human and animal diseases; insects as a tool in forensic investigations; ecological and economic significance of insect pollinators and current threats to their survival and health. Lecturers will be complemented by practical experiences that provide students with skills in the design, conduct, analysis, interpretation and reporting of applied entomological research.

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 220 GS and WTW 248 GS
Contact time	2 discussion classes per week, 4 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	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.

Rock mechanics 364 (GLY 364)

Module credits	18.00
Prerequisites	GLY 254 and 4 of the second-year modules: GLY 255, GLY 253, GLY 261, GLY 262, GLY 265
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	English
Academic organisation	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.

Fundamentals of weather forecasting 366 (WKD 366)

Module credits	36.00
Prerequisites	WKD 155, WKD 261, WKD 254 (students should simultaneously be enrolled for WKD 361)
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Geography, Geoinf + Meteor
Period of presentation	Semester 2

Module content

Meterological observations data codes. Weather applications software and computing environments of meteorological analysis and weather forecasting techniques. Applications of remote sensing in weather forecasting. Aaerological diagrams. Applications of numerical weather prediction, and types of weather forecasts. Integration of information to describe the current state of the atmosphere and to predict a future state of the atmosphere.

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.