University of Pretoria Yearbook 2016

BSc(Computer Science) Computer Science (12134000)

Duration of study	3 years
Total credits	480

Admission requirements

- In order to register NSC/IEB/Cambridge candidates must comply with the minimum requirements for degree studies as well as with the minimum requirements for the relevant study programme.
- Life Orientation is excluded when calculating the APS.
- Grade 11 results are used in the provisional admission of prospective students.
- A valid National Senior Certificate (NSC) with admission to degree studies is required.
- Minimum subject and achievement requirements as set out below are required. On first-year level a student has a choice between Afrikaans and English as language medium.
- In certain cases tuition may be presented in English only for example in electives where the lecturer may not speak Afrikaans or in cases where it is not economically or practically viable.

Minimum requirements for 2016								
Achievement level								
Afrikaans or English				**Mathematics**				**APS**
NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
5	3	C	C	5	3	C	C	30 (26-29 admission based on the NBT)

Should a candidate obtain an APS of 26 to 29 consideration for admission will be based on the results of the NBT provided the quotas regarding student numbers have not been reached.

Additional requirements

Please note that additional admission requirements may result from certain elective groups.

Candidates who do not comply with these requirements are advised to register for BSc IT or BSc IT (Four-year programme), depending on whether they comply with the admission requirements for these programmes.

Promotion to next study year

General

a. A student must pass all the modules of the first year of study, before he or she is permitted to register for any module of the third year of study. Module prerequisites remain applicable. Exceptions to this rule will be considered by the relevant Head of Department and the Dean.
b. A student must pass all the modules of the second year of study, before he or she is permitted to register for any module of the fourth year of study (in the case of a four-year degree). Module prerequisites remain applicable. Exceptions to this rule will be considered by the relevant Head of Department and the Dean.
c. A new first-year student, who has failed in all the prescribed modules of the programme at the end of the first semester, will not be permitted to proceed to the second semester in the School of Information Technology.
d. A student who has not passed at least 70% of the credits of the current year of study after the November examinations will not be re-admitted to the School of Information Technology.
e. Students who fail a module for a second time, forfeit the privilege of registering for any modules of an advanced year of study.
f. Students whose academic progress is not acceptable can be suspended from further studies.

Procedure: Exclusion from and re-admission to further studies in the School of Information Technology

a. 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 of the School of Information Technology at the end of the relevant semester.
b. A student who has been excluded from further studies may apply in writing to the admissions committee of the School of Information Technology on level 6 in the Engineering building I for re-admission.
c. Written applications for re-admission to the second semester must be submitted at least 7 days before lectures resume for the second semester.
d. Written applications for re-admission to the new academic year must be submitted before 12 January.
e. Late applications will be accepted only in exceptional circumstances after approval by the Dean.
f. Should a student not be re-admitted to further studies by the admissions committee of the School of Information Technology, he/she will be informed in writing.
g. A student who is not re-admitted by the admissions committee of the School of Information Technology has the right to appeal to the Appeals Committee: Admissions in the Administration building, room 3-13.
h. Any decision taken by the Appeals Committee: Admissions is final.
i. 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.
j. A student, who is repeating his or her year, may be permitted by the Dean, on recommendation of the relevant head(s) of department, to register for modules of the following year of study in addition to the outstanding modules he or she has failed, providing that he or she complies with the prerequisites of these modules and no timetable clashes occur. In no semester may the total credits for which a student registers, exceed the normal number of credits per semester by more than 16 credits, except with special permission from the relevant Head of Department.

Pass with distinction

A degree (undergraduate) in the School of IT is conferred with distinction on a student who did not repeat any module of his/her final year, obtained a weighted average of at least 75% in all the

prescribed modules for the final year, provided that a subminimum of 65% is obtained in each of these modules and provided that the degree is completed in the prescribed minimum period of time. Ad hoc cases will be considered by the Dean, in consultation with the head of the relevant department.

Curriculum: Year 1

Minimum credits: 147

Fundamental modules

Academic information management 101 (AIM 101)

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.

Module credits	6.00
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
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
Period of presentation	Semester 1

Academic literacy for Information Technology 121 (ALL 121)

Module content:

By the end of this module students should be able to cope more confidently and competently with the reading, writing and critical thinking demands that are characteristic of the field of Information Technology.

Module credits	6.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	No prerequisites.
Contact time	1 web-based period per week, 2 lectures per week
Language of tuition	English
Academic organisation	Unit for Academic Literacy
Period of presentation	Semester 2

Academic orientation 112 (UPO 112)

Module credits	0.00
Language of tuition	Double Medium
Academic organisation	EBIT Dean's Office
Period of presentation	Year

Core modules

Program design: Introduction 110 (COS 110)

Module content:

The focus is on object-oriented (OO) programming. Concepts including inheritance and multiple inheritance, polymorphism, operator overloading, memory management (static and dynamic binding), interfaces, encapsulation, reuse, etc. will be covered in the module. The module teaches sound program design with the emphasis on modular code, leading to well structured, robust and documented programs. A modern OO programming language is used as the vehicle to develop these skills. The module will introduce the student to basic data structures, lists, stacks and queues.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	COS 153 or COS 131 or COS 132 and Maths level 5 or WTW 133
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Computer Science
Period of presentation	Semester 2

Software modelling 121 (COS 121)

Module content:

The module will introduce the concepts of model-driven analysis and design as a mechanism to develop and evaluate complex software systems. Systems will be decomposed into known entities, such as design patterns, classes, relationships, execution loops and process flow, in order to model the semantic aspects of the system in terms of structure and behaviour. An appropriate tool will be used to support the software modelling. The role of the software model in the enterprise will be highlighted. Students who successfully complete this module will be able to conceptualise and analyse problems and abstract a solution.

Module credits	16.00
Prerequisites	COS 153 or COS 131 or COS 132
Contact time	1 tutorial per week
Language of tuition	Both Afr and Eng

Academic organisation	Computer Science
Period of presentation	Semester 2

Introduction to computer science 151 (COS 151)

Module content:

This module introduces concepts and terminology related to the computer science discipline. Topics covered include the history of computing, machine level representation of data, Boolean logic and gates, basic computer systems organisation, algorithms and complexity and automata theory. The module also introduces some of the subdisciplines of computer science, such as computer networks, database systems, compilers, information security and intelligent systems.

Module credits	8.00
Service modules	Faculty of Education
Prerequisites	No prerequisites.
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Double Medium
Academic organisation	Computer Science
Period of presentation	Semester 1

Calculus 114 (WTW 114)

Module content:

*This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218 and WTW 220). Students will not be credited for more than one of the following modules for their degree: WTW 114, WTW 158, WTW 134, WTW 165.
Functions, limits and continuity. Differential calculus of single variable functions, rate of change, graph sketching, applications. The mean value theorem, the rule of L'Hospital. Definite and indefinite integrals, evaluating definite integrals using anti-derivatives, the substitution rule.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	Refer to Regulation 1.2. Mathematics 60% Grade 12.
Contact time	1 tutorial per week, 4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Discrete structures 115 (WTW 115)

Module content:

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

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

Imperative programming 132 (COS 132)

Module content:

*Note: All students registered for degrees within the School of IT, excluding the two four year programmes, BIS (Information Science) and BIS (Publishing), need to enrol for this module.
This module introduces imperative computer programming, which is a fundamental building block of computer science. The process of constructing a program for solving a given problem, of editing it, compiling (both manually and automatically), running and debugging it, is covered from the beginning. The aim is to master the elements of a programming language and be able to put them together in order to construct programs using types, control structures, arrays, functions and libraries. An introduction to object orientation will be given. After completing this module, the student should understand the fundamental elements of a program, the importance of good program design and user-friendly interfaces. Students should be able to conduct basic program analysis and write complete elementary programs.

Module credits	16.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	APS of 30 and level 5 (60-69%) Mathematics
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Computer Science
Period of presentation	Semester 1

Mathematics 124 (WTW 124)

Module content:

*Students will not be credited for more than one of the following modules for their degree:
WTW 124, WTW 146, WTW 148 and WTW 164. This module serves as preparation for students majoring in Mathematics (including all students who intend to enrol for WTW 218, WTW 211 and WTW 220).

The vector space Rn, vector algebra with applications to lines and planes, matrix algebra, systems of linear equations, determinants. Complex numbers and factorisation of polynomials. Integration techniques and applications of integration. The formal definition of a limit. The fundamental theorem of Calculus and applications. Vector functions, polar curves and quadratic curves.

Module credits	16.00
Prerequisites	WTW 114
Contact time	4 lectures per week, 1 tutorial per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Elective modules

Plant biology 161 (BOT 161)

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.

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

General chemistry 117 (CMY 117)

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.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
Prerequisites	Final Grade 12 marks of at least 60% for Mathematics and 60% for Physical Sciences.
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Chemistry
Period of presentation	Semester 1

General chemistry 127 (CMY 127)

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.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Veterinary Science
Prerequisites	Natural and Agricultural Sciences students: CMY 117 GS or CMY 154 GS Health Sciences students: none
Contact time	1 practical per week, 4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Chemistry
Period of presentation	Semester 2

Philosophy 110 (FIL 110)

Module content:

Introduction to Philosophy

The two semester modules at first-year level introduce students to the four main subfields of Philosophy, namely epistemology and metaphysics, ethics and political philosophy. This module introduces students to two of these subfields. Students must contact the Department of Philosophy to ascertain which two subfields are covered in each semester as the choice may change from time to time due to availability of teaching staff. Students will become acquainted with the nature of philosophical reflection by exploring a number of classical philosophical themes in each subfield. Throughout the module there is an emphasis on developing those critical thinking, reading and writing skills that are required in Philosophy, while students become acquainted with the power of critique as critical judgment and discernment.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Law
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 1 discussion class per week
Language of tuition	Both Afr and Eng
Academic organisation	Philosophy
Period of presentation	Semester 1

Philosophy 120 (FIL 120)

Module content:

Introduction to Philosophy
The two semester modules at first-year level introduce students to the four main subfields of Philosophy, namely epistemology and metaphysics, ethics and political philosophy. This module introduces students to two of these subfields. Students must contact the Department of Philosophy to ascertain which two subfields are covered in each semester as the choice may change from time to time due to availability of teaching staff. Students will become acquainted with the nature of philosophical reflection by exploring a number of classical philosophical themes in each subfield. Throughout the module there is an emphasis on developing those critical thinking, reading and writing skills that are required in Philosophy, while students become acquainted with the power of critique as critical judgment and discernment.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Law
Prerequisites	No prerequisites.
Contact time	1 discussion class per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Philosophy
Period of presentation	Semester 2

Financial accounting 111 (FRK 111)

Module content:

The nature and function of accounting; the development of accounting; financial position; financial result; the recording process; processing of accounting data; treatment of VAT; elementary income statement and balance sheet; flow of documents; accounting systems; introduction to internal control and internal control measures; bank reconciliations; control accounts; adjustments; financial statements of a sole proprietorship; the accounting framework.

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Law Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Accounting
Period of presentation	Semester 1

Historical geology 161 (GLY 161)

Module content:

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

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 60% in the Grade 12 examination
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 4

Environmental and hazard geology 162 (GLY 162)

Module content:

Hazardous exogenic and endogenic geological processes and their influence on the human environment; impact of human activities on the geological environment; natural resource utilisation including materials for

construction; natural and mine-induced seismicity; waste disposal; groundwater and environmental pollution. Geological maps; geological profiles; rock specimens; fossil specimens.

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 60% in the Grade 12 examination
Language of tuition	English
Academic organisation	Geology
Period of presentation	Quarter 3

Informatics 112 (INF 112)

Module content:

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

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	Refer to Regulation 1.2(e): A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination; or STK 113 60%, STK 123 60% or STK 110
Contact time	2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 1

Informatics 154 (INF 154)

Module content:

Introduction to programming.

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences

Prerequisites	Refer to Regulation 1.2(f): A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination
Contact time	2 practicals per week, 1 lecture per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 1

Informatics 164 (INF 164)

Module content:

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

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Natural and Agricultural Sciences
Prerequisites	INF 154; Regulation 1.2(f): A candidate must have passed Mathematics with at least 4 (50-59%) in the Grade 12 examination; AIM 101 or AIM 102 or AIM 111 and AIM 121
Contact time	1 lecture per week, 2 practicals per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Semester 2

Criminology 110 (KRM 110)

Module content:

Part 1: Fundamental criminology
Introduction to criminology, definition of crime, crime tendencies, classical and positivistic explanations of crime.
Part 2: Violent crime
A brief analysis of causes, consequences and mechanisms to prevent and reduce violent crime within a South African context. Define violent crime in terms of interpersonal violence, homicide, violent crimes within the criminal justice system and property-related violent crimes.

Module credits	12.00
Service modules	Faculty of Law
Prerequisites	No prerequisites.
Contact time	2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Social Work and Criminology

Period of presentation	Semester 1

Criminology 120 (KRM 120)

Module content:

Part 1: Penology
In Penology attention is given to the criminal justice system to emphasise the importance of using an integrated approach in the handling of offenders. The impact of overpopulation in prisons is critically evaluated. Attention is also given to awaiting trial offenders, the importance of community-based sentences as well as the re-integration of offenders in the community.
Part 2: Crime prevention and control
Responsibilities of the police and the community in crime prevention and control. Primary, secondary and tertiary crime prevention, crime prevention and reduction strategies in South Africa.

Module credits	12.00
Service modules	Faculty of Law
Prerequisites	KRM 110
Contact time	2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Social Work and Criminology
Period of presentation	Semester 2

Introduction to microbiology 161 (MBY 161)

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.

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

Molecular and cell biology 111 (MLB 111)

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.

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

Business management 114 (OBS 114)

Module content:

Introduction to business management as a science; the environment in which the enterprise operates; the field of business, the mission and goals of an enterprise; management and entrepreneurship. The choice of a form of enterprise; the choice of products and/or services; profit and cost planning for different sizes of operating units; the choice of location; the nature of production processes and the layout of the plant or operating unit. Introduction to and overview of general management, especially regarding the five management tasks: strategic management; contemporary developments and management issues; financial management; marketing and public relations. Introduction to and overview of the value chain model; management of the input; management of the purchasing function; management of the transformation process with specific reference to production and operations management; human resources management and information management; corporate governance and black economic empowerment (BEE).

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	May not be included in the same curriculum as OBS 155
Contact time	3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Business Management
Period of presentation	Semester 1

Business management 124 (OBS 124)

Module content:

Responsible leadership and the role of a business in society. The nature and development of entrepreneurship; the individual entrepreneur and characteristics of South African entrepreneurs. Looking at the window of opportunity. Getting started (business start up). Exploring different routes to entrepreneurship: entering a family business, buying a franchise, home-based business and the business buyout. This semester also covers how entrepreneurs can network and find support in their environments. Case studies of successful entrepreneurs - also South African entrepreneurs - are studied.

Module credits	10.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	Admission to the examination in OBS 114
Contact time	3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Business Management
Period of presentation	Semester 2

Psychology 110 (SLK 110)

Module content:

This module is a general orientation to Psychology. An introduction is given to various theoretical approaches in Psychology, and the development of Psychology as a science is discussed. Selected themes from everyday life are explored and integrated with psychological principles. This module focuses on major personality theories. An introduction is given to various paradigmatic approaches in Psychology.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	2 discussion classes per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Psychology
Period of presentation	Semester 1

Psychology 120 (SLK 120)

Module content:

This module introduces the student to a basic knowledge and understanding of the biological basis of human behaviour. The module addresses the key concepts and terminology related to the biological subsystem, the rules and principles guiding biological psychology, and identification of the interrelatedness of different biological systems and subsystems. In this module various cognitive processes are studied, including perception, memory, thinking, intelligence and creativity. Illustrations are given of various thinking processes, such as problem solving, critical, analytic and integrative thinking.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Health Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	No prerequisites.
Contact time	2 lectures per week, 2 discussion classes per week
Language of tuition	Both Afr and Eng
Academic organisation	Psychology
Period of presentation	Semester 2

Statistics 110 (STK 110)

Module content:

Descriptive statistics:
Sampling and the collection of data; frequency distributions and graphical representations. Descriptive measures of location and dispersion.
Probability and inference:
Introductory probability theory and theoretical distributions. Sampling distributions. Estimation theory and hypothesis testing of sampling averages and proportions (one and two-sample cases). Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Module credits	13.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	At least 5 (60-69%) in Mathematics in the Grade 12 examination. Candidates who do not qualify for STK 110 must register for STK 113 and STK 123
Contact time	1 tutorial per week, 1 practical per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Statistics
Period of presentation	Semester 1

Statistics 120 (STK 120)

Module content:

Multivariate statistics:
Analysis of variance, categorical data analysis, distribution-free methods, curve fitting, regression and correlation, the analysis of time series and indices.
Statistical and economic applications of quantitative techniques:
Systems of linear equations: drafting, matrices, solving and application. Optimisation; linear functions (two and more independent variables), non-linear functions (one and two independent variables). Marginal and total functions. Stochastic and deterministic variables in statistical and economic context: producers' and consumers' surplus, distribution functions, probability distributions, probability density functions. Identification, use, evaluation, interpretation of statistical computer packages and statistical techniques.
This module is also presented as an anti-semester bilingual module.

Module credits	13.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities Faculty of Natural and Agricultural Sciences
Prerequisites	STK 110 GS or both STK 113 GS and STK 123 GS or both WST 133 and WST 143 or STK 133 and STK 143 or STK 133 and STK 143
Contact time	1 practical per week, 3 lectures per week, 1 tutorial per week
Language of tuition	Both Afr and Eng
Academic organisation	Statistics
Period of presentation	Semester 2

Mathematical statistics 111 (WST 111)

Module content:

Characterisation of a set of measurements: Graphical and numerical methods. Random sampling. Probability theory. Discrete and continuous random variables. Probability distributions. Generating functions and moments.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	At least 5 (60-69%) in Mathematics in the Grade 12 examination
Contact time	4 lectures per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Statistics
Period of presentation	Semester 1

Mathematical statistics 121 (WST 121)

Module content:

Sampling distributions and the central limit theorem. Statistical inference: Point and interval estimation. Hypothesis testing with applications in one and two-sample cases. Introductory methods for: Linear regression and correlation, analysis of variance, categorical data analysis and non-parametric statistics. Identification, use, evaluation and interpretation of statistical computer packages and statistical techniques.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 111 GS or WST 133, 143 and 153
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

Financial accounting 122 (FRK 122)

Module content:

Budgeting, payroll accounting, taxation – income tax and an introduction to other types of taxes, credit and the new Credit Act, insurance, accounting for inventories (focus on inventory and the accounting entries, not calculations), interpretation of financial statements.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Law Faculty of Natural and Agricultural Sciences
Prerequisites	FRK 111 GS or FRK 133, FRK 143
Contact time	4 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Accounting
Period of presentation	Semester 2

Introduction to geology 155 (GLY 155)

Module content:

Solar system; structure of solid matter; minerals and rocks; introduction to symmetry and crystallography; important minerals and solid solutions; rock cycle; classification of rocks. External geological processes (gravity, water, wind, sea, ice) and their products (including geomorphology). Internal structure of the earth. The dynamic earth – volcanism, earthquakes, mountain building – the theory of plate tectonics. Geological processes

(magmatism, metamorphism, sedimentology, structural geology) in a plate tectonic context. Geological maps and mineral and rock specimens.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics with at least 60% in the Grade 12 examination
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Geology
Period of presentation	Semester 1

First course in physics 114 (PHY 114)

Module content:

SI-units. Significant figures. Waves: intensity, superposition, interference, standing waves, resonance, beats, Doppler. Geometrical optics: Reflection, refraction, mirrors, thin lenses, instruments. Physical optics: Young-interference, coherence, diffraction, polarisation. Hydrostatics and dynamics: density, pressure, Archimedes' principle, continuity, Bernoulli. Heat: temperature, specific heat, expansion, heat transfer. Vectors. Kinematics of a point: Relative, projectile, and circular motion. Dynamics: Newton's laws, friction. Work: point masses, gasses (ideal gas law), gravitation, spring, power. Kinetic energy: Conservative forces, gravitation, spring. Conservation of energy. Conservation of momentum. Impulse and collisions. System of particles: Centre of mass, Newton's laws. Rotation: torque, conservation of angular momentum, equilibrium, centre of gravity.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	Refer to Regulation 1.2: A candidate must have passed Mathematics and Physical Science with at least 60% in the Grade 12 examination
Contact time	4 lectures per week, 1 discussion class per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Physics
Period of presentation	Semester 1

First course in physics 124 (PHY 124)

Module content:

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

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education
Prerequisites	WTW 114 GS and PHY 114 GS
Contact time	4 lectures per week, 1 discussion class per week, 1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Physics
Period of presentation	Semester 2

Curriculum: Year 2

Minimum credits: 181

Fundamental modules

Community-based project 202 (JCP 202)

Module content:

This project-orientated module is a form of applied learning which is directed at specific community needs and is integrated into all undergraduate academic programmes offered by the Faculty of Engineering, Built Environment and Information Technology.
The main objectives with the module are as follows:
(1) The execution of a community-related project aimed at achieving a beneficial impact on a chosen section of society, preferably but not exclusively, by engagement with a section of society which is different from the student's own background.
(2) The development of an awareness of personal, social and cultural values, an attitude to be of service, and an understanding of social issues, for the purpose of being a responsible professional.
(3) The development of important multidisciplinary and life skills, such as communication, interpersonal and leadership skills.
Assessment in this module will include all or most of the following components: evaluation and approval of the project proposal, assessment of oral and/or written progress reports, peer assessment in the event of team projects, written report-back by those at which the project was aimed at, and final assessment on grounds of the submission of a portfolio and a written report.

Module credits	8.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	No prerequisites.
Contact time	1 other contact session per week
Language of tuition	Both Afr and Eng
Academic organisation	Informatics
Period of presentation	Year

Core modules

Data structures and algorithms 212 (COS 212)

Module content:

Data abstraction is a fundamental concept in the design and implementation of correct and efficient software. In prior modules, students are introduced to the basic data structures of lists, stacks and queues. This module continues with advanced data structures such as trees, hash tables, heaps and graphs, and goes into depth with the algorithms needed to manipulate them efficiently. Classical algorithms for sorting, searching, traversing, packing and game playing are included, with an emphasis on comparative implementations and efficiency. At the end of this module, students will be able to identify and recognise all the classical data structures; implement them in different ways; know how to measure the efficiency of implementations and algorithms; and have further

developed their programming skills, especially with recursion and polymorphism.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	COS 110
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

Netcentric computer systems 216 (COS 216)

Module content:

This module introduces the principles of netcentric computing that can be applied to the WWW and internet as well as to distributed applications. After completing this module, a student will have gained, as outcomes, knowledge of how to integrate various programming and web-based technologies. Particular outcomes include gaining knowledge on the concepts of client and server side programming, web-based applications, port and socket interaction, writing programmes that require remote function calls and achieving database connectivity using remote SQL calls. The supporting technologies of mark-up languages like HTML and scripting languages like JavaScript are also studied. In order to practically demonstrate that a student has reached these outcomes, students will be required to use, integrate and maintain the necessary software and hardware by completing a number of smaller practical assignments whereafter integrating all these technologies into a comprehensive and practical netcentric programming project is required.

Module credits	16.00
Prerequisites	COS 110
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

Operating systems 222 (COS 222)

Module content:

Fundamental concepts of modern operating systems in terms of their structure and the mechanisms they use are studied in this module. After completing this module, students will have gained, as outcomes, knowledge of real time, multimedia and multiple processor systems, as these will be defined and analysed. In addition, students will have gained knowledge on modern design issues of process management, deadlock and concurrency control, memory management, input/output management, file systems and operating system security. In order to experience a hands-on approach to the knowledge students would have gained from studying the abovementioned concepts, students will have produced a number of practical implementations of these concepts using the Windows and Linux operating systems.

Module credits	16.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	COS 153 or COS 131 or COS 132
Contact time	1 practical per week
Language of tuition	Both Afr and Eng
Academic organisation	Computer Science
Period of presentation	Semester 2

Concurrent systems 226 (COS 226)

Module content:

Computer science courses mostly deal with sequential programs. This module looks at the fundamentals of concurrency; what it means, how it can be exploited, and what facilities are available to determine program correctness. Concurrent systems are designed, analysed and implemented.

Module credits	16.00
Prerequisites	COS 153 or COS 131 or COS 132
Contact time	1 practical per week, 4 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 2

Computer organisation and architecture 284 (COS 284)

Module content:

This module provides the foundations on which other modules build by enabling a deeper understanding of how software interacts with hardware. It will teach the design and operation of modern digital computers by studying each of the components that make up a digital computer and the interaction between these components. Specific areas of interest, but not limited to, are: representation of data on the machine-level; organisation of the machine on the assembly level; the architecture and organisation of memory; inter- and intra-component interfacing and communication; data paths and control; and parallelism. Topic-level detail and learning outcomes for each of these areas are given by the first 6 units of ‘Architecture and Organisation’ knowledge area as specified by the ACM/IEEE Computer Science Curriculum 2013.
The concepts presented in the theory lectures will be reinforced during the practical sessions by requiring design and implementation of the concepts in simulators and assembly language using an open source operating system.

Module credits	16.00
Prerequisites	COS 110
Contact time	1 practical per week, 4 lectures per week

Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 2

Informatics 214 (INF 214)

Module content:

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

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

Information science 240 (INL 240)

Module content:

Social and ethical impact. This module examines moral and legal regulation practices related to information in print and digital environments. Different ethical theories are identified and applied to privacy, access to information, information poverty and censorship. The interpretation and enforcement of rules and regulations are discussed.

Module credits	20.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 practicals per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
Period of presentation	Semester 1

Mathematical modelling 152 (WTW 152)

Module content:

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

Module credits	8.00
Service modules	Faculty of Engineering, Built Environment and Information Technology
Prerequisites	Refer to Regulation 1.2
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Discrete structures 285 (WTW 285)

Module content:

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

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

Elective modules

Physical chemistry 282 (CMY 282)

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.

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

Language of tuition	English
Academic organisation	Chemistry
Period of presentation	Quarter 2

Analytical chemistry 283 (CMY 283)

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.

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

Organic chemistry 284 (CMY 284)

Module content:

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

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

Inorganic chemistry 285 (CMY 285)

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.

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

Information science 210 (INL 210)

Module content:

Information seeking and retrieval. This module explores the theory and practice of effective information seeking and retrieval. It builds on supporting research paradigms such as the systems, user-centred, cognitive and socio-cognitive paradigms. The focus is on the complexities of effective information seeking and retrieval within the context of information behaviour on a personal level, as well as in the context of professional, academic or everyday information needs.

Module credits	20.00
Service modules	Faculty of Humanities
Prerequisites	AIM 101 or AIM 102 or AIM 111 and 121
Contact time	3 practicals per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
Period of presentation	Semester 1

Information science 220 (INL 220)

Module content:

Representation and organisation. Information needs to be represented and organised in a system for it to be effectively retrievable. This module deals with the representation and organisation of information on the level of individual entities (e.g. indexing), from the perspective of the users (user profiling), as well as within a document collection (taxonomies and ontologies).

Module credits	20.00
Service modules	Faculty of Humanities
Prerequisites	INL 210 or LP
Contact time	3 lectures per week, 3 practicals per week
Language of tuition	Both Afr and Eng

Academic organisation	Information Science
Period of presentation	Semester 2

Information science 260 (INL 260)

Module content:

Economics and politics of information. This module examines the economics and politics of information, with a special emphasis on South Africa's information sector. It aims to promote an understanding of the market and non-market qualities of information, and their consequences for the production, distribution and marketing of information goods and services. The ways in which information access and expression are regulated and the use of ICTs in crime and corruption is also addressed.

Module credits	20.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 practicals per week, 3 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
Period of presentation	Semester 2

Information science 270 (INL 270)

Module content:

Indigenous knowledge and communication. This module focuses on the role and function of Indigenous Knowledge (IK) in the information and knowledge society. Various categories and contexts of IK are explored within international and local perspectives.
Issues pertaining to access and communication of IK, inter alia through Information and Communication Technology (ICT), are addressed in order to ensure sustainable development.

Module credits	20.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 practicals per week, 3 lectures per week
Language of tuition	English
Academic organisation	Information Science
Period of presentation	Semester 2

General physics 263 (PHY 263)

Module content:

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

Module credits	24.00
Service modules	Faculty of Education
Prerequisites	PHY 255 GS and WTW 218 GS and WTW 220# and WTW 248#
Contact time	1 practical per week, 4 lectures per week, 2 discussion classes per week
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 2

Mathematical statistics 211 (WST 211)

Module content:

Set theory. Probability measure functions. Random variables. Distribution functions. Probability mass functions. Density functions. Expected values. Moments. Moment generating functions. Special probability distributions: Bernoulli, binomial, hypergeometric, geometric, negative binomial, Poisson, Poisson process, discrete uniform, uniform, gamma,exponential, Weibull, Pareto, normal. Joint distributions: Multinomial, extended hypergeometric, joint continuous distributions. Marginal distributions. Independent random variables. Conditional distributions. Covariance, correlation. Conditional expected values. Transformation of random variables: Convolution formula. Order statistics. Stochastic convergence: Convergence in distribution. Central limit theorem. Practical applications. Practical statistical modelling and analysis using statistical computer packages and the interpretation of the output.

Module credits	24.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 111, WST 121, WTW 114 GS and WTW 124 GS
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Double Medium
Academic organisation	Statistics

Period of presentation	Semester 1

Mathematical statistics 221 (WST 221)

Module content:

Stochastic convergence: Asymptotic normal distributions, convergence in probability. Statistics and sampling distributions: Chi-squared distribution. Distribution of the sample mean and sample variance for random samples from a normal population. T-distribution. F-distribution. Beta distribution. Point estimation: Method of moments. Maximum likelihood estimation. Unbiased estimators. Uniform minimum variance unbiased estimators. Cramer-Rao inequality. Efficiency. Consistency. Asymptotic relative efficiency.
Bayes estimators. Sufficient statistics. Completeness. The exponential class. Confidence intervals. Test of statistical hypotheses. Reliability and survival distributions. Practical applications. Practical statistical modelling and analysis using statistical computer packages and the interpretation of the output.

Module credits	24.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211 GS
Contact time	2 practicals per week, 4 lectures per week
Language of tuition	Double Medium
Academic organisation	Statistics
Period of presentation	Semester 2

Linear algebra 211 (WTW 211)

Module content:

This is an introduction to linear algebra on Rn. Matrices and linear equations, linear combinations and spans, linear independence, subspaces, basis and dimension, eigenvalues, eigenvectors, similarity and diagonalisation of matrices, linear transformations.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 124
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Calculus 218 (WTW 218)

Module content:

Calculus of multivariable functions, directional derivatives. Extrema and Lagrange multipliers. Multiple integrals, polar, cylindrical and spherical coordinates.

Module credits	12.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 114 and WTW 124
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Analysis 220 (WTW 220)

Module content:

Properties of real numbers. Analysis of sequences and series of real numbers. Power series and theorems of convergence. The Bolzano-Weierstrass theorem. The intermediate value theorem and analysis of real-valued functions on an interval. The Riemann integral: Existence and properties of the interval.

Module credits	12.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 114 and WTW 124
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Both Afr and Eng
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Linear algebra 221 (WTW 221)

Module content:

Abstract vector spaces, change of basis, matrix representation of linear transformations, orthogonality, diagonalisability of symmetric matrices, some applications.

Module credits	12.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences
Prerequisites	WTW 211

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

Differential equations 286 (WTW 286)

Module content:

*Students will not be credited for more than one of the modules for their degree: WTW 264, WTW 286
Theory and solution methods for ordinary differential equations and initial value problems: separable and linear first-order equations, linear equations of higher order, systems of linear equations. Application to mathematical models. Numerical methods applied to nonlinear systems.Qualitative analysis of linear systems.

Module credits	12.00
Service modules	Faculty of Economic and Management Sciences
Prerequisites	WTW 114, WTW 124 and WTW 162
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	English
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Waves, thermodynamics and modern physics 255 (PHY 255)

Module content:

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

Error Analysis (7 practical sessions)
Experimental uncertainties. Propagation of uncertainties. Statistical analysis of random uncertainties. Normal distribution. Rejection of data. Least-squares fitting. Covariance and correlation.

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

Vector analysis 248 (WTW 248)

Module content:

Vectors and geometry. Calculus of vector functions with applications to differential geometry, kinematics and dynamics. Vector analysis, including vector fields, line integrals of scalar and vector fields, conservative vector fields, surfaces and surface integrals, the Theorems of Green, Gauss and Stokes with applications.

Module credits	12.00
Service modules	Faculty of Education
Prerequisites	WTW 218
Contact time	1 discussion class per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Curriculum: Final year

Minimum credits: 144

Core modules

Software engineering 301 (COS 301)

Module content:

The module exposes students to problems associated with software development on an industrial scale. Overall goals of the module are: to become familiar with the latest trends in software engineering; to understand the software engineering process and to appreciate its complexity; to be exposed to a variety of methodologies for tackling different stages of the software lifecycle; to understand and apply the concepts of systems administration and maintenance; to complete the development of a fairly large object orientation-based software product. The focus of the module is on a project that lasts the whole year. The project is completed in groups of approximately four (4) students and teaches students to take responsibility for a variety of roles within a group, and to understand the different requirements for these; to experience the advantages and problems of working in a group; professionalism with regards to particularly colleagues and clients.
After the successful completion of this module, the student will be able to: understand the psychology of a client; work in groups; and have an appreciation for planning, designing, implementing and maintaining large projects. These qualities should place the students in a position in which they are able to handle software development in the corporate environment.

Module credits	27.00
Prerequisites	COS 110 and COS 121
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Year

Computer networks 332 (COS 332)

Module content:

The objective of this module is to acquaint the student with the terminology of communication systems and to establish a thorough understanding of exactly how data is transferred in such communication networks, as well as applications that can be found in such environments. The study material includes: concepts and terminology, the hierarchy of protocols according to the OSI and TCP/IP models, protocols on the data level, physical level and network level as well as higher level protocols. The practical component of the module involves programming TCP/IP sockets using a high level language. The emphasis throughout is on the technical aspects underlying the operation of networks, rather than the application of networks.

Module credits	18.00
Prerequisites	COS 216
Contact time	2 lectures per week, 1 practical per week

Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

Programming languages 333 (COS 333)

Module content:

Programming languages are the backbone for software development. Each language has its own different syntax and semantics, but there are many common concepts that can be studied and then illustrated through the languages. The module concentrates on issues of object orientation, including delegation, iteration and polymorphism. It surveys how languages provide the basic building blocks for data and control, as well as exception handling and concurrency. At the end of the module, students will be able to appreciate the rich history behind programming languages, leading to independent principles that evolve over time. They will be skilled at using a variety of programming languages, including new paradigms such as functional, logical and scripting, and will know how to learn a new language with ease. From this experience, they will be able to apply evaluation criteria for choosing an appropriate programming language in a given scenario.

Module credits	18.00
Prerequisites	COS 110
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 2

Computer security and ethics 330 (COS 330)

Module content:

This module develops an appreciation of the fundamentals and design principles for information assurance and security. Students will develop a clear understanding of the basic information security services and mechanisms, enabling them to design and evaluate the integration of solutions into the user application environment. Emphasis will be placed on services such as authorisation and confidentiality. Students will acquire knowledge and skills of Security Models such as the Bell-LaPadula, Harrison-Ruzzo Ullman and Chinese Wall Model. Students will develop a detailed understanding of the confidentiality service by focusing on cryptology and the practical implementation thereof. The student will be introduced to professional and philosophical ethics. At the end of the module students will be able to engage in a debate regarding the impact (local and global) of computers on individuals, organisations and society. The professionalism of IT staff will be discussed against national and international codes of practices such as those of the CSSA, ACM and IEEE.

Module credits	18.00
Prerequisites	COS 110
Contact time	2 lectures per week, 1 practical per week
Language of tuition	English

Academic organisation	Computer Science
Period of presentation	Semester 2

Elective modules

Physical chemistry 382 (CMY 382)

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.

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

Analytical chemistry 383 (CMY 383)

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.

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

Organic chemistry 384 (CMY 384)

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).

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

Inorganic chemistry 385 (CMY 385)

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.

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

Artificial intelligence 314 (COS 314)

Module content:

The main objective of this module is to introduce a selection of topics from artificial intelligence (AI), and to provide the student with the background to implement AI techniques for solving complex problems.
This module will cover topics from classical AI, as well as more recent AI paradigms. These topics include: search methods, game playing, knowledge representation and reasoning, machine learning, neural networks, genetic algorithms, artificial life, planning methods, and intelligent agents. In the practical part of this module, students will get experience in implementing
(1) game trees and evolving game-playing agents;
(2) a neural network and applying it to solve a real-world problem; and
(3) a genetic algorithm and applying it to solve a real-world problem.

Module credits	18.00

Prerequisites	COS 131 or COS 110
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

Database systems 326 (COS 326)

Module content:

This module builds on a prior introductory module on database technology and provides more advanced theoretical and practical study material.

Module credits	18.00
Prerequisites	INF 214 or TDH
Contact time	1 lecture per week, 2 practicals per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 2

Compiler construction 341 (COS 341)

Module content:

This module will introduce the student to the fundamentals of compiler construction. These include: the structural difference between a high-level and a von-Neumann language, the meaning of syntax and semantics and what semantics-preserving correctness means; the concepts of regular expressions, finite automata, context-free grammars in the context of programming languages; the need to construct parse-trees for given programmes; the application of data structures and algorithms for the purpose of code-analysis, code-optimisation and register-allocation; and the limits of code-analysis in terms of undecideability and the halting problem.
After successful completion of the module, the student will have an understanding of the importance of compilers and will understand how to implement a compiler, in terms of its components, the scanner, parser, type checker and code-generator for a given grammar.

Module credits	18.00
Prerequisites	COS 212
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

Computer graphics 344 (COS 344)

Module content:

The aim of this module is to acquire a sound knowledge of the basic theory of interactive computer graphics and basic computer graphics programming techniques. The theory will cover graphics systems and models, graphics programming, input and interaction, geometric objects and transformations, viewing in 3D, shading, rendering techniques, and introduce advanced concepts, such as object-oriented computer graphics and discrete techniques. The module includes a practical component that enables students to apply and test their knowledge in computer graphics. The OpenGL graphics library and the C programming language will be used for this purpose.

Module credits	18.00
Prerequisites	COS 110 and WTW 126
Contact time	1 practical per week, 2 lectures per week
Language of tuition	English
Academic organisation	Computer Science
Period of presentation	Semester 1

Information science: Information organisation 310 (INL 310)

Module content:

Information Organisation. The module is concerned with the organisation of information in the digital environment focusing on the structure and use of document management and workflow systems, as well as distribution channels and virtual environments. The characteristics and application of the internet, intranets, as well as portals and applications use, are considered.

Module credits	30.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 practicals per week, 3 lectures per week
Language of tuition	English
Academic organisation	Information Science
Period of presentation	Semester 1

Information science: Information and knowledge management 320 (INL 320)

Module content:

Information and Knowledge Management. This module focuses on information and knowledge management at an operational level and introduces information and knowledge management at a corporate strategic level. It deals with the management of information and knowledge, which enables the organisation to be competitive. In this module the focus is on four aspects, namely: the 21st century organisation, the external and internal stakeholders that have an interest in information products, as well as the infrastructure that should be in place in

organisations to manage information products. The module concludes with a few topics relating to information management at a corporate strategic level.

Module credits	30.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 practicals per week, 3 lectures per week
Language of tuition	English
Academic organisation	Information Science
Period of presentation	Semester 2

Information science: Digital repositories 340 (INL 340)

Module content:

This module deals with the construction and management of digital repositories. It also addresses the characteristics of the digital repository in a rapidly changing technological world and a challenging information society. Core aspects include: system design, relationships to hybrid libraries, digital collections and rights management, standards, virtual referencing and the development and evaluation of digital repositories.

Module credits	30.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 3 practicals per week
Language of tuition	English
Academic organisation	Information Science
Period of presentation	Semester 2

Information science: Socio-political aspects of information in global context 360 (INL 360)

Module content:

This module examines aspects of the information and knowledge society within local, regional and international contexts. A special focus of the module is the interaction and exchange of data, information and knowledge from communities' local knowledge system with data, information and knowledge from the global knowledge system. The module discusses the growth and role of information and communication technologies (ICTs), and their implications for development.

Module credits	30.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 practicals per week, 3 lectures per week

Language of tuition	English
Academic organisation	Information Science
Period of presentation	Semester 1

Information science 370 (INL 370)

Module content:

Experiential learning project. This module takes the form of a project and experiential training in co-operation with industry.

Module credits	15.00
Prerequisites	INL 210, 220 and INL 310 or registered for INL 310
Contact time	2 practicals per week, 1 lecture per week
Language of tuition	Both Afr and Eng
Academic organisation	Information Science
Period of presentation	Year

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

Module content:

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

Module credits	36.00
Service modules	Faculty of Education
Prerequisites	PHY 356 and WTW 211 and WTW 218 and WTW 220 GS and WTW 248 GS
Contact time	2 discussion classes per week, 4 lectures per week, 2 practicals per week
Language of tuition	English
Academic organisation	Physics

Period of presentation	Semester 2

Stochastic processes 312 (WST 312)

Module content:

Definition of a stochastic process. Stationarity. Covariance stationary. Markov property. Random walk. Brownian motion. Markov chains. Chapman-Kolmogorov equations. Recurrent and transient states. First passage time. Occupation times. Markov jump processes. Poisson process. Birth and death processes. Structures of processes. Structure of the time-homogeneous Markov jump process. Applications in insurance. Practical statistical modelling, analysis and simulation using statistical computer packages and the interpretation of the output.

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Statistics
Period of presentation	Semester 1

Time-series analysis 321 (WST 321)

Module content:

Stationary and non-stationary univariate time-series. Properties of autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) processes. Identification, estimation and diagnostic testing of a time-series model. Forecasting. Multivariate time-series. Practical statistical modelling and analysis using statistical computer packages.

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WST 311 GS, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Statistics
Period of presentation	Semester 2

Actuarial statistics 322 (WST 322)

Module content:

Decision theory. Loss distributions. Reinsurance. Risk models. Ruin theory. Credibility theory. Methods to forecast

future claim numbers and amounts. The generalised linear model: Exponential family, mean and variance, link functions, deviance and residual analysis, test statistics, log-linear and logit models. Practical statistical modelling and analysis using statistical computer packages.

Module credits	18.00
Service modules	Faculty of Economic and Management Sciences Faculty of Natural and Agricultural Sciences
Prerequisites	WST 211, WST 221, WTW 211 GS and WTW 218 GS
Contact time	1 practical per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Statistics
Period of presentation	Semester 2

Financial engineering 354 (WTW 354)

Module content:

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

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences
Prerequisites	WST 211, WTW 211 and WTW 218
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Algebra 381 (WTW 381)

Module content:

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

Module credits	18.00
Service modules	Faculty of Education Faculty of Economic and Management Sciences Faculty of Humanities

Prerequisites	WTW 114 and WTW 211
Contact time	1 tutorial per week, 2 lectures per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 1

Numerical analysis 383 (WTW 383)

Module content:

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

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Economic and Management Sciences Faculty of Humanities
Prerequisites	WTW 114, WTW 124 and WTW 211
Contact time	2 lectures per week, 1 practical per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Geometry 389 (WTW 389)

Module content:

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

Module credits	18.00
Service modules	Faculty of Engineering, Built Environment and Information Technology Faculty of Education Faculty of Humanities
Prerequisites	WTW 211
Contact time	2 lectures per week, 1 tutorial per week
Language of tuition	Double Medium
Academic organisation	Mathematics and Applied Maths
Period of presentation	Semester 2

Electronics, electromagnetism and quantum mechanics 356 (PHY 356)

Module content:

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

Module credits	36.00
Service modules	Faculty of Education
Prerequisites	PHY 255 GS and PHY 263 GS and WTW 211 GS and WTW 218 GS and WTW 220 GS and WTW 248 GS
Contact time	2 discussion classes per week, 4 lectures per week, 1 practical per week
Language of tuition	English
Academic organisation	Physics
Period of presentation	Semester 1

Information science: Competitive intelligence 380 (INL 380)

Module content:

This module provides an overview of Competitive Intelligence (CI) and focuses on the needs for CI in organisations. The ways in which organisations compete and the benefits that CI can bring to these organisations will also be covered. The growing need for CI among South African organisations will also be examined. Practical examples and case studies will be used to highlight the value of CI in organisations.

Module credits	30.00
Service modules	Faculty of Humanities
Prerequisites	No prerequisites.
Contact time	3 lectures per week, 3 practicals per week

Language of tuition	Both Afr and Eng
Academic organisation	Information Science
Period of presentation	Semester 2