University of Pretoria Yearbook 2019

BSc Environmental Sciences (02133362)

Minimum duration of study	3 years
Total credits	426

Admission requirements

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

Minimum requirements Achievement level English Home Language or English First Additional Language		**Mathematics**		**Physical Science**		**APS**
NSC/IEB	AS Level	NSC/IEB	AS Level	NSC/IEB	AS Level	
5	C	5	C	5	C	**32**

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

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

BSc Extended Programme for the Physical Sciences Minimum requirements Achievement level English Home Language or English First Additional Language		**Mathematics**		**Physical Science**		**APS**
NSC/IEB	AS Level	NSC/IEB	AS Level	NSC/IEB	AS Level	
4	D	4	D	4	D	**26**

Other programme-specific information

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

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

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

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

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

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

The prerequisites are listed in the Alphabetical list of modules.

Promotion to next study year

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

General promotion requirements in the faculty
All students whose academic progress is not acceptable can be suspended from further studies.

- A student who is excluded from further studies in terms of the stipulations of the abovementioned regulations,

will be notified in writing by the Dean or Admissions Committee at the end of the relevant semester.

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

Pass with distinction

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

Curriculum: Year 1

Minimum credits: 140

Minimum credits: 140

Fundamental = 12

Core = 128

Additional information:

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

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

No elective credits are required. However depending on a student's second major or theme, the following combinations of modules are recommended:

- **Chemistry as a second major:** WTW 114 instead of WTW 134
- **Ecology as a theme:** GMC 110
- **Geography as a second major:** GMC 110
- **Geoinformatics as a theme:** GMC 110

Fundamental modules

Academic information management 102 (AIM 102)

Module credits	6.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Information Science
Period of presentation	Semester 2

Module content

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

Academic information management 111 (AIM 111)

Module credits	4.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Information Science
Period of presentation	Semester 1

Module content

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

Academic information management 121 (AIM 121)

Module credits	4.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities Faculty of Law Faculty of Health Sciences Faculty of Natural and Agricultural Sciences Faculty of Theology and Religion Faculty of Veterinary Science
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Module is presented in English
Department	Informatics
Period of presentation	Semester 2

Module content

Apply effective search strategies in different technological environments. Demonstrate the ethical and fair use of information resources. Integrate 21st-century communications into the management of academic information.

Language and study skills 110 (LST 110)

Module credits	6.00

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

Module content

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

Academic orientation 102 (UPO 102)

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

Core 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	Module is presented in English
Department	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	2 lectures per week, fortnightly practicals
Language of tuition	Module is presented in English
Department	Department of 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	A candidate must have Mathematics for at least 60% and 60% for Physical Sciences.
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Semester 1

Module content

General introduction to inorganic, analytical and physical chemistry. Atomic structure and periodicity. Molecular structure and chemical bonding using the VSEOR model. Nomenclature of inorganic ions and compounds. Classification of reactions: precipitation, acid-base, redox reactions and gas-forming reactions. Mole concept and stoichiometric calculations concerning chemical formulas and chemical reactions. Principles of reactivity: energy and chemical reactions. Physical behaviour gases, liquids, solids and solutions and the role of intermolecular forces. Rate of reactions: Introduction to chemical kinetics.

General chemistry 127 (CMY 127)

Module credits	16.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
Prerequisites	Natural and Agricultural Sciences students: CMY 117 GS or CMY 154 GS Health Sciences students: none
Contact time	4 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Semester 2

Module content

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

Introduction to 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	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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.

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	3 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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.

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	A candidate who has passed Mathematics with at least 60% in the Grade 12 examination
Contact time	1 practical/tutorial per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Biochemistry, Genetics and Microbiology

Period of presentation	Semester 1

Module content

Introduction to the molecular structure and function of the cell. Basic chemistry of the cell. Structure and composition of prokaryotic and eukaryotic cells. Ultrastructure and function of cellular organelles, membranes and the cytoskeleton. General principles of energy, enzymes and cell metabolism. Selected processes, e.g. glycolysis, respiration and/or photosynthesis. Introduction to molecular genetics: DNA structure and replication, transcription, translation. Cell growth and cell division.

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	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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	50% for Mathematics in Grade 12
Contact time	4 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 1

Module content

**Students will not be credited for more than one of the 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.

Animal diversity 161 (ZEN 161)

Module credits	8.00
Service modules	Faculty of Education Faculty of Veterinary Science
Prerequisites	MLB 111 GS or permission from the HOD.
Contact time	2 lectures per week, fortnightly practicals
Language of tuition	Module is presented in English
Department	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.

Curriculum: Year 2

Minimum credits: 144

Minimum credits: 144

Core = 84

Elective = 60

Additional information:

Students are advised to select elective modules based on the requirements for a second major or a theme of interest. Further electives may then be selected to complete the required number of credits. It is the student's responsibility to ensure that all prerequisites are taken into account. The prerequisites for each module are listed in its yearbook entry. Second majors (leading to honours studies) that may be combined with Environmental Science are Geography or Chemistry. GIS or Ecology could form synergic themes (not leading to honours) with Environmental Science.

Students must select elective modules with a total number of at least 60 credits. Depending on a student's second major and other interests, the following modules are recommended:

- **Chemistry as a second major:** CMY 282, CMY 283, CMY 284, CMY 285 (Credits 48)
- **Ecology as a theme:** GGY 283, PPK 251, GMA 220, LEK 210 (Credits 55)
- **Geography as second major:** GMA 220, GGY283, GGY 266, (Credits 52)
- **Geoinformatics as a theme:** GMA 220, GGY 283, INF 214, GIS 220 (Credits 56)

Core modules

South African flora and vegetation 251 (BOT 251)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	BOT 161 or permission from head of department
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Department of Plant and Soil Sciences
Period of presentation	Semester 1

Module content

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 permission from head of department

Contact time	2 lectures per week, 1 practical per week
Language of tuition	Separate classes for Afrikaans and English
Department	Department of 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.

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	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Quarter 2

Module content

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

Geographic information systems introduction 221 (GIS 221)

Module credits	12.00
Prerequisites	Prohibited combination GGY 283
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 2

Module content

*GIS 221 does not lead to admission to any module at 300 level.
Introduction to Geographic Information Systems (GIS), theoretical concepts and applications of GIS. The focus will be on the GIS process of data input, data analysis, data output and associated technologies.This module teaches students to use GIS as a tool.

Introductory soil science 250 (GKD 250)

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	CMY 117 GS or permission from the HOD
Contact time	3 lectures per week, 1 practical per week
Language of tuition	Separate classes for Afrikaans and English
Department	Department of Plant and Soil Sciences
Period of presentation	Semester 1

Module content

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

Invertebrate biology 251 (ZEN 251)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	ZEN 161 GS or permission from the HOD.
Contact time	4 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	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 permission from the HOD.
Contact time	4 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	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.

Elective modules

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, 2 practicals per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 2

Module content

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

Analytical chemistry 283 (CMY 283)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	CMY 117 and CMY 127
Contact time	2 practicals per week, 4 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 3

Module content

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

Organic chemistry 284 (CMY 284)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	CMY 117 and CMY 127
Contact time	2 practicals per week, 4 lectures per week, 1 tutorial per week

Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 1

Module content

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

Inorganic chemistry 285 (CMY 285)

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	CMY 117 and CMY 127
Contact time	4 lectures per week, 1 tutorial per week, 2 practicals per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 4

Module content

Theory: Atomic structure, structure of solids (ionic model). Coordination chemistry of transition metals: Oxidation states of transition metals, ligands, stereochemistry, crystal field theory, consequences of d-orbital splitting, chemistry of the main group elements, electrochemical properties of transition metals in aqueous solution, industrial applications of transition metals.Fundamentals of spectroscopy and introduction to IR spectroscopy.

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	3 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 2

Module content

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

Introductory geographic information systems 283 (GGY 283)

Module credits	14.00

Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities
Prerequisites	GMC 110
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 1

Module content

Introduction to Geographic Information Systems (GIS), theoretical concepts and applications of GIS. The focus will be on the GIS process of data input, data analysis, data output and associated technologies. This module provides the foundations for more advanced GIS and Geoinformatics topics.

Geographic data analysis 220 (GIS 220)

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

Module content

The nature of geographical data and measurement.Application of statistics in the geographical domain. Probability, probability distributions and densities, expected values and variances, Central Limit theorem. Sampling techniques. Exploratory data analysis, descriptive statistics, statistical estimation, hypothesis testing, correlation analysis and regression analysis.

Remote sensing 220 (GMA 220)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GMC 110
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 1

Module content

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

Informatics 214 (INF 214)

Module credits	14.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
Prerequisites	AIM 101 or AIM 111 and AIM 121
Contact time	2 lectures per week, 2 practicals per week
Language of tuition	Module is presented in English
Department	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.

Introduction to agricultural economics 210 (LEK 210)

Module credits	12.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	No prerequisites.
Contact time	3 lectures per week
Language of tuition	Afrikaans and English are used in one class
Department	Agricultural Economics Extension and Rural Develo
Period of presentation	Semester 1

Module content

Introduction to financial management in agriculture: Farm management and agricultural finance, farm management information; analysis and interpretation of farm financial statements; risk and farm planning. Budgets: partial, break-even, enterprise, total, cash flow and capital budgets. Time value of money. Introduction to production and resource use: the agricultural production function, total physical product curve, marginal physical product curve, average physical product curve, stages of production. Assessing short-term business costs; Economics of short-term decisions. Economics of input substitution: Least-cost use of inputs for a given output, short-term least-cost input use, effects of input price changes. Least-cost input use for a given budget. Economics of product substitution. Product combinations for maximum profit. Economics of crop and animal production.

Sustainable crop production and agroclimatology 251 (PPK 251)

Module credits	15.00
Prerequisites	BOT 161
Contact time	fortnightly practicals, 3 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Department of Plant and Soil Sciences
Period of presentation	Semester 2

Module content

Influence of climate on cropping systems in South Africa. The surface energy balance. Hydrological cycles and the soil water balance. Sustainable crop production. Simple radiation and water limited models. Potential yield, target yield and maximum economic yield. Crop nutrition and fertiliser management. Principles of soil cultivation and conservation. Climate change and crop production – mitigation and adaptation.

Physical meteorology 261 (WKD 261)

Module credits	12.00
Prerequisites	WTW 114
Contact time	4 lectures per week, 1 tutorial per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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. Radiative transfer. The physical basis of climate change.

Curriculum: Final year

Minimum credits: 144

Minimum credits: 144

Core = 36

Elective = 108

Students must select elective modules with a total number of at least 108 credits. Depending on a student's second major and other interests, the following modules are recommended.

- **Chemistry as a second major**: CMY 382, CMY 383, CMY 384, CMY 385 (Credits 72)
- **Ecology as theme:** GIS 310, BOT 358, BOT 366, ZEN 351, ZEN 353, ZEN 362, ZEN 364 (Credits 112)
- **Geography as a second major:** GMA 320, GGY 356, GGY 366 (Credits 58)
- **Geoinformatics as theme:** GIS 310, GIS 320, GMA 320 (66 Credits)

Core modules

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	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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.

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	2 practicals per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology

Period of presentation	Quarter 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.

Elective modules

Plant ecology 358 (BOT 358)

Module credits	18.00
Prerequisites	BOT 161 and BOT 251 or permission from head of department
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Separate classes for Afrikaans and English
Department	Department of Plant and Soil Sciences
Period of presentation	Semester 1

Module content

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.

Plant diversity 366 (BOT 366)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	BOT 161 or permission from head of department
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Separate classes for Afrikaans and English
Department	Department of Plant and Soil Sciences
Period of presentation	Semester 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	4 lectures per week, 2 practicals per week, 1 discussion class per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 4

Module content

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

Analytical chemistry 383 (CMY 383)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	2 practicals per week, 1 discussion class per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 1

Module content

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

Organic chemistry 384 (CMY 384)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	2 practicals per week, 1 discussion class per week, 4 lectures per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 3

Module content

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

Inorganic chemistry 385 (CMY 385)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	CMY 282, CMY 283, CMY 284 and CMY 285
Contact time	4 lectures per week, 2 practicals per week, 1 discussion class per week
Language of tuition	Module is presented in English
Department	Chemistry
Period of presentation	Quarter 2

Module content

Theory: Structure and bonding in inorganic chemistry. Molecular orbital approach, diatomic and polyatomic molecules, three-centre bonds, metal-metal bonds, transition metal complexes, magnetic properties, electronic spectra, reactivity and reaction mechanisms, reaction types, acid-base concepts, non-aqueous solvents, special topics.

Sustainable development 356 (GGY 356)

Module credits	18.00
Service modules	Faculty of Education Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	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	1 practical per week, 3 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
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.

Geographic information systems 310 (GIS 310)

Module credits	22.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GGY 283
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 1

Module content

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

Spatial analysis 320 (GIS 320)

Module credits	22.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	GIS 310 or permission from the HOD.
Contact time	1 practical per week, 2 lectures per week

Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 2

Module content

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. A project or assignment of at least 64 notional hours.

Soil classification and surveying 350 (GKD 350)

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

Module content

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

Remote sensing 320 (GMA 320)

Module credits	22.00
Prerequisites	GMA 220
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Module is presented in English
Department	Geography Geoinformatics and Meteorology
Period of presentation	Semester 2

Module content

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

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	Module is presented in English
Department	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.

Community ecology 353 (ZEN 353)

Module credits	18.00
Service modules	Faculty of Education
Prerequisites	ZEN 351 (50%) (Note: Prerequisite not applicable to students enrolled for a dual major in Zoology and Plant Science).
Contact time	4 lectures per week, 2 practicals per week
Language of tuition	Module is presented in English
Department	Zoology and Entomology
Period of presentation	Quarter 4

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 environmental gradients and communities. A field trip will be conducted during the September vacation to the Sani Pass region of the Maloti-Drakensberg Mountains.

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	Module is presented in English
Department	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	Module is presented in English
Department	Zoology and Entomology
Period of presentation	Quarter 2

Module content

This module is intended to provide students with the skills and knowledge that are essential for the conservation of biodiversity. The module focuses on conservation theory and practice (e.g. endangered species, habitat loss, overexploitation, climate change), and has a practical component. The students will be actively involved in planning and executing field projects, and will be responsible for analysing and presenting the results. The students will gain valuable theoretical and practical experience in the field of conservation ecology by being exposed to a number of different taxa.