# University of Pretoria Yearbook 2022

# BSc (Biochemistry) (02133398)

| | |
|---|---|
| **Department** | Genetics |
| **Minimum duration of study** | 3 years |
| **Total credits** | 430 |
| **NQF level** | 07 |

## Admission requirements

**Important information for all prospective students for 2022**

- The admission requirements apply to students who apply for admission to the University of Pretoria with a **National Senior Certificate (NSC) and Independent Examination Board (IEB) qualifications.**
- **Applicants with qualifications other than the abovementioned** should refer to:
  - **Brochure:** Undergraduate Programme Information 2022: Qualifications other than the NSC and IEB, available at click here.
- **Citizens from countries other than South Africa (applicants who are not South African citizens)** should also refer to:
  - **Brochure:** Newcomer's Guide 2021, available at click here.
  - **Website:** click here.
- **School of Tomorrow (SOT), Accelerated Christian Education (ACE) and General Education Development Test (GED):** The University of Pretoria no longer accepts qualifications awarded by these institutions.
- **National Certificate (Vocational) (NCV) Level 4:** The University of Pretoria may consider NCV candidates, provided they meet the exemption for bachelor's status criteria and the programme requirements.

**Transferring students**

A transferring student is a student who, at the time of application for a degree programme at the University of Pretoria (UP) –

- is a registered student at another tertiary institution, **or** was previously registered at another tertiary institution and did not complete the programme enrolled for at that institution, and is not currently enrolled at a tertiary institution, **or** has completed studies at another tertiary institution, but is not currently enrolled at a tertiary institution, **or** has started with tertiary studies at UP, then moved to another tertiary institution and wants to be readmitted at UP.

A transferring student will be considered for admission based on

- an NSC or equivalent qualification with exemption to bachelor's or diploma studies (whichever is applicable); **and** meeting the minimum faculty-specific subject requirements at NSC or tertiary level; **or** having completed a higher certificate at a tertiary institution with faculty-specific subjects/modules passed (equal to or more than 50%), as well as complying with faculty rules on admission;
- previous academic performance (must have passed all modules registered for up to the closing date of

application ) or as per faculty regulation/promotion requirements;
- a certificate of good conduct.

**Note:** Students who have been dismissed at the previous institution due to poor academic performance, will not be considered for admission to UP.

**Returning students**

A returning student is a student who, at the time of application for a degree programme –

- is a registered student at UP, and wants to transfer to another degree at UP, **or** was previously registered at UP and did not complete the programme enrolled for, and did not enrol at another tertiary institution in the meantime (including students who applied for leave of absence), **or** has completed studies at UP, but is not currently enrolled or was not enrolled at another tertiary institution after graduation.

A returning student will be considered for admission based on

- an NSC or equivalent qualification with exemption to bachelor's or diploma studies (whichever is applicable); **and** meeting the minimum faculty-specific subject requirements at NSC or tertiary level; **or** previous academic performance (should have a cumulative weighted average of at least 50% for the programme enrolled for);
- having applied for and was granted leave of absence.

**Note:** Students who have been excluded/dismissed from a faculty due to poor academic performance may be considered for admission to another programme at UP. The Admissions Committee may consider such students if they were not dismissed more than twice. Only ONE transfer between UP faculties will be allowed, and a maximum of two (2) transfers within a faculty.

**Important faculty-specific information on undergraduate programmes for 2022**

- The closing date is an administrative admission guideline for non-selection programmes. Once a non-selection programme is full and has reached the institutional targets, then that programme will be closed for further admissions, irrespective of the closing date. However, if the institutional targets have not been met by the closing date, then that programme will remain open for admissions until the institutional targets are met.
- The following persons will be considered for admission: Candidates who have a certificate that is deemed by the University to be equivalent to the required National Senior Certificate (NSC) with university endorsement; candidates who are graduates from another tertiary institution or have been granted the status of a graduate of such an institution, and candidates who are graduates of another faculty at the University of Pretoria.
- Life Orientation is excluded when calculating the Admission Point Score (APS).
- Grade 11 results are used for the conditional admission of prospective students. Final admission is based on the final NSC/IEB results.

**University of Pretoria website:** click here

| **Minimum requirements** | | | |
|---|---|---|---|
| **Achievement level** | | | |
| **English Home Language or English First Additional Language** | **Mathematics** | **Physical Sciences** | **APS** |
| NSC/IEB | NSC/IEB | NSC/IEB | |
| 5 | 5 | 5 | **32** |

Candidates who do not comply with the minimum admission requirements for BSc (Biochemistry), may be considered for admission to the BSc – Extended programme – Biological and Agricultural Sciences, which requires an additional year of study.

| **BSc – Extended Programme – Biological and Agricultural Sciences**<br>**Minimum requirements**<br>**Achievement level**<br>**English Home Language or English First Additional Language** | **Mathematics** | **Physical Sciences** | **APS** |
|---|---|---|---|
| NSC/IEB | NSC/IEB | NSC/IEB | |
| 4 | 4 | 4 | **26** |

**Note:**

*The BSc – Extended programmes are not available for students who meet all the requirements for the corresponding mainstream programme.

*Please note that only students who apply in their final NSC or equivalent qualification year will be considered for admission into any of the BSc – Extended programmes.

# Other programme-specific information

### 1.1 Requirements for specific modules

A candidate who:

a. does not qualify for STK 110, must enrol for STK 113 and STK 123;
b. egisters for Mathematical Statistics (WST) and Statistics (STK) modules must take note that WST and STK modules, except for STK 281, may not be taken simultaneously in a programme; a student must take one and only one of the following options:

- WST 111, WST 121, WST 212, WST 211, WST 221, WST 311, WST 312, WST 322, WST 321, and STK 353

  or

- WST 111, WST 121, WST 212, WST 211, WST 221, WST 311, WST 312, WST 322, STK320, STK353.

  or

- STK 110, STC 122, STK 210, STK 220, WST 212, STK 310, STK 320, STK 353.

c. registers for a module presented by another faculty must take note of the timetable clashes, prerequisites for that module, subminimum required in examination papers, supplementary examinations, etc.

### 1.2 Fundamental modules

a. It is compulsory for all new first-year students to satisfactorily complete the Academic orientation (UPO 102) and to take Academic information management modules (AIM 111 and AIM 121) and Language and study skills (LST 110). Please see curricula for details.
b. Students who intend to apply for admission to MBChB or BChD in the second semester, when places become available in those programmes, may be permitted to register for up to 80 module credits and 4 core modules in the first semester during the first year provided that they obtained a final mark of no less than 70% for Grade 12 Mathematics and achieved an APS of 34 or more in the NSC.

# Promotion to next study year

A student will be promoted to the following year of study if he or she passed 100 credits of the prescribed credits

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

**General promotion requirements in the faculty**

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

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

# Curriculum: Year 1

**Minimum credits: 142**

Fundamental = 14
Core = 128

Students intend applying for **MBChB**, or **BChD** selection, have to enrol for FIL 155(6), MGW 112(6) and MTL 180(12) with the understanding that they defer doing WTW 134 in the first semester, however, should they not be selected and want to continue with a BSc programme, WTW 165 must be taken in the **second** semester of the first year.

## Fundamental modules

### Academic information management 111 (AIM 111)

| | |
|---|---|
| **Module credits** | 4.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Economic and Management Sciences<br>Faculty of Humanities<br>Faculty of Law<br>Faculty of Health Sciences<br>Faculty of Natural and Agricultural Sciences<br>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 |
| **NQF Level** | 05 |

| | |
|---|---|
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Economic and Management Sciences<br>Faculty of Humanities<br>Faculty of Law<br>Faculty of Health Sciences<br>Faculty of Natural and Agricultural Sciences<br>Faculty of Theology and Religion<br>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 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Natural and Agricultural Sciences<br>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 |
| **NQF Level** | 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 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Natural and Agricultural Sciences<br>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.

## Plants and society 161 (BOT 161)

| | |
|---|---|
| **Module credits** | 8.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>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**

Botanical principles of structure and function; diversity of plants; introductory plant systematics and evolution; role of plants in agriculture and food security; principles and applications of plant biotechnology; economical and valuable medicinal products derived from plants; basic principles of plant ecology and their application in conservation and biodiversity management.
This content aligns with the United Nation's Sustainable Debelopment Goals of No Poverty, Good Health and Well-being, Climate Action, Responsible Consumption and Production, and Life on Land.

## General chemistry 117 (CMY 117)

| | |
|---|---|
| **Module credits** | 16.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Health Sciences<br>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 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Health Sciences<br>Faculty of Veterinary Science |
| **Prerequisites** | Natural and Agricultural Sciences students: CMY 117 GS or CMY 154 GS Health Sciences students: none |
| **Contact time** | 1 practical per week, 4 lectures per week |
| **Language of tuition** | 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.

## Introductory genetics 161 (GTS 161)

| | |
|---|---|
| **Module credits** | 8.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Veterinary Science |
| **Prerequisites** | MLB 111 GS |
| **Contact time** | 2 lectures per week, fortnightly tutorials |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

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

## Introduction to microbiology 161 (MBY 161)

| | |
|---|---|
| **Module credits** | 8.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology |
| **Prerequisites** | No prerequisites. |
| **Contact time** | 2 lectures per week, fortnightly tutorials |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **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 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Health Sciences<br>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.

## Physics for biology students 131 (PHY 131)

| | |
|---|---|
| **Module credits** | 16.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Education<br>Faculty of Health Sciences<br>Faculty of Veterinary Science |
| **Prerequisites** | A candidate must have passed Mathematics with at least 60% in the Grade 12 examination |
| **Contact time** | 1 discussion class per week, 1 practical per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physics |

| | |
|---|---|
| **Period of presentation** | Semester 1 |

**Module content**

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 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Veterinary Science |
| **Prerequisites** | 50% for Mathematics in Grade 12 |
| **Contact time** | 1 tutorial per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Mathematics and Applied Mathematics |
| **Period of presentation** | Semester 1 |

**Module content**

**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.

## Mathematics 165 (WTW 165)

| | |
|---|---|
| **Module credits** | 16.00 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education<br>Faculty of Economic and Management Sciences<br>Faculty of Veterinary Science |
| **Prerequisites** | 50% for Mathematics in Grade 12 and MGW 112# or registered for BVSc |
| **Contact time** | 1 tutorial per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Mathematics and Applied Mathematics |

| | |
|---|---|
| **Period of presentation** | Semester 2 |

**Module content**

*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 165 does not lead to Mathematics at 200 level and is intended for students who require Mathematics at 100 level only. WTW 165 is offered in English 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 |
| **NQF Level** | 05 |
| **Service modules** | Faculty of Education<br>Faculty of Veterinary Science |
| **Prerequisites** | No prerequisites. |
| **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 organisation 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 in various animal phyla. In-class discussion will address the sustainable development goals #3, 12, 13, 14 and 15 (Good Health and Well-being. Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land).

# Curriculum: Year 2

**Minimum credits: 144**

Core = 72
Elective = 72

**Additional information:**
**Dual major track:**

- **Biochemistry and Chemistry combination:** Students must take CMY 282, CMY 283, CMY 284, CMY 285 and choose one additional elective per semester from BOT 251, BOT 261, FLG 211, FLG 212, FLG 221, FLG 222, MBY 251, MBY 261, MBY 262.
- **Biochemistry and Genetics combination:** Students must take CMY 282, CMY 283, CMY 284, CMY 285, MBY 251, MBY 261.
- **Biochemistry and Human Physiology combination:** Students must take FLG 211, FLG 212, FLG 221, FLG 222, MBY 251, MBY 261.
- **Biochemistry and Microbiology combination:** Students must take CMY 282, CMY 283, CMY 284, MBY 251, MBY 261, MBY 262.
- **Biochemistry and Plant Science combination:** Students must take BOT 251, BOT 261, CMY 282, CMY 283, CMY 284, CMY 285.
- **Biochemistry and Zoology combination:** Students must take BOT 251, BOT 261, MBY 251, MBY 261, ZEN 251, ZEN 261.

## Core modules

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

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Health Sciences |
| **Prerequisites** | CMY 117 GS and CMY 127 GS and MLB 111 GS |
| **Contact time** | 1 tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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. Enzyme kinetics and enzyme inhibition. Allosteric enzymes, regulation of enzyme activity, active centres and mechanisms of enzyme catalysis. Examples of industrial applications of enzymes and in clinical pathology as biomarkers of diseases. Online activities include introduction to practical laboratory techniques and Good Laboratory Practice; techniques for the quantitative and qualitative analysis of biological molecules; enzyme activity measurements; processing and presentation of scientific data.

## Carbohydrate metabolism 252 (BCM 252)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education<br>Faculty of Health Sciences |
| **Prerequisites** | BCM 251 GS and BCM 257 GS. |
| **Contact time** | 1 tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

Carbohydrate structure and function. Blood glucose measurement in the diagnosis and treatment of diabetes. Bioenergetics and biochemical reaction types. Glycolysis, gluconeogenesis, glycogen metabolism, pentose phosphate pathway, citric acid cycle and electron transport. Total ATP yield from the complete oxidation of glucose. A comparison of cellular respiration and photosynthesis. Online activities include techniques for the study and analysis of metabolic pathways and enzymes; PO ratio of mitochondria, electrophoresis, extraction, solubility and gel permeation techniques; scientific method and design.

## Introductory biochemistry 257 (BCM 257)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Prerequisites** | CMY 117 GS and CMY 127 GS and MLB 111 GS |
| **Contact time** | 1 tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 1 |

**Module content**

Chemical foundations. Weak interactions in aqueous systems. Ionisation of water, weak acids and weak bases. Buffering against pH changes in biological systems. Water as a reactant and function of water. Carbohydrate structure and function. Biochemistry of lipids and membrane structure. Nucleotides and nucleic acids. Other functions of nucleotides: energy carriers, components of enzyme cofactors and chemical messengers. Introduction to metabolism. Bioenergetics and biochemical reaction types. Online activities include introduction to laboratory safety and Good Laboratory Practice; basic biochemical calculations; experimental method design and scientific controls, processing and presentation of scientific data.

## Lipid and nitrogen metabolism 261 (BCM 261)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |

| | |
|---|---|
| **Service modules** | Faculty of Health Sciences |
| **Prerequisites** | BCM 251 GS and BCM 257 GS. |
| **Contact time** | 1 tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

Biochemistry of lipids, membrane structure, anabolism and catabolism of lipids. Total ATP yield from the complete catabolism of lipids. Electron transport chain and energy production through oxidative phosphorylation. 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. Online activities include training in scientific reading skills; evaluation of a scientific report; techniques for separation analysis and visualisation of biological molecules; hypothesis design and testing, method design and scientific controls.

## Molecular genetics 251 (GTS 251)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education |
| **Prerequisites** | GTS 161 GS |
| **Contact time** | 2 lectures per week, fortnightly tutorials |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 1 |

**Module content**

The chemical nature of DNA. The processes of DNA replication, transcription, RNA processing, 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 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology<br>Faculty of Education |
| **Prerequisites** | GTS 251 GS |
| **Contact time** | 2 lectures per week, fortnightly tutorials |

| | |
|---|---|
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **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.

## Elective modules

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

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | BOT 161 |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Department of Plant and Soil Sciences |
| **Period of presentation** | Semester 1 |

**Module content**

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 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | BOT 161 and CMY 127 GS. |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Department of Plant and Soil Sciences |
| **Period of presentation** | Semester 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 abiotic stress tolerant and disease resistant plants. Practicals: Basic laboratory skills in plant physiology; techniques used to investigate nitrogen metabolism, carbohydrate metabolism, pigment analysis, water transport in plant tissue and response of plants to hormone treatments.

## Physical chemistry 282 (CMY 282)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 117 and CMY 127 |
| **Contact time** | 1 tutorial per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Chemistry |
| **Period of presentation** | Quarter 2 |

**Module content**

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

## Analytical chemistry 283 (CMY 283)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 117 and CMY 127 |
| **Contact time** | 1 tutorial per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Chemistry |
| **Period of presentation** | Quarter 3 |

**Module content**

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

## Organic chemistry 284 (CMY 284)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 117 and CMY 127 |
| **Contact time** | 1 tutorial per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Chemistry |
| **Period of presentation** | Quarter 1 |

**Module content**

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

## Inorganic chemistry 285 (CMY 285)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 117 and CMY 127 |
| **Contact time** | 1 tutorial per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Chemistry |
| **Period of presentation** | Quarter 4 |

**Module content**

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

## Introductory and neurophysiology 211 (FLG 211)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |

| | |
|---|---|
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | CMY 127 GS and MLB 111 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 1 |

**Module content**

Orientation in physiology, homeostasis, cells and tissue, muscle and neurophysiology, cerebrospinal fluid and the special senses.
Practical work: Practical exercises to complement the theory.

## Circulatory physiology 212 (FLG 212)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | CMY 127 GS and MLB 111 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 1 |

**Module content**

Body fluids; haematology; cardiovascular physiology and the lymphatic system. Practical work: Practical exercises to complement the theory.

## Lung and renal physiology, acid-base balance and temperature 221 (FLG 221)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | FLG 211 GS and FLG 212 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 2 |

**Module content**

Structure, gas exchange and non-respiratory functions of the lungs; structure, excretory and non-urinary functions of the kidneys, acid-base balance, as well as the skin and body temperature control.
Practical work: Practical exercises to complement the theory.

## Digestion, endocrinology and reproductive systems 222 (FLG 222)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | FLG 211 GS and FLG 212 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 2 |

**Module content**

Nutrition, digestion and metabolism; hormonal control of the body functions and the reproductive systems.
Practical work: Practical exercises to complement the theory.

## Bacteriology 251 (MBY 251)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology |
| **Prerequisites** | MBY 161 GS |
| **Contact time** | 2 lectures per week, fortnightly practicals |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |

| | |
|---|---|
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology |
| **Prerequisites** | MBY 161 GS |
| **Contact time** | 2 lectures per week, Fortnightly practicals/tutorials |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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.

## Food microbiology 262 (MBY 262)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Prerequisites** | MBY 251 GS. |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

Primary sources of migroorganisims 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.

## Invertebrate biology 251 (ZEN 251)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | ZEN 161 GS |
| **Contact time** | 1 practical 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**

Origin and extent of modern invertebrate diversity; parasites of man and domestic animals; biology and medical importance of arachnids and insects; insect life styles; the influence of the environment on insect life histories; insect herbivory; predation and parasitism; insect chemical, visual, and auditory communication. Examples used in the module are relevant to the sustainable development goals of Life on Land and Good Health and Well-being.

## African vertebrates 261 (ZEN 261)

| | |
|---|---|
| **Module credits** | 12.00 |
| **NQF Level** | 06 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | ZEN 161 GS |
| **Contact time** | 1 practical per week, 4 lectures 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. The module addresses the sustainable development goals of Life below Water and Life on Land.

# Curriculum: Final year

**Minimum credits: 144**

Core = 72
Elective = 72

**Dual major track:**

- **Biochemistry and Chemistry combination:** Students must take CMY 382, CMY 383, CMY 384 and CMY 385.
- **Biochemistry and Genetics combination:** Students must take GTS 351, GTS 354, GTS 367 and [GTS368 or BTC 361].
- **Biochemistry and Human Physiology combination:** Students must take FLG 327, FLG 330, FLG 331 and FLG 332.
- **Biochemistry and Microbiology combination:** Students must take MBY 351, MBY 355, MBY 364 and MBY 365.
- **Biochemistry and Plant Science combination:** Students must take BOT 356, BOT 358, BOT 365 and BOT 366.
- **Biochemistry and Zoology combination:** Students must take ZEN 352, ZEN 354, ZEN 361 and ZEN 363.

## Core modules

### Macromolecules of life: structure-function and bioinformatics 356 (BCM 356)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | BCM 251 GS and BCM 257 GS and BCM 261 GS and BCM 252 GS. |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 1 |

**Module content**

Structure, function, bioinformatics and biochemical analysis of (oligo)nucleotides, amino acids, proteins and ligands – and their organisation into hierarchical, higher order, interdependent structures. Principles of structure-function relationships, protein folding, sequence motifs and domains, higher order and supramolecular structure, self-assembly, conjugated proteins, post-translational modifications. Molecular recognition between proteins, ligands, DNA and RNA or any combinations. The RNA structural world, RNAi, miRNA and ribosomes. Cellular functions of coding and non-coding nucleic acids. Basic principles of mass spectrometry, nuclear magnetic resonance spectroscopy, X-ray crystallography and proteomics. Protein purification and characterisation including, pI, molecular mass, amino acid composition and sequence. Mechanistic aspects and regulation of information flow from DNA via RNA to proteins and back. Practical training includes hands-on nucleic acid purification and sequencing, protein production and purification, analysis by SDS-PAGE or mass spectrometry, protein structure analysis and 3D protein modelling.

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

| | |
|---|---|
| **Module credits** | 18.00 |

| | |
|---|---|
| **NQF Level** | 07 |
| **Prerequisites** | BCM 251 GS and BCM 257 GS and BCM 261 GS and BCM 252 GS. |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 1 |

**Module content**

Regulation of metabolic pathways. Analysis of metabolic control. Elucidation of metabolic pathways with isotopes. Metabolomics. Coordinated regulation of glycolysis/gluconeogenesis and glycogen breakdown/synthesis. Overview of homone action. Metabolism of xenobiotics. Hormonal regulation of feul metabolism. Metabolic adaptions during diabetes. Obesity and the regulation of body mass. Obesity, metabolic syndrome and Type 2 diabetes (T2D). Management of T2D with diet, exercise and medication. Practical sessions cover tutorials on case studies and biochemical calculations, and hands-on isolation of an enzyme, determination of pH and temperature optima, determination of Km and Vmax, enzyme activation and enzyme inhibition.

## Cell structure and function 367 (BCM 367)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | BCM 251 and BCM 257 and BCM 261 GS and BCM 252 GS. |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

Visualising cell structure and localisation of proteins within cells. Cell ultrastructure. Purification of subcellular organelles. Culturing of cells. Biomembrane structure. Transmembrane transport of ions and small molecules and the role of these processes in disease. Moving proteins into membranes and organelles. Vesicular traffic, secretion, exocytosis and endocytosis. Cell organisation and movement motility based on the three types of cytoskeletal structures including microfilaments, microtubules and intermediate filaments as well as their associated motor proteins. Cell-cell and cell-matrix adhesion through corresponding proteins and morphological structures. Practical training includes tutorials on cytometry and microscopy, mini-research projects where students are introduced and guided through aspects of research methodology, experimental planning techniques associated with cellular assays, buffer preparation, active transport studies in yeast cells, structure-function analyses of actin and binding partners.

## Molecular basis of disease 368 (BCM 368)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |

| | |
|---|---|
| **Prerequisites** | BCM 251 and BCM 257 and BCM 261 GS BCM 252 GS. |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

Molecular mechanisms behind exogenous and endogenous diseases. Foundational knowledge of the immune system, with innate-, adaptive- and auto-immunity (molecular mechanisms of the maintenance and failure of the recognition of foreign in the context of self in the mammalian body) being some of the key concepts. Molecular pathology and immunobiochemistry of exogenous diseases against viral, bacterial and parasitic pathogens with a focus on the human immunodeficiency virus (HIV), tuberculosis (TB) and malaria. Endogenous disease will describe the biochemistry of normal cell cycle proliferation, quiescence, senescence, differentiation and apoptosis, and abnormal events as illustrated by cancer. Tutorials will focus on immunoassays, vaccines, diagnostic tests for diseases and drug discovery towards therapeuticals.

## Elective modules

### Plant ecophysiology 356 (BOT 356)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | BOT 161 |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Department of Plant and Soil Sciences |
| **Period of presentation** | Semester 1 |

**Module content**

Introduction to plant ecophysiology and plants response to environmental stress. Understanding how various biotic and abiotic factors affect plant metabolic processes, including photosynthesis and respiration. Emphasis is placed on the efficiency of the mechanisms whereby C3-, C4 and CAM-plants bind CO2 and how they are impacted by the environment. To understand the functioning of plants in diverse environments, the relevant structural properties of plants, the impact of soil composition, water flow in the soil-plant air continuum and long distance transport of assimilates will be discussed. Students will research a topic relevant to plant ecophysiology and present this in the form of an oral presentation. Students will conduct a practical project to study the effects of environmental factors on C3 and C4 plant growth and physiology. Students will present the report in a written format according to the guidelines of a relevant scientific journal. Relevant readings will be used to highlight the alignment of the module with the Sustainable Development Goals, with emphasis placed on climate action.

### Plant ecology 358 (BOT 358)

| | |
|---|---|
| **Module credits** | 18.00 |

| | |
|---|---|
| **NQF Level** | 07 |
| **Prerequisites** | BOT 161 and BOT 251. |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Department of Plant and Soil Sciences |
| **Period of presentation** | Semester 1 |

**Module content**

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 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | BOT 161 |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Department of Plant and Soil Sciences |
| **Period of presentation** | Semester 2 |

**Module content**

The 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 is presented. The role of these natural products in defense against microorganisms and herbivores is reviewed during the module. The importance of ethnobotany and phylogenetics in modern drug discovery from biodiversity will presented along with legal and ethical considerations surrounding bioprospecting. This will follow on with modern theories and practices regarding sustainable utilisation and conservation of medicinal plants. The basics of alternative medicines, with an emphasis on traditional African and Chinese medicines, are also discussed as well as current evidence-based research and product development derived from these. Biotechnological approaches to medicinal natural product production, ‘farmer to pharma’, will be covered, including plant cell culture and bioreactors. Practical sessions on drug discovery approaches using chromatographic techniques for phytochemical analysis of secondary metabolites such as tannins, alkaloids, 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.

## Plant diversity 366 (BOT 366)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | BOT 161 |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Department of Plant and Soil Sciences |
| **Period of presentation** | Semester 2 |

**Module content**

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.

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

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology |
| **Prerequisites** | GTS 251 and {GTS 261 GS or BOT 261} |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **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: flowering, genetics imprinting. 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

## Physical chemistry 382 (CMY 382)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |

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

**Module content**

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

## Analytical chemistry 383 (CMY 383)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 282, CMY 283, CMY 284 and CMY 285 |
| **Contact time** | 1 discussion class per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Chemistry |
| **Period of presentation** | Quarter 1 |

**Module content**

Separation methods: Extraction, multiple extraction, chromatographic systems. Spectroscopy: Construction of instruments, atomic absorption and atomic emission spectrometry, surface analysis techniques. Mass spectrometry. These techniques are discussed in terms of their use in environmental analysis and the value they contribute to meeting the UN sustainable development goals (#3,6 & 11). Instrumental electrochemistry. The relevance of electrochemistry to providing affordable and clean energy (UN SDG#7) is addressed.

## Organic chemistry 384 (CMY 384)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 282, CMY 283, CMY 284 and CMY 285 |
| **Contact time** | 1 discussion class per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |

| | |
|---|---|
| **Department** | Chemistry |
| **Period of presentation** | Quarter 3 |

**Module content**

Theory: NMR spectroscopy: applications. Aromatic chemistry, Synthetic methodology in organic chemistry. Carbon-carbon bond formation: alkylation at nucleophilic carbon sites, aldol and related condensations, Wittig and related reactions, acylation of carbanions (Claisen condensation). Practical: Laboratory sessions are designed to develop the rational thinking behind the design of organic chemistry experiments. An industrial project specifically prepares students for work in SA industry context and honours projects. As part of this practical programme the UN sustainable development goals must be considered in evaluating the best industrial process.

## Inorganic chemistry 385 (CMY 385)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Education |
| **Prerequisites** | CMY 282, CMY 283, CMY 284 and CMY 285 |
| **Contact time** | 1 discussion class per week, 2 practicals per week, 4 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Chemistry |
| **Period of presentation** | Quarter 2 |

**Module content**

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

## Higher neurological functions 327 (FLG 327)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | BCM 251 GS, BCM 252 GS, BCM 257 GS, FLG 221 GS and FLG 222 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 1 |

**Module content**

Overview of higher cognitive functions and the relations between psyche, brain and the immune system. Practical work: Applied practical work with specific examples drawn from South African case studies taught within the framework of the UN Sustainable Development Goal 3 (Good Health and Well-being).

## Cellular and developmental physiology 330 (FLG 330)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | BCM 251 GS, BCM 252 GS, BCM 257 GS, FLG 221 GS and FLG 222 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 1 |

**Module content**

During this module the biology of cellular processes such as the cell cycle, cell death, migration and their related cellular signalling pathways will be discussed as well as their role in early stage embryology and age-related pathologies. Practical work: Exposure to applied molecular biology techniques with specific examples drawn from South African case studies taught within the framework of the UN Sustainable Development Goal of Good Health and Well-being (Sustainable Development Goal 3).

## Exercise and nutrition science 331 (FLG 331)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | BCM 251 GS, BCM 252 GS, BCM 257 GS, FLG 221 GS and FLG 222 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 2 |

**Module content**

Mechanisms of muscle contraction and energy sources. Cardio-respiratory changes, thermo-regulation and other adjustments during exercise. Use and misuse of substances to improve performance. Practical work: Applied practical work with exercise descriptions for the South African context taught within the framework of the UN Sustainable Development Goal 3 (Good Health and Well-being).

## Applied and pathophysiology 332 (FLG 332)

| | |
|---|---|
| **Module credits** | 18.00 |

| | |
|---|---|
| **NQF Level** | 07 |
| **Service modules** | Faculty of Natural and Agricultural Sciences |
| **Prerequisites** | BCM 251 GS, BCM 252 GS, BCM 257 GS, FLG 221 GS and FLG 222 GS |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Physiology |
| **Period of presentation** | Semester 2 |

**Module content**

Integration of all the human physiological systems. Practical work: Applied practical work.

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

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | GTS 251 GS and GTS 261 GS |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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 eg cell signaling pathways, development cancer and other diseases in humans.

## Genome evolution and phylogenetics 354 (GTS 354)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology |
| **Prerequisites** | GTS 251 and GTS 261 GS |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 2 |

**Module content**

A unifying framework for biology. Mechanisms involved in the evolution of genes, genomes and species. Comparative genomics across the kingdoms of life. Phylogenetic inference. Applications of phylogenetics and evolutionary genomics research, including relevance to sustainable development goals for food security, good health and the biosphere.

## Population and evolutionary genetics 367 (GTS 367)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Service modules** | Faculty of Engineering, Built Environment and Information Technology |
| **Prerequisites** | GTS 251 GS and GTS 261 GS. |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | Semester 1 |

**Module content**

Processes that affect genetic evolution: mutation, drift, natural selection and recombination. Fisher-Wright and coalescence models. Groupings of genes: linkage, inbreeding, population structure and gene flow. Neutral and nearly neutral theory. Quantitative genetics and the phenotype. Optimality. Adaptation. Levels of selection in sex ratios and conflict. Reproductive value and life history. Relatedness and kin selection. Sexual reproduction and selection. Genomic complexity and neutrality.

## Genetics in human health 368 (GTS 368)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | GTS 251 and GTS 261 GS |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **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.

## Virology 351 (MBY 351)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | MBY 251 GS |
| **Contact time** | 1 practical/tutorial per week, 2 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 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.

## Bacterial genetics 355 (MBY 355)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | MBY 251 GS, GTS 251 GS and GTS 261 GS. |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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.

## Genetic manipulation of microbes 364 (MBY 364)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | MBY 251 and GTS 251 |
| **Contact time** | 1 practical per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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 mutagenisis of cloned DNA fragments. Gene expression in Gram negative (E.coli) Gram positive (B.subtilis) and yeast cells (S.cerevisea). Use of Agrobacterium and baculoviruses for gene expression in plant and insect cells respectively. Applications in protein engineering, diagnostics and synthesis of useful products.

## Microbe interactions 365 (MBY 365)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **Prerequisites** | MBY 251 and MBY 355 GS |
| **Contact time** | 1 practical/tutorial per week, 2 lectures per week |
| **Language of tuition** | Module is presented in English |
| **Department** | Biochemistry, Genetics and Microbiology |
| **Period of presentation** | 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.

## Mammalogy 352 (ZEN 352)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **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**

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. The module addresses the sustainable development goals of Life on Land and Good Health and Well-being.

## Evolutionary physiology 354 (ZEN 354)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **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 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. Many examples used in this module are directly relevant to the sustainable development goals of Good Health and Well-being, Sustainable Cities and Communities, Climate Action and Life on Land.

## Physiological processes 361 (ZEN 361)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **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 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. In line with UN sustainable development goals, 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.

## Behavioural ecology 363 (ZEN 363)

| | |
|---|---|
| **Module credits** | 18.00 |
| **NQF Level** | 07 |
| **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. The module covers sustainable development goals 1-10 and 12-15.

The regulations and rules for the degrees published here are subject to change and may be amended after the publication of this information.

The General Academic Regulations (G Regulations) and General Student Rules apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations.