

# University of Pretoria Yearbook 2016

## BSc Genetics (03133051)

**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	30

Candidates who do not comply with the minimum admission requirements above because they obtained a NSC/IEB achievement level of 4 in one of the prescribed prerequisite subjects are required to write the NBT and 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 may enrol for AIM 111 and AIM 121 instead of AIM 101 (the same content presented over 2 semesters).

Electives are chosen as follows:

Second year – 12 credits

Third year – 54 credits

- **Electives in the second year may be chosen from: BCM 262, GGY 283, PLG 262, MBY 262.**
- **Students interested in combining Genetics in a dual major with Microbiology must take PLG 262.**
- **Students interested in combining Genetics in a dual major with Biochemistry must take BCM 262 and may replace [BOT 251 + BOT 261] and [ZEN 251 + ZEN 261] with [CMY 282 + CMY 284 + CMY**

## **283 + CMY 285].**

Single major track:

Electives may be chosen from any combination of:

BCM 356, BCM 357, BCM 367, BCM 368, BOT 356, BOT 358, BOT 365, MBY 351, MBY 355, MBY 364, MBY 365, PLG 351, PLG 363, ZEN 361, ZEN 363.

Dual major track:

- Genetics and Biochemistry combination:

Students must replace BTC 361 with Biochemistry modules and must take [BCM 356 + BCM 357] and [BCM 367 + BCM 368] to a total value of 72 credits.

- Genetics and Microbiology combination:

Students must replace either GTS 368 or BTC 361 with Microbiology modules, and must take [MBY 351 + MBY 355] and [MBY 364 + MBY 365] to a total value of 72 credits.

- Genetics and Plant Science combination:

Students must take [BOT 356 + BOT 358] and [BOT 365] to a value of 54 credits. Students may also choose to replace GTS 368 with BOT 366.

- Genetics and Zoology combination:

Students must replace either BTC 361 or GTS 368 with Zoology modules, and must take [any 2 modules of ZEN 351 or ZEN 352 or ZEN 353 or ZEN 354] and [ZEN 361 + ZEN 363] to a total value of 72 credits.

- Genetics and Entomology combination:

Students must replace either BTC 361 or GTS 368 with Zoology modules, and must take [ZEN 355 + ZEN 351 or ZEN 353 or ZEN 354] and [ZEN 361 + ZEN 365] to a total value of 72 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 the first semester during the first year provided that he or she obtained a final mark of no less than 70% for grade 12 Mathematics and achieved an APS of 34 or more in the NSC.

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

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

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

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

The prerequisites are listed in the Alphabetical list of modules.

## 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

### 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

### 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

<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
<b>Prerequisites</b>	Final Grade 12 marks of at least 60% for Mathematics and 60% for Physical Sciences.
<b>Contact time</b>	1 practical per week, 4 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Chemistry
<b>Period of presentation</b>	Semester 1

## Module content

General introduction to inorganic, analytical and physical chemistry. Atomic structure and periodicity. Molecular structure and chemical bonding using the VSEOR model. Nomenclature of 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

<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
<b>Prerequisites</b>	Natural and Agricultural Sciences students: CMY 117 GS or CMY 154 GS Health Sciences students: none
<b>Contact time</b>	1 practical per week, 4 lectures per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Chemistry
<b>Period of presentation</b>	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.

## Introductory genetics 161 (GTS 161)

**Module credits** 8.00

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

**Prerequisites** MLB 111 GS

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

**Language of tuition** Both Afr and Eng

**Academic organisation** Genetics

**Period of presentation** Semester 2

## Module content

Chromosomes and cell division. Principles of Mendelian inheritance: locus and alleles, dominance interactions and epistasis. Probability studies. Sex determination and sex linked traits. Pedigree analysis. Extranuclear inheritance. Genetic linkage and chromosome mapping. Chromosome variation.

## Introduction to microbiology 161 (MBY 161)

**Module credits** 8.00

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

**Prerequisites** MLB 111 GS

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

**Language of tuition** Both Afr and Eng

**Academic organisation** Microbiology and Plant Path

**Period of presentation** Semester 2

## Module content

The module will introduce the student to the field of Microbiology. Basic Microbiological aspects that will be covered include introduction into the diversity of the microbial world (bacteria, archaea, eukaryotic microorganisms and viruses), basic principles of cell structure and function, microbial nutrition and microbial growth and growth control. Applications in Microbiology will be illustrated by specific examples i.e. bioremediation, animal-microbial symbiosis, plant-microbial symbiosis and the use of microorganisms in industrial microbiology. Wastewater treatment, microbial diseases and food will be introduced using specific examples.





## 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.

## Physics for biology students 131 (PHY 131)

**Module credits** 16.00

**Service modules** Faculty of Education  
Faculty of Health Sciences  
Faculty of Veterinary Science

**Prerequisites** Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 50% in the Grade 12 examination

**Contact time** 1 practical per week, 4 lectures per week, 1 discussion class per week

**Language of tuition** Both Afr and Eng

**Academic organisation** Physics

**Period of presentation** Semester 1

### Module content

Units, vectors, one dimensional kinematics, dynamics, work, equilibrium, sound, liquids, heat, thermodynamic processes, electric potential and capacitance, direct current and alternating current, optics, modern physics, radio activity.

## 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 .

<b>Contact time</b>	4 lectures per week, 1 tutorial per week
<b>Language of tuition</b>	Both Afr and Eng
<b>Academic organisation</b>	Mathematics and Applied Maths
<b>Period of presentation</b>	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 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.

## Curriculum: Year 2

**Minimum credits: 144**

### Core modules

#### Introduction to proteins and enzymes 251 (BCM 251)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Health Sciences
<b>Prerequisites</b>	[CMY117 GS] and [CMY127 GS] and [MLB111 GS]
<b>Contact time</b>	2 lectures per week, 90 minute practical per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 1

##### Module content

Structural and ionic properties of amino acids. Peptides, the peptide bond, primary, secondary, tertiary and quaternary structure of proteins. Interactions that stabilise protein structure, denaturation and renaturation of proteins. Introduction to methods for the purification of proteins, amino acid composition, and sequence determinations. Introduction to enzyme kinetics and enzyme inhibition. Allosteric enzymes, regulation of enzyme activity, active centres and mechanisms of enzyme catalysis. Examples of industrial applications of enzymes. Practical training in laboratory techniques and Good Laboratory Practice. Techniques for the quantitative and qualitative analysis of biological molecules. Processing and presentation of scientific data.

#### Carbohydrate metabolism 252 (BCM 252)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Education Faculty of Health Sciences
<b>Prerequisites</b>	[CMY117 GS] and [CMY127 GS] and [MLB111 GS]
<b>Contact time</b>	90 minute practical per week, 2 lectures per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 1

##### Module content

Biochemistry of carbohydrates. Thermodynamics and bioenergetics. Glycolysis, citric acid cycle and electron transport. Glycogen metabolism, pentose-phosphate pathway, gluconeogenesis and photosynthesis. Practical training in study and analysis of metabolic pathways and enzymes. Scientific method and design: Hypothesis design and testing, method design and scientific controls.

#### Lipid and nitrogen metabolism 261 (BCM 261)

<b>Module credits</b>	12.00
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<b>Service modules</b>	Faculty of Health Sciences
<b>Prerequisites</b>	[CMY117 GS] and [CMY127 GS] and [MLB111 GS]
<b>Contact time</b>	90 minute practical per week, 2 lectures per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 2

#### Module content

Biochemistry of lipids, membrane structure, anabolism and catabolism of lipids. Nitrogen metabolism, amino acid biosynthesis and catabolism. Biosynthesis of neurotransmitters, pigments, hormones and nucleotides from amino acids. Catabolism of purines and pyrimidines. Therapeutic agents directed against nucleotide metabolism. Examples of inborn errors of metabolism of nitrogen containing compounds. The urea cycle, nitrogen excretion. Practical training in scientific writing skills: evaluation of a scientific report. Techniques for separation and analysis of biological molecules

### South African flora and vegetation 251 (BOT 251)

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

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

## Molecular genetics 251 (GTS 251)

**Module credits** 12.00

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

**Prerequisites** GTS 161 GS

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

**Language of tuition** English

**Academic organisation** Genetics

**Period of presentation** Semester 1

### Module content

Chemical nature of DNA. Replication transcription, RNA processing and translation. Control of gene expression in prokaryotes and eukaryotes. Recombinant DNA technology and its applications in gene analysis and manipulation.

## Genetic diversity and evolution 261 (GTS 261)

**Module credits** 12.00

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

**Prerequisites** GTS 251 GS

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

**Language of tuition** English

**Academic organisation** Genetics

**Period of presentation** Semester 2

### Module content

Chromosome structure and transposable elements. Mutation and DNA repair. Genomics and proteomics. Organelle genomes. Introduction to genetic analysis of populations: allele and genotypic frequencies, Hardy Weinberg Law, its extensions and implications for different mating systems. Introduction to quantitative and evolutionary genetics.

## Bacteriology 251 (MBY 251)

**Module credits** 12.00

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

<b>Prerequisites</b>	MBY 161 GS
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 1

#### Module content

Growth, replication and survival of bacteria, Energy sources, harvesting from light versus oxidation, regulation of catabolic pathways, chemotaxis. Nitrogen metabolism, iron-scavenging. Alternative electron acceptors: denitrification, sulphate reduction, methanogenesis. Bacterial evolution, systematic and genomics. Biodiversity; bacteria occurring in the natural environment (soil, water and air), associated with humans, animals, plants, and those of importance in foods and in the water industry.

### Mycology 261 (MBY 261)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	MBY 161
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 2

#### Module content

Organisation and molecular architecture of fungal thalli, chemistry of the fungal cell. Chemical and physiological requirements for growth and nutrient acquisition. Mating and meiosis; spore development; spore dormancy, dispersal and germination. Fungi as saprobes in soil, air, plant, aquatic and marine ecosystems; role of fungi as decomposers and in the deterioration of materials; fungi as predators and parasites; mycoses, mycetisms and mycotoxicoses; fungi as symbionts of plants, insects and animals. Applications of fungi in biotechnology.

### Invertebrate biology 251 (ZEN 251)

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

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

### Biochemical principles of nutrition and toxicology 262 (BCM 262)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Health Sciences
<b>Prerequisites</b>	[CMY117 GS] and [CMY127 GS] and [MLB111 GS]
<b>Contact time</b>	90 minute practical per week, 2 lectures per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 2



## Module content

Biochemistry of nutrition and toxicology. Proximate analysis of nutrients. Review of energy requirements and expenditure. Respiratory quotient. Requirements and function of water, vitamins and minerals. Interpretation and modification of RDA values for specific diets, eg growth, exercise, pregnancy and lactation, aging and starvation. Interactions between nutrients. Comparison of monogastric and ruminant metabolism. Cholesterol, polyunsaturated, essential fatty acids and dietary anti-oxidants. Oxidation of fats. Biochemical mechanisms of water- and fat-soluble vitamins and assessment of vitamin status. Mineral requirements, biochemical mechanisms, imbalances and diarrhoea. Biochemistry of xenobiotics: absorption, distribution, metabolism and excretion (ADME); detoxification reactions: oxidation/reduction (Phase I), conjugations (Phase II), export from cells (Phase III); factors affecting metabolism and disposition. Toxic responses: tissue damage and physiological effects, teratogenesis, immunotoxicity, mutagenesis and carcinogenesis. Examples of toxins: biochemical mechanisms of common toxins and their antidotes. Antibiotics and resistance. Natural toxins from fungi, plants and animals: goitrogens, cyanogens, cholinesterase inhibitors, ergotoxin, aflatoxins. Practical training in analyses of nutrients, fatty acids separations, antioxidant determination, and enzyme activity measurements, PO ratio of mitochondria, electrophoresis, extraction, solubility and gel permeation techniques.

## Physical chemistry 282 (CMY 282)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	CMY 117 and CMY 127
<b>Contact time</b>	4 lectures per week, 1 tutorial per week, 2 practicals per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Chemistry
<b>Period of presentation</b>	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)

<b>Module credits</b>	12.00
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	CMY 117 and CMY 127
<b>Contact time</b>	2 practicals per week, 4 lectures per week, 1 tutorial per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Chemistry
<b>Period of presentation</b>	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  $^{13}\text{C}$  NMR spectroscopy. Electrophilic addition: alkenes. Nucleophilic substitution, elimination, addition: alkyl halides, alcohols, ethers, epoxides, carbonyl compounds: ketones, aldehydes, carboxylic acids and their derivatives.

### 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.

### 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

<b>Prerequisites</b>	Only available to students studying the following:12132022, 12132002, 12132004, 02133312, 02133383, 02133361, 02133385, 09133040 and 01130001
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Geography, Geoinf + Meteor
<b>Period of presentation</b>	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.

## Introduction to crop protection 251 (PLG 251)

<b>Module credits</b>	12.00
<b>Prerequisites</b>	No prerequisites.
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 1

### Module content

Development and importance of crop protection. Basic principles in crop protection i.e. epidemic development of disease and insect pest populations, ecology of plant diseases and abiotic factors that affect plant health i.e. environmental pollution and pesticides, nutrient deficiencies and extreme environmental conditions. Ecological aspects of plant diseases, pest outbreaks and weed invasion. Important agricultural pests and weeds. Life cycles of typical disease causing organisms. Basic principles of integrated pest and disease management.

## Principles of plant pathology 262 (PLG 262)

<b>Module credits</b>	12.00
<b>Prerequisites</b>	MBY 161
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 2

### Module content

Fundamental principles of plant pathology. The concept of disease in plants. Causes of plant diseases. Stages in development of plant diseases. Disease cycles. Diagnosis of plant diseases.

### Food microbiology 262 (MBY 262)

**Module credits** 12.00

**Prerequisites** MBY 251

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

**Language of tuition** English

**Academic organisation** Microbiology and Plant Path

**Period of presentation** Semester 2

### Module content

Primary sources of microorganisms in food. Factors affecting the growth and survival of microorganisms in food. Microbial quality, spoilage and safety of food. Different organisms involved, their isolation, screening and detection. Conventional approaches, alternative methods rapid methods. Food fermentations: fermentation types, principles and organisms involved.

## Curriculum: Final year

Minimum credits: 144

### Core modules

#### Eukaryotic gene control and development 351 (GTS 351)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	GTS 251 GS and GTS 261 GS
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Genetics
<b>Period of presentation</b>	Semester 1

##### Module content

Regulation of gene expression in eukaryotes: regulation at the genome, transcription, RNA processing and translation levels. DNA elements and protein factors involved in gene control. The role of chromatin structure and epigenetic changes. Technology and experimental approaches used in studying eukaryotic gene control. Applications of the principles of gene control in embryonic development and differentiation, cancer and other diseases in humans.

#### Genome evolution and phylogenetics 354 (GTS 354)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	GTS 251 GS and GTS 261 GS
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Genetics
<b>Period of presentation</b>	Semester 1

##### Module content

Mechanisms involved in the evolutions of genomes. Comparison of the molecular organisation of viral, archaea, eubacterial and eukaryotic genomes. Genome project design, DNA sequencing methods and annotation. Molecular evolution. Phylogenetic inference methods. Applications of phylogenetics and contemporary genome research.

#### Population and evolutionary genetics 367 (GTS 367)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Engineering, Built Environment and Information Technology
<b>Prerequisites</b>	GTS 251 and GTS 261
<b>Contact time</b>	1 practical per week, 2 lectures per week

**Language of tuition** English

**Academic organisation** Genetics

**Period of presentation** Semester 2

#### Module content

Genetic and phenotypic variation. Organisation of genetic variation. Random genetic drift. Mutation and the neutral theory. Darwinian selection. Inbreeding, population subdivision and migration. Evolutionary quantitative genetics. Population genomics. Human population genetics. Levels of selection and individuality. Arms races and irreversibility. Complexity. Applied evolution.

### Genetics in human health 368 (GTS 368)

**Module credits** 18.00

**Prerequisites** GTS 251 and GTS 261 GS

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

**Language of tuition** English

**Academic organisation** Genetics

**Period of presentation** Semester 2

#### Module content

Application of modern genetics to human variability, health and disease. Molecular origin of Mendelian and multifactorial diseases. The use of polymorphisms, gene mapping, linkage and association studies in medical genetics. Genetic diagnosis – application of cytogenetic, molecular and genomic techniques. Congenital abnormalities, risk assessment and genetic consultation. Prenatal testing, population screening, treatment of genetic diseases and gene-based therapy. Pharmacogenetics and cancer genetics. Ethical aspects in medical genetics.

### Plant genetics and crop biotechnology 361 (BTC 361)

**Module credits** 18.00

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

**Prerequisites** GTS 251 and {GTS 261 GS or BOT 261} and {GTS 351 and GTS 352 are recommended}

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

**Language of tuition** English

**Academic organisation** Genetics

**Period of presentation** Semester 2



## Module content

Plant genetics and genomics: gene control in plants, epigenetics, co-suppression, forward and reverse genetics, structural and functional genomics. Plant development: signal perception, cell death, control of cell division. Plant-environment interactions. Crop genetic modification: food security, GMO regulation, plant transformation, whole-chromosome transformation, synthetic biology, homologous recombination. Crop molecular markers: marker types, genotyping, QTL mapping, marker-assisted breeding. Future of crop biotechnology: applications of genomics, biopharming, genetical genomics, systems biology

## 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 CO<sub>2</sub> 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)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	CMY 282, CMY 283, CMY 284 and CMY 285
<b>Contact time</b>	2 practicals per week, 1 discussion class per week, 4 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Chemistry
<b>Period of presentation</b>	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)

<b>Module credits</b>	18.00
<b>Service modules</b>	Faculty of Education
<b>Prerequisites</b>	CMY 282, CMY 283, CMY 284 and CMY 285
<b>Contact time</b>	2 practicals per week, 4 lectures per week, 1 discussion class per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Chemistry
<b>Period of presentation</b>	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.

### Virology 351 (MBY 351)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	BCM 251 and CMY 127 and MBY 161
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 1

## Module content

Introduction to the viruses as a unique kingdom inclusive of their different hosts, especially bacteria, animals and plants; RNA and DNA viruses; viroids, tumour viruses and oncogenes, mechanisms of replication, transcription and protein synthesis; effect on hosts; viral immunology; evolution of viruses.

## Genetic manipulation of microbes 364 (MBY 364)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	BCM 251 and CMY 127 and MBY 161
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 2

## Module content

Isolation of clonable DNA (genomic libraries, cDNA synthesis) cloning vectors (plasmids, bacteriophages, cosmids) plasmid incompatibility and control of copy number. Ligation of DNA fragments, modification of DNA end and different ligation strategies. Direct and indirect methods for the identification of recombinant organisms. Characterization (polymerase chain reaction, nucleic acid sequencing) and mutagenesis of cloned DNA fragments. Gene expression in Gram negative (E.coli) Gram positive (B.subtilis) and yeast cells (S.cerevisiae). Use of Agrobacterium and baculoviruses for gene expression in plant and insect cells respectively. Applications in protein engineering, diagnostics and synthesis of useful products.

## General plant pathology 351 (PLG 351)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	MBY161, MBY261 and PLG262
<b>Contact time</b>	2 lectures per week, 1 practical per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 1

## Module content

Principles and examples of plant diseases and their socio-economic importance. Current trends in plant pathology such as biosecurity, sanitary and phytosanitary issues of trade. Risk assesment and international food safety standards. The use of global information systems to assess disease spread and impact of global warming. Supply chain analysis, postharvest technology and food trade aspects.

## Plant disease control 363 (PLG 363)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	PLG251 or PLG262 or TDH. MBY261 is recommended
<b>Contact time</b>	2 lectures per week, 1 practical per week

<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 2

#### Module content

Principles of plant disease control. Non-chemical control including biological control, disease resistance, regulatory measures, cultivation practices, physical methods. Modern chemo-therapy: characteristics, mode of action and application of fungicides, bactericides and nematicides. Principles of integrated disease management.

### Population ecology 351 (ZEN 351)

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

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

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

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

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

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

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

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

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

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

## Microbe interactions 365 (MBY 365)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	MBY251, MBY261 and MBY351
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 2

### Module content

Interactions between microbes and their abiotic environment; microbial interaction with other strains of the same and other species; microbial interactions across kingdoms; pathogenic interactions between microbes and plant or animal hosts; mutualistic interactions between microbes and their hosts; introduction to systems biology.

## Bacterial genetics 355 (MBY 355)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	MBY 161, CMY 127, BCM 251
<b>Contact time</b>	1 practical per week, 2 lectures per week
<b>Language of tuition</b>	English
<b>Academic organisation</b>	Microbiology and Plant Path
<b>Period of presentation</b>	Semester 1



## Module content

DNA replication and replication control. DNA recombination. DNA damage and repair. Genetics of bacteriophages, plasmids and transposons. Bacterial gene expression control at the transcriptional, translational and post-translational levels. Global regulation and compartmentalisation.

## Macromolecules of life: Structure-function and Bioinformatics 356 (BCM 356)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	BCM 251 and BCM 252
<b>Contact time</b>	180 minute practical per week, 2 lectures per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 1

## Module content

Perspectives on the flow of information from nucleic acids to proteins, the structure and functions of nucleic acids and proteins and their organisation into hierarchical, interdependent systems. Nucleic acid structure as observed in fibres and crystals as well as global DNA and RNA analyses (methods and bioinformatic analyses). Biochemical analyses of nucleotides. DNA-DNA recognition: non-standard and higher order DNA structures. The RNA structural world, RNAi, miRNA and ribosomes. Cellular functions of coding and non-coding nucleic acids. Principles of small molecule-DNA recognition. Principles of protein-DNA recognition and interactions. Bioinformatics predictions of protein and small molecule DNA interactions. Chemical reactivity of amino acids. Domain structures of proteins and Ramachandran plots. Protein folding, sequence motifs and domains, higher order and supramolecular structure, self-assembly, conjugated proteins, post-translational modifications, conjugated proteins and bioinformatics predictions. Principles of protein function and protein structure relationships. Protein-ligand and protein-protein interactions. Protein aggregation in disease. Examples of the diverse functions of proteins and peptides, including enzymes, hormones, neurotransmitters, antibodies, receptors, transport and membrane proteins. Global analysis of proteins through proteomics. Basic principles of nuclear magnetic resonance, mass spectrometry and X-ray crystallography. Protein purification and characterization including, pI, molecular mass, amino acid composition and sequence. Practical training will include interactive computer-guided demonstrations of protein analysis, hands-on practical sessions for nucleic acid purification and chemical structure characterisation, protein expression and purification (including SDS-PAGE), protein sequence analysis including mass spectrometry, protein structure analysis by 3D protein modelling and protein folding (Bioinformatics).

## Biocatalysis and integration of metabolism 357 (BCM 357)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	BCM 251 and BCM 252 and BCM 261
<b>Contact time</b>	2 lectures per week, 180 minute practical per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 1





## Module content

Nomenclature: enzyme nomenclature and classification. Specificity and mechanisms: the active site, mechanisms of catalysis and examples of specific enzyme mechanisms, e.g. lysozyme and carboxypeptidase A. Advanced enzyme kinetics, Cleland nomenclature and multi-substrate reactions. Allosteric enzymes: models by Koshland, Hill and Monod. Ligands binding to proteins. Problems and answers: tutorials of problems and answers based on above concepts. Integration of metabolism; hormones and second messengers; cell signalling; a case study in connectivity among metabolic pathways and their regulation, in for example diabetes and starvation. Inhibitors of angiotensin converting enzyme (ACE). RNA as enzymes. Applications of enzymes in food and cosmetics industries and in clinical pathology assays as biomarkers of diseases and toxic responses. Elucidation of metabolic pathways.

Practical sessions cover tutorials on calculations, isolation of an enzyme, determination of pH and temperature optimum, determination of  $K_m$  and  $V_{max}$ , enzyme activation, enzyme inhibition, purification table and final report, oral defense of report.

## Cell structure and function 367 (BCM 367)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	BCM 251 and BCM 252 and BCM 261
<b>Contact time</b>	2 lectures per week, 180 minute practical per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 2

## Module content

Visualising cell structure and localising proteins within cells. Cell ultrastructure. Purification of subcellular organelles. Culturing of cells. Diversity and commonality of cells. Biomembrane structure. Transmembrane transport of ions and small molecules. Moving proteins into membranes and organelles. Vesicular traffic, secretion, exocytosis and endocytosis. Cell organisation and movement. Cell-cell and cell-matrix adhesion. Practical training includes tutorials on electron-, immunofluorescent- and confocal microscopy. TLC of neutral lipids and phospholipids. Isolation and characterisation of erythrocyte membranes. Active transport studies in yeast cells.

## Molecular basis of disease 368 (BCM 368)

<b>Module credits</b>	18.00
<b>Prerequisites</b>	BCM 251 and BCM 252 and BCM 261
<b>Contact time</b>	180 minute practical per week, 2 lectures per week
<b>Language of tuition</b>	Double Medium
<b>Academic organisation</b>	Biochemistry
<b>Period of presentation</b>	Semester 2

## Module content

Normal and abnormal regulation of the cell cycle: The biochemistry of proliferation, quiescence, senescence, differentiation and apoptosis, illustrated by cancer. Host-Pathogen co-evolution: How adaptive immunity emerged from innate immunity. Infection: Molecular and cellular immunobiochemistry of protection against viral, bacterial and parasitic pathogens. Auto-immunity: Molecular mechanisms of the maintenance and failure of the recognition of foreign in the context of self in the mammalian body. Practical training includes debate on ethics of research on animal and human diseases, experimental design and execution of an immunoassay to test for a biomarker antibody of an infectious disease, tutorials to determine the performance of a diagnostic test for disease, including the principle of ROC curve analysis, positive and negative predictiveness, sensitivity, specificity and accuracy, applications of polyclonal and monoclonal antibodies for characterisation of disease with fluorescence, confocal and electron microscopy, flow cytometry and biosensors.

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