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Faculty of **Science**

Interim Dean:
Prof DE Rawlings
BScHons, PhD (Rhodes)

CALENDAR 2013
PART 5

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General Information

A STANDING INVITATION TO ALL ALUMNI

The Registrar warmly invites all alumni of Stellenbosch University (SU) to notify him in writing of changes of address.

The Registrar would like to be informed of academic and other distinctions achieved by alumni, and of the titles of their publications.

The Senior Director: Library and Information Services would be glad to receive copies of such publications on behalf of the University Library.

SUMMARY: LANGUAGE POLICY AND PLAN

The official Language Policy and Plan of Stellenbosch University was approved by the Council of the University in 2002. The following summary is provided in the interests of brevity, but must be read in conjunction with, and is subject to, the full Language Policy and Plan. The full version is available at http://www.sun.ac.za/taal.

A. Language Policy

1. The University is committed to the use and sustained development of Afrikaans as an academic language in a multilingual context. Language is used at the University in a manner that is directed towards its engagement with knowledge in a diverse society.
2. The University acknowledges the special status of Afrikaans as an academic language and accepts the responsibility to promote it. At the same time, it takes account of the status of English as an international language of communication and of isiXhosa as an emerging academic language.
3. The University distinguishes between the use of the three languages in the following manner:
   - Afrikaans is by default the language of learning and teaching at undergraduate level, while English is used to a greater extent at the postgraduate level;
   - isiXhosa is promoted as an emerging academic language. The University creates opportunities for students and staff to acquire communication skills in isiXhosa.
4. The institutional language of the University is, by default, Afrikaans, while English is also used, depending on the circumstances, as an internal language of communication. All three languages are used, where possible, for external communication.

B. Language Plan

1. The Language Plan distinguishes between the implementation of the policy in learning and teaching situations and in the support services and management.
2. Choices between various language options may be made in learning and teaching situations, depending on the language abilities of the lecturer and the composition of the students and programme. These language options are arranged in a hierarchy. Reasons must be provided for deviating from the default option (see point 4 for details).

   In extraordinary and compelling circumstances the University may deviate from the language specification of a module or programme, on condition that any such deviation must be reviewed at the end of each semester to determine whether its continuation remains justified. The deans manage this process, reporting on it to the Executive Committee (Senate). The Language Committee must be informed of any deviation from the language specification of a module or programme and must be given the opportunity to enquire about such deviation, where necessary.

3. Three general guidelines apply with regard to the language of learning and teaching in class:
   - Modules in which a language is taught are conducted mainly in the language in question (e.g. isiXhosa is taught mainly in isiXhosa, Mandarin in Mandarin) and tasks, tests and examinations are set and answered accordingly.
   - Questions papers in all other modules are set in Afrikaans and English and students may answer in Afrikaans or English.
   - Except in cases where the aim of the module is language acquisition or the study of the language, students may ask questions and expect answers in Afrikaans or English.
4. Departments choose and implement the various language specifications as follows (the above three points apply generally for all options):

A Specification*

Rationale

Applies as the default mode for all undergraduate modules. No reasons need to be given for exercising this option.

Characteristics

- Teaching is mainly in Afrikaans
- Study material (textbooks, notes, transparencies, electronic learning and teaching material) may be in Afrikaans and/or English
- Study framework is in Afrikaans and English.

T Specification* (bilingual classes)

Rationale

Is used for classes where

- students' language competence requires greater use of English
- a programme offered is unique to the University
- multilingualism is important in the context of a specific occupation
- the lecturer does not yet have an adequate command of Afrikaans.

Characteristics

- Teaching is in Afrikaans for at least 50% of the time.
- Textbooks and reading matter are in Afrikaans and/or English.
- Study notes, transparencies and electronic learning and teaching material are fully in Afrikaans and English, or alternately in Afrikaans and English.

E Specification (English as the main medium of instruction)

Rationale

Is used only in highly exceptional circumstances for

- programmes unique in South Africa
- programmes in which students do not have adequate language skills (foreign or English-speaking students)
- modules in which the lecturer does not have a command of Afrikaans
- regional co-operation and strategic aims necessitate English.

Characteristics

- Teaching is primarily in English.
- Textbooks and reading matter are in Afrikaans and/or English.
- Notes are in English with core notes in Afrikaans.
- Transparencies and electronic learning and teaching material are in English.

A & E Specification (separate 'streams' in Afrikaans and English)

Rationale

Used only in most exceptional circumstances when academically and financially justified and attainable for

- modules with large numbers of students
- regional co-operation and attaining strategic goals

- programmes offered by satellite technology or distance education.

Characteristics

- The characteristics of the A and E options apply respectively here.

* For both of these options an academic language competence in Afrikaans and English is essential for successful study.

5. Afrikaans is the default language of communication for the support services and management. All official documents of the University are available in Afrikaans. 'Default' does not, however, mean 'exclusively': important policy documents are available in English and communication with staff is also conducted in English. Guidelines are provided for the language to be used at meetings. Documents relating to the service conditions for staff are available in Afrikaans, English and isiXhosa.
6. Written communication with students is conducted in Afrikaans and English, and recruitment is conducted, where possible, also in isiXhosa. Oral communication is conducted in Afrikaans or English, according to the language of preference of the student.
7. The corporate image of the University reflects the Language Policy and Plan.
8. A Language Committee is appointed by the Council to implement the Language Policy and Plan.
9. The Language Centre assumes the responsibility for the provision of and/or co-ordination of the relevant language support required for the effective implementation of the Language Policy and Plan.

Please note: A further explanation of the language specifications, as well as the language specification(s) of individual modules, is given in the section Subjects, modules and module contents.

CODE OF CONDUCT FOR LANGUAGE IN THE CLASSROOM

This Code of Conduct has been drawn up in order to provide practical guidelines for understanding and implementing the Language Policy and Plan of Stellenbosch University, which was accepted by the University Council in 2002. The Council regards it as important that the Language Policy and Plan of the University should be implemented with integrity. The Code is offered as an aid for dealing constructively with possible difficulties or uncertainties.

The core principle governing the day-to-day use of language on the campus is that all staff, students and clients of the University are responsible for language matters and may have the expectation that disputes will be approached and dealt with in a spirit of co-operation in which workable solutions are sought.

A distinction is drawn in the Code of Conduct between the responsibilities and expectations of staff and of students. Complaints on language matters of an academic nature will be dealt with in accordance with standard procedures.

The Language Policy and Plan sets the minimum language requirements for students studying at Stellenbosch University (Language Plan 2002:5):

As a general rule, students taking an A module or a T module requires an academic language proficiency in both Afrikaans and English for effective study at the undergraduate level. A higher level of academic language proficiency is required for postgraduate study.

Lecturers, especially with regard to their obligations to set and assess assignments, tests and question papers in English and Afrikaans, will be expected within a reasonable time from their appointment to develop sufficient receptive skills (listening and reading) in Afrikaans and English to be able to follow discussions in class, to set assignments and examination question papers in both languages and to be able to understand students' answers in both languages. They should also be capable of judging the equivalence of translations and of fairly assessing answers in Afrikaans and English.

Lecturers' Responsibilities

Lecturers bear the responsibility of:

1. Implementing the language specifications of the module being taught in accordance with the requirements of the Language Plan (see especially paragraph 3 of the Language Plan).
2. Revising and adjusting the language specifications where necessary and according to the circumstances (new text books, other lecturers).
3. Informing students briefly at the beginning of the teaching of the module, orally and in the module framework, of the choices and alternatives for which the language specifications make provision.
4. Ensuring that questions in assignments, tests and examinations have exactly the same content in English and Afrikaans.
5. Developing sufficient language proficiency to be able to mark assignments, tests and examinations in Afrikaans and English, or making other satisfactory arrangements that it takes place.
6. Ensuring that, in accordance with the guidelines for the T option (see 3.3.1.2 of the Language Plan), students' language proficiency is sufficiently developed, and the necessary measures are in place to ensure subject-specific language proficiency in Afrikaans and English.
7. Striving at all times to act courteously and accommodatingly in situations involving language use (e.g. when questions are asked in English in a class where the language specification for the module is A).

Lecturers' Expectations

Lecturers can expect students to:

1. Take note of the characteristics of the language specification applicable to the specification laid down for the module. (See paragraph 3, Language Plan).
2. Inform the lecturer of their needs with regard to academic language skills.
3. Respect the spirit of the Language Policy and Plan, especially with regard to the development of skills in a language which is not their language of choice, by deliberately paying attention to it, taking part actively in class and working on their knowledge of subject terminology and subject discourse in both languages. This expectation applies especially to the T Specification for modules.

Students' Responsibilities

Students bear the responsibility of:

1. Ascertaining the language options for each module and noting especially the consequences; e.g. that translations will not be available in some instances.
2. being honest and open-hearted about their language skills and taking the responsibility for early and appropriate action if they should experience difficulties.
3. Deliberately developing the receptive skills (listening and reading) in the language not of choice for learning and teaching by active participation in class.
4. Buying and using the prescribed material (especially text books) to improve their language skills in the subject.
5. being courteous and accommodating, and acting accordingly, in situations where language use is at issue, e.g. with regard to the difficulties of the minority group in the class.
6. Accepting that one or a few students, because of inadequacies in his/their language proficiency, may not exercise or try to exercise a right of veto with regard to the use of Afrikaans or English in the class situation.

Students' Expectations

Students can expect that:

1. Help with language skills development will be provided should their academic language proficiency in Afrikaans and/or English be inadequate.
2. They can ask questions and conduct discussions in Afrikaans or English (unless the other languages are required, as in language modules), taking into account their own and the lecturer's language proficiency.
3. Afrikaans and English versions of assignments and question papers will be available and will have the same content.
4. There will be sensitivity for language difficulties, so that language errors made under examination conditions will be assessed with discretion.

NONRACISM

Stellenbosch University admits students of any race, colour, nationality or ethnic origin to all rights, privileges, programmes and activities generally accorded or made available to students of the University. The University does not discriminate on the basis of race, colour, nationality or ethnic origin in the implementation of its educational policies, its scholarship and loan programmes, or its sports programmes.

Please note:

1. In this publication any expression signifying one of the genders includes the other gender equally, unless inconsistent with the context.
2. Before making a final choice of modules (subjects), every student should closely consult the relevant timetables. Should it then become apparent that two modules fall in the same time slot on a particular timetable, the University will not allow registration as a student in both of them for the same year/semester since they will be an inadmissible combination.
3. The University reserves the right to amend the Calendar at any time. The Council and the Senate of the University accept no liability for any inaccuracies there may be in the Calendar. Every reasonable care has, however, been taken to ensure that the relevant information to hand as at the time of going to press, is given fully and accurately in the Calendar.
4. In the event of uncertainty or a dispute regarding information in this Part 5 of the Calendar, the final interpretation will be based on the Afrikaans version.
5. Parts 1, 2 and 3 of the Calendar contain general information applicable to all students. Students are urged to note with special care the content of the Provisions relating to Examinations and Promotions in the "University Examinations" chapter of Part 1 of the Calendar.

CALENDAR CLASSIFICATION

The University Calendar is divided into the following parts:

General	Part 1
Bursaries and Loans	Part 2
Student Fees	Part 3
Arts and Social Sciences	Part 4
Science	Part 5
Education	Part 6
AgriSciences	Part 7
Law	Part 8
Theology	Part 9
Economic and Management Sciences	Part 10
Engineering	Part 11
Medicine and Health Sciences	Part 12
Military Science	Part 13

Afrikaans (Part 1 - 12) or English copies of the individual parts may be obtained from the Registrar on request.

COMMUNICATION WITH THE UNIVERSITY

Student Number

In dealing with new formal applications for admission, the University assigns a student number to each applicant. This number serves as the unique identification of the person concerned. However, the mere assignment of a student number does not imply that the applicant has been accepted for the proposed programme of study. Whether you have been accepted or not will be communicated to you in a separate letter.

Once you have been informed of your student number you should please quote it in all future correspondence with the University.

Addresses at the Central Administration

Correspondence on academic matters such as study-related matters, bursaries and loans should be directed to:

The Registrar
Stellenbosch University
Private Bag X1
MATIELAND
7602

Correspondence on matters relating to finance and services, including services at University residences, should be directed to:

The Executive Director: Operations and Finance
Stellenbosch University
Private Bag X1
MATIELAND
7602

Other official addresses

The Dean Faculty of Science
Stellenbosch University
Private Bag X1
Matieland
7602

Centre of Student Affairs (non-academic matters)
Neelsie
Private Bag X1
Matieland
7602

USEFUL TELEPHONE AND FAX NUMBERS

For divisions or sections not listed below, please contact the Stellenbosch University Contact Centre on the Stellenbosch Campus at 021 808 9111, with fax number 021 808 3822 and e-mail info@sun.ac.za.

Major entities by campus	**Telephone**	**Fax**
Graduate School of Business (Bellville Park)	021 918 4111	021 918 4112
Medicine and Health Sciences, Faculty of (Tygerberg)	021 938 9111	021 931 7810
Library (=JS Gericke) (Stellenbosch)	021 808 4385/ 021 808 4883	021 808 4336
Military Science, Faculty of (Saldanha)	022 702 3999	022 814 3824
School of Public Leadership (Bellville Park)	021 918 4122	021 918 4123
Telematic Services (Stellenbosch)	021 808 3563	021 808 3565
Other Units		
Bursaries (Postgraduate candidates)	021 808 4208	021 808 2739
Bursaries and Loans (Undergraduate candidates)	021 808 9111	021 808 2954
Centre for Student Communities	021 808 2848	021 808 2847
Centre for Student Counselling and Development	021 808 3894	021 808 4706
Centre for Teaching and Learning (Extended Degree Programmes)	021 808 3717	021 886 4142
Communication and Liaison	021 808 4977	021 808 3800
Development and Alumni Relations	021 808 4020	021 808 3026
Examinations Section	021 808 9111	021 808 2884
Postgraduate and International Office (PGIO)	021 808 4628	021 808 3799
Research Development	021 808 4914	021 808 4537
Faculty Secretaries		
AgriSciences	021 808 9111	021 808 3822
Arts and Social Sciences	021 808 9111	021 808 3822
Economic and Management Sciences	021 808 9111	021 808 3822
Education	021 808 9111	021 808 3822
Engineering	021 808 9111	021 808 3822
Medicine and Health Sciences: Applications, Stellenbosch	021 808 9111	021 808 3822
Medicine and Health Sciences: Tygerberg Campus	021 938 9204	021 931 7810
Law	021 808 9111	021 808 3822
Military Science	021 808 9111	021 808 3822
Science	021 808 9111	021 808 3822
Theology	021 808 9111	021 808 3822

University web site: http://www.sun.ac.za

Contact details of the Science Faculty
For specific queries related to the Science Faculty, use the following contact details:
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Stellenbosch University
Private Bag X1
MATIELAND
7602
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Interim Dean
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Dean's Office
Ms S Els
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Faculty Secretary (Enquiries about academic issues)
Mr BP Abels
Tel: 021 808 4832; Fax: 021 808 3822; E-mail: bpa@sun.ac.za

Ms CS Fransman (Faculty Officer: enquiries about academic issues):
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Faculty web site: http://www.sun.ac.za/science

Departments:
Biochemistry 021 808 5862; biochair@sun.ac.za; http://www.sun.ac.za/biochem
Botany and Zoology 021 808 3236; lwillems@sun.ac.za; http://www.sun.ac.za/botzoo
Chemistry and Polymer Science 021 808 2344; deidre@sun.ac.za; http://www.sun.ac.za/chemistry
Earth Sciences Tel: 021 808 3219; Fax: 021 808 3129; lcon@sun.ac.za; http://www.sun.ac.za/geo
Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science) 021 808 3279 la2@sun.ac.za; 021 808 4215; mvann@sun.ac.za; 021 808 4232; ala@sun.ac.za; http://math.sun.ac.za
Microbiology 021 808 5847; wendyw@sun.ac.za; http://academic.sun.ac.za/microbiology
Physics 021 808 3391; physoffice@sun.ac.za; http://www.sun.ac.za/physics
Physiological Sciences 021 808 3146; gas@sun.ac.za; http://academic.sun.ac.za/physiosciences

The Faculty of Science

The Faculty of Science is a well-established, leading institution with a rich tradition dating back to the first days of Stellenbosch University. Over the past decades, it has undergone dynamic changes to become a national and international role player in basic and applied research.

In the past decade, our postgraduate student numbers have shown a significant increase, the research outputs by our academics and postgraduate students have more than doubled and we are increasingly obtaining financial contributions from the private and industry sectors.

Many of our teaching staff excel on international level or have been awarded with national accolades. They also play a leading role within their professional communities, i.e. in a management capacity in professional societies or by being involved in editorial work for various leading journals.

History

This Faculty is the second oldest at the University. Its roots can be traced back to 1866, when courses in Mathematics and Physical Sciences were part of the training offered at the former Stellenbossche Gymnasium. It was formally founded though with the establishment of the Arts Department of the Stellenbossche Gymnasium in 1874.

During the founding years of Stellenbosch University – from the establishment of the Arts Department, the elevation of its status to college with the establishment of Stellenbosch College in 1881, its renaming as Victoria College in 1887 to the independence of the University in 1918 – the staff and student numbers, as well as subjects offered, increased to such an extent that an independent Faculty of Mathematics and Physical Science was established in 1918. It was renamed to the Faculty of Science in 1957.

With the independence of Stellenbosch University in 1918, Mathematics, Applied Mathematics, Physics, Chemistry, Geology, Zoology and Botany were already established fields of study. In the subsequent years, the Faculty was extended with a number of additional fields of study: Physiology in 1922, Home Economics in 1925 (Home Economics changed to Consumer Science in 2000), Computer Science in 1969 and Biochemistry in 1974.

Initially students obtained a BA degree in Science, but since the establishment of the Faculty of Mathematics and Physical Science in 1918, a BSc degree has been offered.

Since 2000 our study programmes are compiled in line with the Higher Education Criteria and Guidelines and structured in such a way that a student may obtain a BSc degree, an honours degree (BScHons), a master's degree (MSc) or a doctoral degree (PhD or DSc) with them.

Structure

Over the past few years, the departmental structure of the Faculty has undergone many changes in an effort to keep up with changing academic requirements and a stronger focus on research.

The Zoology and Botany departments amalgamated into the Department of Botany and Zoology to strengthen research focuses in their fields. The end of 2005 saw the unbundling of the Department of Consumer Science: Foods, Clothing, Housing, while the Departments of Computer Science and Mathematics amalgamated in 2006 with the Department of Applied Mathematics (formerly part of the Engineering Faculty) to form the Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science) thereby achieving greater synergy between their areas of research. The Department of Geology amalgamated with the Department of Geography and Environmental Studies (from the Faculty of Arts and Social Sciences) in 2006 to form the Department of Geology,

Geography and Environmental Studies. From 2010, the Department of Geography and Environmental Studies again resides in the Faculty of Arts and Social Sciences and the name of the former Department of Geology has changed to Department of Earth Sciences.
The eight departments of the Faculty are: Biochemistry; Botany and Zoology; Chemistry and Polymer Science; Earth Sciences; Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science); Microbiology; Physics; and Physiological Sciences.
BSc degrees are offered with majors from these departments, as well as with majors from other faculties. These include Genetics, Operations Research, Psychology, Sport Science and Mathematical Statistics.
In addition, service courses in Science are offered to students in the Faculties of AgriSciences, Economic and Management Sciences, Engineering, and Medicine and Health Sciences.
The Faculty is housed in a number of buildings on the main campus, where teaching and postgraduate research are supported by ultra-modern technology and highly qualified and experienced staff. Scientists from the Faculty use advanced research equipment with success in their work. The equipment, which is managed by the University's Central Analytical Facility, includes a DNA sequencing unit, an amino acid analysis unit and a high resolution mass spectrometry unit.
Extensive financial support from industry and other organisations makes it possible for research bodies to play a leading role with regard to basic and applied sciences on an international level. It also empowers the Faculty to support South African and international postgraduate students.

Mission

As part of its strategy for the future, the Faculty strives to nurture and recruit leading figures in the fields of academia and research.
The mission of the Faculty is to develop the natural sciences through high-quality teaching and research and to contribute to the well being of the South African society and the environment.

Teaching

The prestige of the Faculty is enhanced by both the high quality and the relevance of its teaching. Teaching focuses on giving all students the opportunity to develop their full potential by using the most suitable methods of teaching and by cultivating a sound scientific attitude in students. The ideal is to shape graduates who are competitive and much sought after in the work environment and who can also function as independent thinkers.
The realities of localised natural sciences in the context of the international world of science cannot be denied. Therefore the Faculty focuses increasingly on equipping students with the scientific, language and electronic communication skills needed to hold their own in a challenging environment.

Research

The status of the Faculty is promoted through high-quality research. Good teaching and quality research go hand in hand. At higher level, state-of-the-art teaching is impossible without good research. The Faculty's research includes the following: Sustainable biodiversity and the environment; biotechnology; technology for the industry; and fundamental theory, mathematics and complexity.
In the various research fields it focuses on, the Faculty strives for a healthy balance between basic and applied research, which takes into consideration the needs of the South African community at large. A multidisciplinary approach across subject, faculty and other boundaries is advocated.

Service-rendering

In addition to a focus on excellent teaching and research, the Faculty strives to render service to the community by promoting science education at school-level. The Faculty also makes knowledge available to the community on both a formal and an informal basis. Furthermore, the needs of and problems experienced by the wider community are considered when research topics are decided on.

For more information about the Faculty, visit http://www.sun.ac.za/science

Information for Students

UNDERGRADUATE ENROLMENT MANAGEMENT

In order to meet the targets of Council with regard to the *size* (the total number of students) and *shape* (fields of study and diversity profile) of the student body of Stellenbosch University (SU), it is necessary to manage the undergraduate enrolments at SU.

SU's total number of enrolments is managed to be accommodated by its available capacity.

SU offers a balanced package of programmes covering all of three main study areas, namely (a) the humanities, (b) the economic and management sciences, and (c) the natural sciences, agricultural sciences, health sciences and engineering (Science, Engineering and Technology or SET).

SU is committed to the advancement of diversity.

Undergraduate enrolment management at SU adheres to the framework of the national higher-education system. A well grounded cohesion between national and institutional goals, respecting important principles such as institutional autonomy, academic freedom and public responsibility, is pursued. The following points of departure apply:

- The expansion of academic excellence by maintaining high academic standards.
- The maintenance and improvement of high success rates.
- The fulfilment of SU's commitment to correction, to social responsibility and to contributing towards the training of future role models from all population groups.
- The expansion of access to higher education especially for students from educationally disadvantaged and economically needy backgrounds who possess the academic potential to study at SU with success.

Due to the limited availability of places and the strategic and purposeful management of enrolments, not all undergraduate applicants who meet the minimum requirements of a particular programme will automatically gain admission.

Details about the selection procedures and admission requirements for undergraduate programmes are given on www.maties.com and on the Faculty's web page at science.sun.ac.za.

All undergraduate prospective students with the 2013 intake and beyond in mind must write the National Benchmarking Tests (NBT). Consult the NBT web site (www.nbt.ac.za) or the SU web site at www.maties.com for more information on the National Benchmarking Tests.

The results of the National Benchmarking Tests may be used by SU for the following purposes (details are available at www.maties.com):

- Supporting decision-making about the placement of students in extended degree programmes,
- selection, and
- curriculum development**.**

ADMISSION REQUIREMENTS FOR THE BSc DEGREE

For university admission, a prospective student is required to be in possession of a National Senior Certificate (NSC) or school-leaving certificate from the Independent Examination Board (IEB) as certified by Umalusi, with admission to bachelor's degree studies (which requires a performance level of at least 4 (50-59%) in each of four designated university admission subjects), or an exemption certificate issued by the South African Matriculation Board to students with other school qualifications

For admission to the BSc degree programmes in the Faculty of Science, the following admission requirements apply from 2013:

- An average performance level of 65% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification.

- A performance level of 70% (6) for Mathematics (for degree programmes in the Physical and Mathematical Sciences) **OR** 60% (5) (for degree programmes in the Biological Sciences).
- A performance level of 50% (4) for Physical Sciences (excluding degree programmes in the Mathematical Sciences where students do not take Chemistry or Physics).
- Afrikaans or English (Home Language or First Additional Language) 50% (4).
- One other designated university admission subject (4).

The prospective student is also required to take the National Benchmark Tests (NBT), including the Mathematics component (MAT) of the tests.

Admission is subject to the availability of places per programme or programme fields of study, and a selection process is followed in order to obtain enrolment targets. Meeting the minimum admission requirements of the programme applied for does not guarantee selection. The selection policy and procedures are available online at www.maties.com.

Physical Sciences is required as a school subject for all prospective students who wish to register for programmes in the Biological Sciences or the Physical Sciences, or who wish to take any modules in Chemistry or Physics. Any student who wishes to take Mathematics 114 and/or 144 or Physics 114 and/or 144 have to comply with the Mathematics admission requirements as set for the programmes in the Mathematical Sciences. Furthermore, it is required that prospective students meet the subject-specific admission requirements, as set for the specific programme or stream in a programme to be taken (see tables below). Life Sciences as a school subject is recommended for prospective students who wish to register for programmes in the Biological Sciences.

Prospective students who are already in possession of a National Senior Certificate (NSC) or an Independent Examination Board (IEB) school-leaving certificate, as certified by Umalusi, when they apply

The application of a prospective student, who applies within one year after obtaining the NSC or IEB school-leaving certificate, will be considered if the admission requirements of the year in which the certificate was obtained, were met. All applications will further be considered in accordance with the selection process.

Applications of prospective students who do not meet the admission requirements, but who are busy improving on their NSC or IEB final examination results during the year of application, will be put on a waiting list until the improved examination results are known.

Prospective students with a school qualification other than the NSC or IEB school-leaving certificate

Prospective students, who offer school qualifications other than the NSC or IEB school-leaving certificate, have to ensure that exemption certificates are issued by the South African Matriculation Board. If Physical Sciences are set as admission requirement, the prospective students have to offer both Physics and Chemistry as school subjects.

BSc (EXTENDED DEGREE PROGRAMME)

This programme offers alternative access to the broad natural sciences (Programmes in Biological Sciences, Physical Sciences and Mathematical Sciences).

Minimum admission requirements for the extended degree programme are:

1. An average performance level of 55% in the NSC, excluding Life Orientation.
2. For programmes in the Physical or Mathematical Sciences: one symbol lower than the admission requirement for the mainstream degree programme, thus either a performance level of 60% (5) for Mathematics or performance level of 40% (3) for Physical Sciences.

OR

- For programmes in the Biological Sciences: one symbol lower than the admission requirement for the mainstream degree programme, thus a performance level of 50% (4) for Mathematics and a performance level of 40% (3) for Physical Sciences.

- Afrikaans or English (Home Language or First Additional Language) 50% (4).
- Physical Sciences as school subject is required for all candidates who want to be considered for the extended degree programme.

Students apply according to the process set out in Part 1 (General) of the Calendar. A limited number of students will be selected for this programme and preference will be given to students from previously disadvantaged communities. The selection policy and procedures are available online at www.maties.com.

The duration of this programme is at most one year longer than the mainstream degree programme. During the first year the students' knowledge bases are strengthened and their skills developed in preparing them for entering the mainstream modules from the second year. Because of the nature of this programme, class attendance is compulsory and students must pass all modules in Year 1 to proceed to their next year of study. Modules from this year cannot be repeated in the next year of study. Therefore students will not be readmitted to the extended degree programme if they fail a module or modules and/or as a result of poor class attendance. After successful completion of this degree programme, students will receive a degree certificate of the University that is exactly the same as those received by the mainstream students. Only the routes differ, not the destinations.

Admission requirements per programme

Under the curriculum of each programme, as set out in the table *Programme Offering* below, the combinations of subject-specific admission requirements applicable to a specific programme, are also indicated.

Programme Offering

Programme, stream and *first-year curriculum (curr)*	**Admission requirements from 2013**
1. PROGRAMMES IN THE BIOLOGICAL SCIENCES **1.1 Biodiversity and Ecology** (*Curr 1*) **1.2 Molecular Biology and Biotechnology** *(Curr 1, or adapted 3)* **1.3 Human Life Sciences** 1.3.1 Stream: Biology *(Curr 1, or adapted 3)* 1.3.2 Stream: Biology with Psychology *(Curr 2)* **1.4 Sport Science** *(Curr specific to programme)*	• Afrikaans or English (Home Language or First Additional Language) 4 • Physical Sciences 4 *If Mathematics 114, 144 and Physics 114, 144 are taken:* • Mathematics 6 *If Mathematics (Bio) 124 and Physics (Bio) 134, 154 are taken:* • Mathematics 5

Programme, stream and *first-year curriculum (curr)*	**Admission requirements from 2013**
2. PROGRAMMES IN THE PHYSICAL SCIENCES **2.1 Chemistry** 2.1.1 Stream: Chemistry and Polymer Science *(Curr 3, or 4, or 5, or 6)* 2.1.2 Stream: Chemical Biology *(Curr 3)* 2.1.3 Stream: Textile and Polymer Science *(Curr 3, or 4, or 5, or 6)* **2.2 Physics** 2.2.1 Stream: Laser Physics (Physical), Nuclear Physics, Radiation and Health Physics *(Curr 5, or 6, or 7)* 2.2.2 Stream: Laser Physics (Biological) *(Curr 3)* 2.2.3 Stream: Theoretical Physics *(Curr 7)*	• Afrikaans or English (Home Language or First Additional Language) 4 • Physical Sciences 4 • Mathematics 6
2.3 Earth Science *(Curr specific to programme)* **2.4 Geo-informatics** *(Curr specific to programme)*	• Afrikaans or English (Home Language or First Additional Language) 4 • Physical Sciences 4 *If Mathematics 114, 144 and Physics 114, 144 are taken:* • Mathematics 6 *If Mathematics (Bio) 124 and Physics (Bio) 134, 154 are taken:* • Mathematics 5
2.5 BSc (Ed) (Four-year) 2.5.1 Stream: Chemistry *(Curr 3, or 4, or 5, or 6)* 2.5.2 Stream: Physics *(Curr 3, or 4, or 5, or 6)*	NO FIRST-YEAR REGISTRATION FROM 2011

Programme, stream and *first-year curriculum (curr)*	**Admission requirements from 2013**
3. PROGRAMMES IN THE MATHEMATICAL SCIENCES **3.1 Mathematical Sciences** 3.1.1 Stream: Financial Mathematics *(Curr specific to programme)* 3.1.2 Stream: Computer Science *(Curr specific to programme)* 3.1.3 Stream: Applied Mathematics *(Curr specific to programme)* 3.1.4 Stream: Mathematics *(Curr specific to programme)* 3.1.5 Stream: Mathematical Statistics *(Curr specific to programme)* 3.1.6 Stream: Operations Research *(Curr specific to programme)*	• Afrikaans or English (Home Language or First Additional Language) 4 • Mathematics 6 • A 4 in any other subject from the designated list for university admission. **OR** **Please note:** *If Physics or Chemistry is taken*: • Physical Sciences 4
3.1.7. Stream: Biomathematics (Option 1: Molecular Biology) *(Curr specific to programme)* 3.1.7.1 Stream: Biomathematics (Option 2: Ecology) *(Curr specific to programme)*	• Afrikaans or English (Home Language or First Additional Language) 4 • Physical Sciences 4 • Mathematics 6
3.2 BSc (Ed) (Four-year) 3.2.1 Stream: Mathematics *(Curr 3, or 4, or 5, or 6)*	NO FIRST-YEAR REGISTRATION FROM 2011

Please note:
Students considering studies in programmes in the Biological Sciences should note that these programmes may entail working with animal and/or human biological material, which in the case of animals may also include primary sample collection.

PROVISIONS RELATING TO EXAMINATIONS AND PROMOTIONS

The complete provisions relating to examinations and promotions applicable to programmes and modules are contained in Part 1 (General) of the University Calendar. Students are expected to familiarise themselves with these provisions.

Apart from the above-mentioned provisions, the following regulations are applicable to the Faculty of Science:

1. Students taking a degree programme in the Faculty of Science shall not be allowed to register for any other degree programme in any other faculty.
2. All class marks between 35 and 50 shall be allocated in multiples of 5; below 35 and above 50 the actual mark may be allocated.
3. Students are permitted to take modules from different years of study in the same year provided that there are no clashes in the times of the classes or in the test and examination timetables. No student shall be permitted to attend any class or write any test or examination in a subject that has, or in subjects that have, timetable clashes.
4. A student may take a module from a specific year of study provided that, at most, the following number of credits is in arrears:
   4.1. half of the credits of a single preceding year of the subject; or

4.2. sixteen (16) credits from a combination of two or more preceding years of the subject, with the proviso that this regulation is subject to the applicable corequisite, prerequisite and prerequisite pass requirements, and dependent on the class, test and examinations timetables concerned.

5. All test and examination answer sheets shall be answered in ink.
6. A student who, for one year, followed the first year of any programme in the Faculty shall be readmitted as a student to the programme only if he obtained at least a 0,50 HEMIS credit for this year in terms of the required modules of the first year.

STUDENTS WITH CREDITS IN ARREARS

Students in their second year of study, who are credits in arrears due to unsuccessful studies in their first year, shall be allowed to add a maximum of sixteen credits per semester to the normal credit load of their programme. Thus an upper limit is put on the additional number of credits that may be taken in the non-final years of study in order to make up credits in arrears.

STANDING RULES FOR DEAN'S CONCESSION EXAMINATIONS (DCEs)

1. An undergraduate, final-year student, who, when he has taken all the examinations and when all final marks are available, is a maximum of two modules with a total credit value of no more than 32 credits in arrears for his degree, or such credit value in arrears for his degree as the individual faculties permit in highly exceptional cases (in other words, he has taken the examination in the modules concerned and failed), may – subject to the provisions of paragraphs 2, 3 and 4 below – be admitted to a Dean's Concession Examination (DCE) as a concession by the Dean, in consultation with the academic department(s) concerned.
2. Such students shall be identified by the faculty secretary, who shall furnish the departments concerned with their names via the Dean's office. The onus shall be on the students concerned to communicate with the faculty secretary in good time (not later than 15 January) about their admission to the DCE. The DCE shall be taken at a scheduled time during the last week of January or the first week of February.
3. If the student fails the module in the DCE, no further DCE shall be granted.
4. DCEs in modules subject to continuous assessment shall be taken at the same time as referred to in paragraph 2 above, subject to the procedures laid down in paragraph 2 above.
5. DCEs are conducted departmentally. Students who have been granted a DCE shall ascertain from the department concerned when and where the DCE in question is to be written. They shall ensure that they present themselves at such time and place.
6. DCEs shall be granted only with the approval of the Dean. No student shall be granted a DCE, under any circumstances, by any department. It shall not be competent for any teacher to give an undertaking to a student in this matter.
7. Admission to a Dean's Concession Examination in a module is subject to the rules of the faculty offering the module. For the rules governing Dean's Concession Examinations in modules not offered by the Faculty of Science, consult the relevant faculty's part of the Calendar or the faculty secretary.

MEDALS

The following medals are awarded to students in the Faculty of Science for academic achievement:

Dean's Medal

A solid silver medal, donated by Prof JA de Bruyn, is presented annually to the honours student who scores the highest average percentage throughout both the BSc and BScHons programmes. (For calculation purposes, and according to HEMIS norms, each year of the

BSc programme is weighted with a factor of one and the BScHons programme with a factor of two.)

Element Six (Pty) Ltd and DST-NRF Centre of Excellence in Strong Materials Medals
A gold-plated medal is presented annually to the best third-year student in the undergraduate Chemistry programme with an aggregate mark of at least 70% that includes the marks obtained in the two polymer modules.
A gold-plated medal is also presented annually to the best honours student (minimum mark 70%) in Polymer Science.

John Todd Morrison Research Medal
Donated by Mrs JT Morrison, spouse of the late Prof JT Morrison. A solid silver, gold-plated medal is presented annually to the best student who obtains the MSc degree in Physics and Applied Mathematics *cum laude*.

Meiring Naudé Medal
Donated by the late Dr S Meiring Naudé. A gilded silver medal is presented annually to the best candidate who scores a mark of at least 80 in an approved BScHons programme in Physics and also maintains a mark of at least 60 in each module of the programme.

SJ Shand Memorial Medal
Donated by Ms Helen B Shand in memory of the late Prof SJ Shand. An 18-carat gold medal is presented annually to the best student who obtains the MSc degree in Geology *cum laude*.

Van der Walt Medal
To be awarded annually in memory of the late Prof APJ van der Walt. The medal is awarded to an undergraduate final-year student with the highest aggregate percentage for all Computer Science modules over the first three years of study.

(Details of awards presented in the Faculty of Science are supplied in the University Calendar, Part 2.)

CONNECTION OF STUDENTS' PRIVATE COMPUTERS TO SU NETWORK

(All the information listed below can be found at: **www.sun.ac.za/studentIT**)
All registered students (and non-SU students who stay in University residences, Academia and Meerhof) are allowed to connect their personal private computers to the University of Stellenbosch (SU) Computer Network, at designated areas for student access. The connections of these private computers however are limited and subject to the Network Terms and Conditions given below.

Network Terms and Conditions

Read the conditions carefully. It is in your own interest to acquaint yourself with them. Ignorance of the law excuses no one (*Ignorantia Juris non excusat)*. The conditions are subject to the **Electronic Communication Policy (www.sun.ac.za/ecp/ecp_december_eng.pdf)**. Direct any enquiries via e-mail to the IT Student Help Centre at student_help@sun.ac.za.

Your Computer:

- Only registered computers with IT-allocated IP addresses may be connected to the network. No IP addresses may be keyed in statically.
- Computers with Microsoft operating systems must be kept up to date with the latest Microsoft updates by means of WSUS, as must the antivirus software, by means of the ePO agent of McAfee, as set up and installed by the IT Student Help Centre.
- No server or network services that could be to the detriment of the functionality of the network, such as DHCP, DNS or filesharing hubs, may be linked to the network or be activated on your computer without the sole permission of IT.

The Network:

- You may only connect equipment to a network connection for which it is registered.
- Do not extend or expand network points for use by more than one computer.
- Damage to SU equipment or network points is charged to your student fees account.
- Neither SU equipment nor the SU network may be used for the provision of business equipment or services.

Password:

- Use only your own password.
- Do not provide your password to anyone – you remain responsible for the misuse of your password by other parties.
- The security or integrity of the network and/or computer systems may under no circumstances be undermined through attempts at obtaining passwords or access to restricted systems.

Data:

- The purpose of the computer network is for official and academic communication, and data, games and unauthorised filesharing that could flood the network are regarded as undesirable.
- Do not use pseudonyms, false user names and anonymous e-mails from and to SU systems.
- Do not spam.
- Do not harass fellow users with discourteous, defamatory or improper messages.
- Do not send or make available over the network through filesharing services, such as DC and KaZaA, any data or software for which you do not have copyright. Violation of copyright is a serious offence and will be prosecuted.

If a user violates any of the conditions above, his network access may be suspended either temporarily or permanently and/or he may be reported to the relevant authorities (SU or the SA Police Services), as warranted by the seriousness of the offence.

Where can you connect to the network?

- All **student rooms in residences and houses** are currently equipped with one network point per bed for use by students.
- The **library and CUAs** also have allocated network points where students can connect their laptops.
- **Wireless Hotspots** are available to all students throughout campus.
- Students can connect wireless via the SCN Network to the Campus Network.

What do you need to connect to the SU Network?

You need a **User name and Password** to connect to the network.

- All enrolled students already have a user name.
- Students from other institutions qualifying for connection to the network must first pay the Student Help Centre cashier a **registration fee** before they can register for a user name and password.

You need your **Own Computer**.

It is necessary for IT to download standard antivirus and antispyware onto all computers connected to the network. These programs can unfortunately make older computers uselessly slow, which is why we recommend the following **minimum hardware configuration**:

- Intel Pentium 4 or AMD of a similar standard.
- 1 GB RAM.
- 10 GB hard drive with at least 100 MB available.
- CD ROM, DVDR or a USB2 portal.

- To **connect to the network**, you need one of the following:
    - A LAN network card and ethernet network cable; or
    - a wifi card if you want to connect your laptop to the wireless hotspots; or
    - a wireless link to the SCN network.

Current standard computer:

- Intel Core i3 or AMD Athlon 64.
- 2 GB RAM, an 80 GB Hard drive, a DVD writer and a 19" LCD monitor.
- the Windows 7 Enterprise or Professional operating system.

Your computer must have its **own legally licensed operating system**. Please note the following in this regard:

- Microsoft Windows XP SP3 or Windows 7 is preferable.
- If you do not have one of the preferred operating systems, you can buy a Microsoft operating system at a **discounted price** from Information technology.
- Windows 2000, Windows Vista, Windows 98, Millenium and XP Home are not recommended, since they do not support the latest automatic antivirus and spyware-program updates, which exposes them to undesirable attacks.
- Apple Mac and Linux can be connected to the network, but are unfortunately not supported by the IT Student Help Centre.

The Procedure for connecting your computer to the SU network

Take your computer to the IT Student Help Centre so that it can be **certified**.

To protect the integrity of the SU network, it is essential that all computers connected to the network use the latest version of the operating system and the necessary antivirus and spyware software. Since new malicious attacks occur daily, it is also necessary to the keep the software updated regularly. This is why it is necessary for the computers of all students first to be certified by the IT Student Help Centre before they can be permitted to be connected to the network.

The MAC address of your computer is added to a list of certified computers and can then be registered.

What will be done with your computer?

For **Microsoft** operating systems:

- SP3 for Windows XP and are downloaded onto your computer.
- The latest updates are downloaded onto your computer and WSUS is installed to update your computer automatically.
- McAfee Antivirus with the ePO agent is downloaded onto your computer to keep the package up to date; any other antivirus software is first removed. The languages available for McAfee updates and agents are English, French, German, Dutch, traditional Chinese and Korean.
- Antispyware with Microsoft Defender is downloaded onto your computer.
- Internet Explorer with the correct proxy settings and mymaties.com as home page are set up.
- Inetkey is installed for internet access.

For **Linux** and **Apple** computers:

- Your computer is certified as a non-Microsoft operating system. You are responsible for clearing and updating your computer yourself.

Important: The software downloaded by the IT Student Help Centre is essential for protection against attacks on the network and all the other computers on the network. Do not remove it. If you download the operating system onto your computer again, return your computer for re-certification. Exposed computers will be isolated from the network without notification.

Registration of your network card

You can register only after the IT Student Help Centre has certified your computer and approved your network-card address.

You need:

- your room number and the name of your residence or university house;
- the particulars of your SU e-mail address (i.e. your student number or user name and password); and
- the network-point number of your room.

You can now register the network card of your computer at https://maties2.sun.ac.za/rtad4/netcard_register/.

- Before your application for registration is accepted, however, you must first electronically accept the Network Terms and Conditions set out above.
- Two computers on which you can register are available at the IT Student Help Centre.
- Your approved MAC address or addresses are displayed in a drop-down. Confirm that your address or addresses are correct before you continue with your application.
- Completion of the registration form gives approval for your connection fee to be recovered directly from your student fees account during the second week in August.
- If you register after the cut-off date, contact the Student Help Centre to arrange for cash payment of the connection fee.

Activation of your network point

- The registration of your network card automatically places you on a list for the activation of your network point.
- You will receive an e-mail confirming that your application for the registration of your network card was successful, with the information of the computer representative of your residence.
- You can check the status of your application or applications by going to the same web page where you registered, i.e. https://maties2.sun.ac.za/rtad4/netcard_register/.
- **Note** that activation takes five working days and depends on network stability and the number of applications being processed.
- As soon as your network point has been activated, you will receive another e-mail.

If you experience problems after confirmation of your point having been activated, contact your residence representative or the IT Student Service Centre

IT Student Service Centre

To get assistance with computer- and network-related issues, you can contact your residence computer representative or contact the IT Student Service Centre.

For Stellenbosch:

Office Hours: Monday to Friday from 08h00 to 16h30, excluding public holidays
Telephone: 021 808 3788
E-mail: student_help@sun.ac.za
Location: 7 Joubert Street, Stellenbosch

SOCIETY FOR SCIENCE STUDENTS

Students in the Faculty of Science have their own society, the Science Society, which operates under the auspices of the Science Student Committee. Committee members are chosen from student nominees each year.

All students who are registered for programmes in the Faculty of Science automatically belong to this society, which aims to promote a general interest in science among students, to broaden their knowledge of the sciences and to make them aware of the practical applications of science.

For more information, visit http://www.sun.ac.za/nsk

Qualifications

DEGREES, DIPLOMAS AND CERTIFICATES OFFERED

The Faculty of Science offers the degrees and diploma, with the minimum years of study as indicated, listed below:

BSc, BSc (Ed)	3 or 4 years
BScHons	1 year
Postgraduate Diploma in Science (Mathematical Sciences)	1 year
MSc	1 or 2 years
PhD	2 years
DSc	1 or 3 years

STRUCTURE OF THE BSc DEGREE

The BSc programme extends over three or four academic years. A student who has already passed acknowledged subjects at another university, after attaining matriculation exemption, shall complete subjects in at least two academic years at this University before a BSc degree can be conferred upon him, provided that at least half of the total amount of credits, including all final-year credits prescribed for the proposed degree, be obtained at this University. Modules in Computer Literacy do not fall within this stipulation and shall be taken at this University unless similar modules have been passed at another institution and are acknowledged.

The above-mentioned stipulations are also applicable to students who want to take a BSc programme and are already in possession of another degree of this University.

Please note:

The remainder of this section is only applicable to programme development and may be ignored by students, since all curricula of programmes do comply with these requisites.

Three-year BSc

1. A BSc degree programme of three years comprises at least 24 standard semester modules (named standard modules) of 16 credits each, plus the modules that include the compulsory generic skills (such as Scientific Communication Skills 172).
   At least 18, but preferably more, of these standard modules shall be from the core subjects of the Science and Mathematics streams. These are modules of the Faculty of Science offered by the School for Biological Sciences, the grouping of the Physical Sciences (Chemistry, Physics and Geology) and the grouping of the Mathematical Sciences (Computer Science, Mathematics, Applied Mathematics, Mathematical Statistics and Operations Research). The Faculty Board of Science shall approve acknowledged equivalent modules.
2. The following rules with regards to module combinations (plus the modules that include the compulsory generic skills) for the three-year BSc degree apply: First year: At least 8 standard modules at first-year level. Second year: At least 8 standard modules with at least 6 at second-year level. Third year: At least 8 standard modules with at least 6 at third-year level, of which at least 4 are from the core subjects, with the remaining 2 standard modules which might be at second-year level.
3. All three-year BSc programmes shall contain at least 1 standard module in Mathematics and at least 2 standard modules (preferably more) in the core subjects outside the major stream (namely Biological, Physical or Mathematical). The current approved first-year curricula meet these stipulations.

4. For programme compilation, a major is defined as follows:

A number of acknowledged coherent modules with a total value of at least 64 credits at final-year level, that may be comprised from different departments and that will lead to specified postgraduate studies.

Four-year BSc

For any professional or multidisciplinary four-year BSc programme, comprising 32 standard modules, at least 8 standard modules (1 HEMIS credit) shall be from the core subjects but may include service courses. Ten standard modules (or equivalent) of the specific degree programme shall make use of, and link to, the content of the core modules. In context therefore it must be subjects in the Sciences. BScHons and MSc degrees can follow on from B degrees that satisfy these criteria.

The following apply to all BSc programmes:

1. Combinations shall be compiled in such a way as to eliminate repetition of modules and to enable neighbouring departments to adapt joint curricula.
2. A BSc programme shall lead to one or more honours and/or master's study programmes.

Programme Offering

SUMMARY OF PROGRAMMES AND STREAMS

The curricula (combination(s) of subjects) that can be taken to obtain a degree are represented in terms of (a) programme(s). A programme can be composed of a number of prescribed curricula, where each specific curriculum is known as a stream.
The following programmes and streams can be taken from 2013 for the under-mentioned degrees in the Faculty of Science:

Undergraduate (The BSc Degree)

1. **BIOLOGICAL SCIENCES**	
PROGRAMMES	STREAMS IN PROGRAMME
1.1 Biodiversity and Ecology	
1.2 Molecular Biology and Biotechnology	
1.3 Human Life Sciences	1.3.1 Biology 1.3.2 Biology with Psychology
1.4 Sport Science	

2**. PHYSICAL SCIENCES**	
PROGRAMMES	STREAMS IN PROGRAMME
2.1 Chemistry	2.1.1 Chemistry and Polymer Science 2.1.2 Chemical Biology 2.1.3 Textile and Polymer Science
2.2 Physics	2.2.1 Laser Physics (Physical), Nuclear Physics, Radiation and Health Physics 2.2.2 Laser Physics (Biological) 2.2.3 Theoretical Physics
2.3 Earth Science	
2.4 Geo-informatics	

3. **MATHEMATICAL SCIENCES**	
PROGRAMMES	STREAMS IN PROGRAMME
3.1 Mathematical Sciences	3.1.1 Financial Mathematics 3.1.2 Computer Science 3.1.3 Applied Mathematics 3.1.4 Mathematics 3.1.5 Mathematical Statistics 3.1.6 Operations Research 3.1.7 Biomathematics: Option 1 Molecular Biology 3.1.7.1 Biomathematics: Option 2 Ecology

Please note:
The curricula (subjects and modules) that must be taken for the different programmes and streams are indicated in this Part of the Calendar under the heading "Programme curricula for BSc".
These undergraduate programmes lead to the following postgraduate programmes:

Postgraduate

BScHons (Biological Sciences)	Biochemistry; Biodiversity and Ecology; Biokinetics; Genetics; Microbiology; Physiological Sciences; Plant Biotechnology; Plant Pathology; Psychology; Sport Science; Wine Biotechnology
BScHons (Physical Sciences)	Chemistry; Geoinformatics; Earth Sciences; Physics; Polymer Science; Theoretical Physics
BScHons (Mathematical Sciences)	Applied Mathematics; Computer Science; Mathematical Statistics; Mathematics; Operations Research; Physical and Mathematical Analysis
MSc (Biological Sciences)	Biochemistry; Botany; Clinical Psychology and Community Counselling; Entomology; Exercise Science; Genetics; Microbiology; Physiological Sciences; Plant Biotechnology; Psychology; Sport Science; Wine Biotechnology; Zoology
MSc (Physical Sciences)	Chemistry; Geography and Environmental Studies; Geoinformatics; Geology; Polymer Science; Physics
MSc (Mathematical Sciences)	Applied Mathematics; Computer Science; Mathematical Statistics; Mathematics; Operations Research; Physical and Mathematical Analysis
PhD	Applied Mathematics; Biochemistry; Botany; Chemistry; Computer Science; Entomology; Genetics; Geography and Environment Studies; Geology; Mathematical Statistics; Mathematics; Microbiology; Operations Research; Physical and Mathematical Analysis; Physics; Physiological Sciences; Plant Biotechnology; Polymer Science; Psychology; Wine Biotechnology; Zoology
DSc	Applied Mathematics; Biochemistry; Botany; Chemistry; Computer Science; Entomology; Genetics; Geology; Mathematics; Microbiology; Physics; Physiological Sciences; Polymer Science; Wine Biotechnology; Zoology

First-year curricula for the BSc programmes

The following first-year curricula are prescribed for the BSc programmes, unless the first-year curriculum is indicated at the specific programme curriculum. First-year curricula are numbered from 1 to 7. These numbers are used in the programme curricula to indicate which specific first-year curriculum is required to take a specific programme curriculum.

Curriculum 1 (credits = 140)

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Scientific Communication Skills	172(8)

Curriculum 2 (credits = 148)

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Psychology	114(12), 144(12)
Scientific Communication Skills	172(8)

Curriculum 3 (credits = 140)

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

Curriculum 4 (credits = 140)

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Geo-Environmental Science	124(16), 154(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

Curriculum 5 (credits = 140)

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

Curriculum 6 (credits = 140)

Applied Mathematics	144(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

Curriculum 7 (credits = 140)

Applied Mathematics	144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

BSc (Extended Degree Programme)

Year 1 (credits = 130)

Chemistry	176(32)
Physics	146(16)
Computer Skills	176(8)
University Practice in the Natural Sciences	116(8)
Scientific Communication Skills	116(12), 146(6)
and	
Mathematics (Bio)	176(32) or
Mathematics	186(32)
en	
Biology	146(16) or
Computer Science	146(16)

Year 2, 3, and 4

Students choose curriculums from Year 1, Year 2 and Year 3 as per BSc Biological Sciences, Physical Sciences, Mathematical Sciences.

Programme curricula for BSc

To obtain a BSc degree, a specific programme, or one of the streams of a programme, must be chosen and prescribed curriculum (subjects and modules) of the chosen programme or stream must be taken and passed.

The following programme curricula can be taken for the BSc degree:

1. PROGRAMMES IN THE BIOLOGICAL SCIENCES

1.1 Biodiversity and Ecology

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 5

1st year (credits = 140)
Curriculum 1

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Scientific Communication Skills	172(8)

2nd year (credits = 128)
Compulsory modules (credits = 96)

Biodiversity and Ecology	212(16), 214(16), 224(16), 244(16), 254(16), 264(16)

plus
Elective modules (credits = 32)

Biochemistry	214(16), 244(16)
Genetics	214(16), 244(16)

3rd year (credits = 128)
Compulsory modules (credits = 96)

Biodiversity and Ecology	315(16), 324(16), 334(16), 344(16), 354(16), 364(16)

plus
Elective modules (credits = 32)

Biochemistry	314(16), 345(16) or 355(16) a maximum of 60 students will be selected on merit for Biochemistry 355
or	
Genetics	314(16), 324(16) or 344(16)

Please note:
1. This stream leads to an honours degree programme in Biodiversity and Ecology and also, if applicable modules are taken, to an honours degree programme in Genetics.
2. Biochemistry 314 plus Biochemistry 355 are required modules for admission to the honours degree programme in Biochemistry.

1.2 Molecular Biology and Biotechnology

Admission Requirements
- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4

If Mathematics 114, 144 and Physics 114, 144 are taken:
- Mathematics 6

If Mathematics (Bio) 124 and Physics (Bio) 134,154 are taken:
- Mathematics 5

1st year (credits = 140)
Curriculum 1

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Scientific Communication Skills	172(8)

or
Adapted Curriculum 3

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

2nd year (credits = 136)
Compulsory modules (credits = 120)

Biochemistry	214(16), 244(16)
Biometry	211(8)
Biotechnology	244(16)
Genetics	214(16), 244(16)
Microbiology	214(16), 244(16)

plus

Elective modules (credits = 16)

Chemistry	214(16)
Physiology	214(16)

3rd year (credits = 136)
Compulsory modules (credits = 72)

Biochemistry	314(16)
Biology	312(8)
Genetics	314(16), 344(16)
Microbiology	314(16)

plus
Elective modules (credits = 64)

Biotechnology	314(16), 344(16)
Biochemistry	345(16), 355(16) A maximum of 60 students will be selected on merit for Biochemistry 355
Genetics	324(16)
Microbiology	344(16), 354(16)

Please note:
1. Biochemistry 314 plus Biochemistry 355 are required modules for admission to the honours degree programme in Biochemistry.
2. Microbiology 314 plus one of the other two third-year Microbiology modules are required for admission to an honours degree programme in Microbiology.
3. The compulsory modules are required for admission to the honours degree programme in Genetics.
4. Biotechnology 314 and 344 are required for admission to the honours degree programme in Plant Biotechnology.

1.3. Human Life Sciences

1.3.1 Stream: Biology

Admission Requirements
- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4

If Mathematics 114, 144 and Physics 114, 144 are taken:
- Mathematics 6

If Mathematics (Bio) 124 and Physics (Bio) 134, 154 are taken:
- Mathematics 5

1st year (credits = 140)
Curriculum 1

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Scientific Communication Skills	172(8)

or

Adapted Curriculum 3

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

2nd year (credits = 136)
Compulsory modules (credits = 72)

Biochemistry	214(16), 244(16)
Biometry	211(8)
Physiology	214(16), 244(16)

plus
Elective modules (credits = 64)
Choose two of:

Anatomy	214(16), 244(16) A maximum of 30 students will be selected for the Anatomy modules on merit. To be considered, a student must obtain a 60% average for the first-year modules, with 60% for Biology 124 and 60% for Biology 154. The Faculty of Medicine and Health Sciences reserves the right to not select any students in a particular year.
Genetics	214(16), 244(16)
Microbiology	214(16), 244(16)

3rd year (credits = 136)
Compulsory modules (credits = 72)

Biochemistry	314(16), 345(16) or 355(16) A maximum of 60 students will be selected on merit for Biochemistry 355
Biology	312(8)
Physiology	314(16), 344(16)

plus
Elective modules (credits = 64)
Select one of from the following options

Genetics	314(16), 344(16) and
Physiology	334(16), 364(16)
or	
Genetics	314(16), 344(16) and
Microbiology	314(16), 354(16)
or	
Genetics	314(16), 344(16) and
Anatomy	314(16), 344(16)
or	
Microbiology	314(16), 354(16) and
Anatomy	314(16), 344(16)

or

Physiology	334(16), 364(16) and
Anatomy	314(16), 344(16)

Please note:
1. Biochemistry 314 plus Biochemistry 355 are required modules for admission to an honours degree programme in Biochemistry.
2. Microbiology 314 plus one of the other two third-year Microbiology modules are required for admission to an honours programme in Microbiology.
3. This stream leads to an honours degree programme in Physiology and also, if applicable elective modules are taken, to an honours degree programme in Anatomy or Genetics.

1.3.2 Stream: Biology with Psychology

Admission Requirements
- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 5

1st year (credits = 148)
Curriculum 2

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Psychology	114(12), 144(12)
Scientific Communication Skills	172(8)

2nd year (credits = 128)

Biochemistry	214(16), 244(16)
Genetics	214(16), 244(16)
Physiology	214(16), 244(16)
Psychology	212(8), 222(8), 242(8), 252(8)

3rd year (credits = 144)
Compulsory modules (credits = 112)

Biochemistry	314(16), 345(16) or 355(16) A maximum of 60 students will be selected on merit for Biochemistry 355
Physiology	314(16), 344(16)
Psychology	318(24), 348(24)

plus
Elective modules (credits = 32)
Select one from

Genetics	314(16), 344(16) or
Physiology	334(16), 364(16)

Please note:
1. This stream leads to an honours degree programme in Physiological Sciences or Psychology and also, if applicable elective modules are taken, to an honours degree programme in Genetics.
2. Biochemistry 314 plus Biochemistry 355 are required modules for admission to an honours degree programme in Biochemistry.

1.4. Sport Science

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 5

Special provisions:

- Only a limited number of students are annually admitted to the first year of this programme. Applications close 30 June of the previous year, but late applications will be accepted until 30 September. Selection for the programme is done according to clear guidelines, which are based on both the academic and non-academic merits of the applicant. Students who are selected must complete a medical history form. If a student is not declared medically fit, he will not be allowed to register for the compulsory practical modules (for example Kinesiology 182).
- Students shall adhere to the prescribed regulations regarding dress. Particulars can be obtained from the Department of Sport Science on the commencement of the academic year.
- Attendance of all practical classes is compulsory. At least 40% is required for each component of the practical classes. The pass mark for all practical and theoretical modules is 50%

Please note the following prerequisite pass requirements:

Kinesiology 162 is a prerequisite pass requirement for Sport Science 262.

Kinesiology 182 is a prerequisite pass requirement for Movement Studies, Sport and Recreation 282.

1st year (credits = 140)

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Kinesiology	162(8), 182(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Scientific Communication Skills	172(8)

2nd year (credits = 128)

Biochemistry	214(16), 244(16)
Movement Education Sport and Recreation	212(8), 222(8), 242(8), 282(8)
Physiology	214(16), 244(16)
Sport Science	222(8), 232(8), 252(8), 262(8)

3rd year (credits = 134)

Compulsory modules (credits = 110)

Kinesiology	312(8), 332(8), 342(8), 352(8), 372(8)
Physiology	314(16), 334(16), 344(16), 364(16)
Sport Science	382(6)

Elective modules (credits = 24)

Select one from

Applied Kinesiology(Adapted Physical Activity)	324(12), 344(12)

or

Applied Kinesiology(Sport Coaching)	312(12), 342(12)

or

Applied Kinesiology(Fitness Industry)	314(12), 352(12)

Please note:

1. This stream leads to a BScHons degree programme in (Biokinetics), a BScHons (Sport Science) (Stream: Performance Sport) and a BScHons (Sport Science) (Stream: Kinder Kinetics).
2. This option can also lead to an honours programme in Physiological Sciences. Students will be selected on merit.

2. PROGRAMMES IN THE PHYSICAL SCIENCES

2.1 Chemistry

2.1.1 Stream: Chemistry and Polymer Science

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)

Curriculum 3

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

or

Curriculum 4

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Geo-Environmental Science	124(16), 154(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

or

Curriculum 5

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

or

Curriculum 6

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Physics	114(16), 144(16)
Applied Mathematics	144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

2nd year (credits = 133)
Compulsory modules (credits = 69)

Chemistry	214(16), 234(16), 254(16), 264(16)
Computer Skills	272(5)

plus
Elective modules (credits = 64)

Applied Mathematics	214(16), 244(16)
Biochemistry	214(16), 244(16)
Computer Science	214(16), 244(16)
Genetics	214(16), 244(16)
Geology	224(16), 254(16)
Mathematics	214(16), 244(16)
Microbiology	214(16), 244(16)
Physics	224(16), 254(16)
Textile Science	254(16)

3rd year (credits = 133)
Compulsory modules (credits = 101)

Applied Chemistry	324(16), 344(16) Exception: Students who wish to combine Chemistry and Physics at third-year level and register for Physics 314, 334, 342, 352 and 384, are not required to register for Applied Chemistry 324 and 344.
Chemistry	314(16), 324(16), 344(16), 364(16)
Computer Skills	372(5)

plus
Elective modules (credits = 32)

Applied Mathematics	314(16), 364(16)
Mathematics	314(16), 324(16), 344(16), 354(16)
Microbiology	314(16), 344(16)
Physics	314(16), 334(16), 342(8), 352(8), 384(16)
Textile Science	314(16), 344(16)

Please note:
Physics 384 may only be taken with other physics modules in the same slot and not with other modules in the same slot because of practical class clashes.

2.1.2 Stream: Chemical Biology

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)
Curriculum 3

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

2nd year (credits = 133)

Biochemistry	214(16), 244(16)
Chemistry	214(16), 234(16), 254(16), 264(16)
Computer Skills	272(5)
Microbiology	214(16), 244(16)

3rd year (credits = 133)
Compulsory modules (credits = 117)

Biochemistry	314(16), 345(16)
Chemistry	314(16), 324(16), 344(16), 364(16)
Computer Skills	372(5)
Microbiology	314(16)

plus
Elective modules (credits = 16)

Biochemistry	355(16) A maximum of 60 students will be selected on merit for Biochemistry 355.
Microbiology	344(16)

2.1.3 Textile and Polymer Science

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)
Curriculum 3

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

or
Curriculum 4

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Geo-Environmental Science	124(16), 154(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

or
Curriculum 5

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

or

Curriculum 6

Applied Mathematics	144(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

2nd year (credits = 133)
Compulsory modules (credits = 85)

Chemistry	214(16), 234(16), 254(16), 264(16)
Computer Skills	272(5)
Textile Science	254(16)

plus
Elective modules (credits = minimum 48, maximum 52)

Applied Mathematics	214(16), 244(16)
Biochemistry	214(16), 244(16)
Computer Science	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematics	214(16), 244(16)
Microbiology	214(16), 244(16)
Physics	224(16)
Economics	114(12), 144(12) and Business Management 113(12)

3rd year (credits = 133)
Compulsory modules (credits = 101)

Applied Chemistry	324(16), 344(16)
Chemistry	314(16), 344(16)
Computer Skills	372(5)
Textile Science	314(16), 344(16)

plus
Elective modules* (credits = 32)
(At least 16 credits on third-year level)

Applied Mathematics	314(16), 324(16), 364(16)
Chemistry	324(16), 364(16)
Computer Science	314(16), 344(16), 354(16)
Financial Management	214(16)
Logistics Management	214(16)
Microbiology	314(16), 344(16)
Physics	334(16)

*Students must ensure before registration that the elective modules they choose do not clash on the timetables with compulsory modules

Please note:

1. It is expected of students in their 2nd and 3rd years to gain at least 2 weeks' practical experience in the textile industry.
2. Enquiries about the programme in Textile and Polymer Science or **options for postgraduate studies** should be directed to: Ms A Gericke (programme coordinator); Tel: 021 808 3341; E-mail: agericke@sun.ac.za.

2.2 Physics

2.2.1 Streams: Laser Physics (Physical), Nuclear Physics, Radiation and Health Physics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)
Curriculum 5

Chemistry	124(16), 144(16)
Physics	114(16), 144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Scientific Communication Skills	172(8)

or
Curriculum 6

Chemistry	124(16), 144(16)
Physics	114(16), 144(16)
Computer Skills	171(4)
Applied Mathematics	144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

or
Curriculum 7

Physics	114(16), 144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Applied Mathematics	144(16)
Scientific Communication Skills	172(8)

2nd year (credits = 133)
Compulsory modules (credits = 69)

Mathematics	214(16), 244(16)
Physics	224(16), 254(16)
Scientific Computing	272(5)

plus
Elective modules (credits = 64)
A choice from the following modules, depending on the first-year curriculum taken.
(Please note: A student may, in the third year, change to Stream 2.2.3 Theoretical Physics if Physics 214 and 244 have been taken).

Applied Mathematics	214(16), 244(16)
Chemistry	214(16), 234(16), 254(16), 264(16)
Computer Science	214(16), 244(16)
Physics	214(16), 244(16)

3rd year (credits = 133)
Compulsory modules (credits = 85)

Applied Mathematics	364(16) Exception: Students who wish to combine Chemistry and Physics at third-year level and register for Chemistry 314(16) 324(16), 344(16), 364(16) are not required to register for Applied Mathematics 364.
Physics	314(16), 334(16), 342(8), 352(8), 384(16)
Scientific Computing	372(5)

plus
Elective modules (credits = 48)
(A choice of 48 credits from the following modules, depending on the choice of modules taken in the second year.)

Applied Mathematics	324(16), 354(16)
Chemistry	314(16), 324(16), 344(16), 364(16)
Computer Science	314(16), 334(16), 344(16)
Mathematics	324(16), 365(16)
Physics	214(16), 244(16) (if not taken in second year and if permitted by the timetables), 344(16)

2.2.2 Stream: Laser Physics (Biological)
Admission Requirements

- Afrikaans or English (Home Language or First Additional Language 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)
Curriculum 3

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Scientific Communication Skills	172(8)

2nd year (credits = 133)

Biochemistry	214(16), 244(16)
Chemistry	234(16), 254(16) or 264(16)
Mathematics	214(16), 244(16)
Physics	224(16), 254(16)
Scientific Computing	272(5)

3rd year (credits = 133)
Compulsory modules (credits = 117)

Applied Mathematics	364(16)
Physics	314(16), 334(16), 342(8), 352(8), 384(16)
Physiology	214(16), 244(16)
Scientific Computing	372(5)

plus

Elective modules (credits = 16)

Biochemistry	314(16)
Chemistry	314(16) or 324(16)

2.2.3 Stream: Theoretical Physics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)

Curriculum 7

Applied Mathematics	144(16)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

2nd year (credits = 133)

Compulsory modules (credits = 101)

Mathematics	214(16), 244(16)
Physics	214(16), 224(16), 244(16), 254(16)
Scientific Computing	272(5)

plus

Elective modules (credits = 32)

Applied Mathematics	214(16), 244(16) or
Computer Science	214(16), 244(16)

3rd year (credits = 133)

Compulsory modules (credits = 101)

Applied Mathematics	364(16)
Mathematics	324(16)
Physics	314(16), 334(16), 342(8), 344(16)
Project (Physical and Mathematical Analysis)	372(8)
Scientific Computing	372(5)

plus

Elective modules (credits = 32) (Choice dependent on the choice made in the second year.)

Applied Mathematics	324(16), 354(16)
Computer Science	314(16), 334(16)
Mathematics	314(16), 344(16), 354(16), 365(16)

2.3 Earth Science

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4

If Mathematics 114, 144 and Physics 114, 144 are taken:

- Mathematics 6

If Mathematics (Bio) 124 and Physics (Bio) 134, 154 are taken:

- Mathematics 5

1st year (credits = 148)

Chemistry	124(16), 144(16)
Computer Skills	171(4)
Earth Science Field Skills	172(8)
Geo-Environmental Science	124(16), 154(16)
Scientific Communication Skills	172(8)
and	
Physics	114(16), 144(16) plus
Mathematics	114(16), 144(16)
or	
Physics (Bio)	134(16), 154(16) plus
Mathematics (Bio)	124(16) plus
Biology	124(16)

2nd year (credits = 133)
Compulsory modules (credits = 85)

Computer Skills	272(5)
Earth Science Field Skills	272(16)
Environmental Geochemistry	214(16)
Geology	224(16), 244(16), 254(16)

plus
Elective modules (credits = 48)
At least 32 credits on second-year level

Biology	144(16)
Chemistry	234(16), 254(16), 264(16)
Geographical Information Technology	211(16), 241(16), 242(16)
Geography and Environmental Studies	214(16), 265(16)

3rd year (credits = 133)
Compulsory modules (credits = 85)

Computer Skills	372(5)
Earth Science Field Skills	374(16)
Geology	314(16), 324(16), 344(16), 354(16)

plus
Elective modules (credits = 48)
At least 16 credits on third-year level

Biodiversity and Ecology	224(16)
Chemistry	234(16), 254(16), 264(16)
Environmental Geochemistry	314(16)
Geography and Environmental Studies	358(16)
Geographical Information Technology	311(16), 312(16), 341(16), 342(16)

Soil Science	214(16)

2.4 Geo-informatics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4

If Mathematics 114, 144 and Physics 114, 144 are taken:

- Mathematics 6

If Mathematics(Bio)124 and Physics(Bio) 134, 154 are taken:

- Mathematics 5

1st year (credits = 140)

Computer Skills	171(4)
Geo-Environmental Science	124(16), 154(16)
Scientific Communication Skills	172(8)
and	
Mathematics	114(16), 144(16) plus
Physics	114(16), 144(16) plus
Computer Science	114(16), 144(16)
or	
Mathematics (Bio)	124(16) plus
Physics (Bio)	134(16), 154(16) plus
Biology	124(16) plus
Chemistry	124(16), 144(16)

2nd year (credits = 127)

Compulsory modules (credits = 95)

Business Ethics	214(8)
Geographical Information Technology	211(16), 241(16), 242(16)
Geography and Environmental Studies	214(16)
Scientific Computing	272(5)
Statistical Methods	176(18)

plus

Elective modules (credits = minimum 32, maximum 40)

Computer Science	214(16), 244(16)
or	
Socio-Informatics	224(16), 254(16), 262(8)

3rd year (credits = minimum 133, maximum 141)

Compulsory modules (credits = 69)

Geographical Information Technology	311(16), 312(16), 341(16), 342(16)
Scientific Computing	372(5)

plus

Elective modules (credits = minimum 64, maximum 72)

This option may only be taken if there are no timetable clashes. If honours studies in Computer Science or Socio-Informatics is being considered, the full set of modules for the field of study concerned must be taken.

Computer Science	314(16), 334(16), 344(16), 354(16)
Socio-Informatics	314(18), 334(18), 354(18), 364(18)

2.5 BSc (Ed) (four-year)

2.5.1 Stream: Chemistry

NO FIRST-YEAR REGISTRATION FROM 2011

Enquiries about modules should be directed to Ms W Wagener, Dean's Office, AI Perold Building, at tel. 021 808 3063 or e-mail ww@sun.ac.za.

4th year (credits = 98)

School visits take place during the whole of the third school term.

Applied Chemistry	324(16) Or any module that follows on or links up with science modules taken in the second or third year of study. This option may only be taken if there are no timetable clashes.
Education Governance, Leadership and Management [PGCE]	174(12)
Teaching Practice	175(26)
Philosophy of Education [PGCE]	174(12)
Diversity and Inclusivity [PGCE]	174(12)
Learning and Learning Support [PGCE]	174(12)
Introduction to Educational Research [PGCE]	172(8)

2.5.2 Stream: Physics

NO FIRST-YEAR REGISTRATION FROM 2011

For enquiries on modules, please contact Ms W Wagener, Dean's Office, AI Perold Building, tel. 021808 3063 or e-mail ww@sun.ac.za.

4th year (credits = 98)

School visits take place during the whole of the third school term.

Education Governance, Leadership and Management [PGCE]	174(12)
Teaching Practice	175(26)
Philosophy of Education [PGCE]	174(12)
Diversity and Inclusivity [PGCE]	174(12)
Learning and Learning Support [PGCE]	174(12)
Introduction to Educational Research [PGCE]	172(8)

Plus one module (credits = 16) that follows on from or correspond to Science modules taken in the second or third year of study.

3. PROGRAMMES IN THE MATHEMATICAL SCIENCES

3.1 Mathematical Sciences

3.1.1 Stream: Financial Mathematics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 6
- A 4 in any other subject from the designated list for university admission.

OR

Please note: *If Physics or Chemistry is taken*:

- Physical Sciences 4

1st year (credits = minimum 120)
Compulsory modules (credits = 100)

Actuarial Science	112(8)
Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	144(16)
Scientific Communication Skills	172(8)

plus
Elective modules (credits = minimum 20, maximum 40)
Only modules that do not lead to timetable clashes may be chosen.

Biology	124(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
Financial Accounting	188(24)
General Linguistics	178(24)
Geo-Environmental Science	124(16), 154(16)
Physics	114(16), 144(16)

2nd year (credits = minimum 125)
Compulsory modules (credits = 109)

Actuarial Science	274(24)
Financial Risk Management	212(8), 242(8)
Mathematical Statistics	214(16), 244(16)
Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus
Elective modules (credits = minimum 16)
Please note that the elective modules have prerequisites that are elective modules in the first year.
Only modules that do not lead to timetable clashes may be chosen.

Chemistry	234(16), 254(16)
Computer Science	214(16), 244(16)
Economics	214(16), 244(16)
Financial Accounting	288(32)
Mathematics	278(32)
Music Technology	222(8), 252(8)
Operations Research	214(16), 244(16)

3rd year (credits = 133)
Compulsory modules (credits = 85)

Financial Mathematics	378(32)
Mathematical Statistics	318(32)
Mathematics	324(16)
Scientific Computing	372(5)

plus

Elective modules (credits = 48)
Choice of 16 credits from:

Mathematics	314(16), 354(16), 365(16)

Choice of 32 credits from:

Mathematical Statistics	344(16), 354(16), 364(16)

3.1.2 Stream: Computer Science
Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 6
- A 4 in any other subject from the designated list of subjects for university admission

OR
Please note: *If Physics or Chemistry is taken*:

- Physical Sciences 4

1st year (credits = minimum 132, maximum 140)
Compulsory modules (credits = 92)

Computer Skills	171(4)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Scientific Communication Skills	172(8)

plus
One of the following modules:

Probability Theory and Statistics	114(16) or 144(16) Please note: Probability Theory and Statistics 114 and 144 are identical but is offered in different semesters. Probability Theory and Statistics 144 and the elective module Applied Mathematics 144 clash on the timetable, thus both can not be chosen.

plus
Elective modules (credits = minimum 40, maximum 48).
Choose at least one of the following two subjects:

Physics	114(16) AND 144(16)
Applied Mathematics	144(16)

plus
More modules may be chosen from the list below to make up the required credits.
Only modules that do not lead to timetable clashes may be chosen.

Biology	124(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
General Linguistics	178(24)
Financial Accounting	188(24)
Geo-Environmental Science	124(16), 154(16)
Music Technology	122(12), 152(12) Please note: Due to the possibility of timetable clashes, the Music Technology modules are not necessarily available each year in this programme. Therefore, students who want to register for these modules have to apply individually in writing to the Department

	of Music in advance.

2nd year (credits 133)
Compulsory modules (credits =69)
The following 2 subjects (3 modules) are compulsory (credits = 37):

Computer Science	214(16), 244(16)
Scientific Computing	272(5)

plus
One of the following two subjects (credits = 32):

Applied Mathematics	214(16), 244(16)
Mathematics	214(16), 244(16)

plus
Elective modules (credits = 64)

Applied Mathematics	214(16), 244(16)
Biomathematics	214(16)
Mathematical Statistics	214(16), 244(16)
Mathematics	214(16), 244(16)
Operations Research	214(16), 244(16)
Physics	214(16), 224(16), 244(16), 254(16)

More modules to a maximum of 32 credits may be chosen from the list below to make up the required total credits. Only modules that do not lead to timetable clashes may be chosen. Please note that the modules in the list below have prerequisite modules that are elective modules in the first year.

Chemistry	234(16), 254(16)
Economics	214(16), 244(16)
Financial Accounting	288(32)
General Linguistics	278(32)
Genetics	214(16), 244(16)
Geography and Environmental Studies	214(16)
Geographical Information Technology	211(16), 241(16), 242(16)
Music Technology	222(8), 252(8)
Mathematics	278(32)

3rd year (credits = 133)
Compulsory modules (credits = 69)

Computer Science	314(16), 334(16), 344(16), 354(16)
Scientific Computing	372(5)

plus
Elective modules (credits = 64)
Any of the modules listed below that follow on second-year modules. Only modules that do not lead to timetable clashes may be chosen.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	314(16), 344(16), 374(16)
Chemistry	324(16), 364(16)
Computer Science	315(16) or 364(16)
Economics	318(24), 388(24)
Financial Accounting	389(48)
General Linguistics	379(48)
Genetics	314(16), 324(16), 344(16), 354(16)
Geography and Environmental Studies	358(16)

Mathematics	314(16), 324(16), 344(16), 354(16), 365(16), 378(32)
Mathematical Statistics	318(32), 344(16), 354(16)
Music Technology	379(48)
Operations Research	314(16), 324(16), 344(16), 354(16)
Physics	314(16), 334(16), 384(16)

Please note:
The following additional elective modules are proposed, but currently clash on the timetable with compulsory modules and can only be followed in exceptional cases (e.g. repeaters) and in consultation with the Department: Financial Mathematics 378(32); Physics 342(8), 344(16), 352(8); Mathematical Statistics 364(16).

3.1.3 Stream: Applied Mathematics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 6
- A 4 in any other subject from the designated list for university admission.

OR

Please note: *If Physics or Chemistry is taken*:

- Physical Sciences 4

1st year (credits = minimum 132, maximum 140)
Compulsory modules (credits = 76)

Applied Mathematics	144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

plus
Elective modules (credits = 56 to 64)

Computer Science	114(16) AND 144(16)
Physics	114(16) AND 144(16)

plus
More modules may be chosen from the list below to make up the required credits.
Only modules that do not lead to timetable clashes may be chosen

Biology	124(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
General Linguistics	178(24)
Financial Accounting	188(24)
Geo-Environmental Science	124(16), 154(16)
Music Technology	122(12), 152(12) Please note: Due to the possibility of timetable clashes, the Music Technology modules are not necessarily available each year in this programme. Therefore, students who want to register for these modules have to apply individually in writing to the Department of Music in advance.

2nd year (credits = minimum 125, maximum 133)
Compulsory modules (credits = 69)

Applied Mathematics	214(16), 244(16)
Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus
Elective modules (credits = 56 to 64)

Biomathematics	214(16)
Computer Science	214(16), 244(16)
Mathematical Statistics	214(16), 244(16)
Operations Research	214(16), 244(16)
Physics	214(16), 224(16), 244(16), 254(16)

More modules to a maximum of 32 credits may be chosen from the list below to make up the required total credits. Only modules that do not lead to timetable clashes may be chosen. Please note that the modules in the list below have prerequisite modules that are elective modules in the first year.

Chemistry	234(16), 254(16)
Economics	214(16), 244(16)
Financial Accounting	288(32)
Geography and Environmental Studies	214(16)
Geographical Information Technology	211(16), 241(16), 242(16)
Mathematics	278(32)
Music Technology	222(8), 252(8)

3rd year (credits = 133)
Compulsory modules (credits = 69)

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Scientific Computing	372(5)

plus
Elective modules (credits = 64)
Any of the modules listed below that follow on second-year modules. Only modules that do not lead to timetable clashes may be chosen.

Biomathematics	314(16), 344(16), 374(16)
Chemistry	324(16), 364(16)
Computer Science	314(16), 315(16), 334(16), 344(16), 354(16), 364(16)
Economics	318(24), 388(24)
Financial Accounting	389(48)
Financial Mathematics	378(32)
Geography and Environmental Studies	358(16)
Mathematics	314(16), 324(16), 344(16), 354(16), 365(16), 378(32)
Music Technology	379(48)
Operations Research	314(16), 324(16), 344(16), 354(16)
Physics	314(16), 342(8), 344(16), 352(8), 384(16)

Please note:
The following additional elective modules are proposed, but currently clash on the timetable with compulsory modules and can only be followed in exceptional cases (e.g. repeaters) and in consultation with the Department: Chemistry 344(16), 364(16); Physics 334(16); Mathematical Statistics 318(32), 344(16), 354(16), 364(16).

3.1.4 Stream: Mathematics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 6
- A 4 in any other subject from the designated list for university admission.

OR

Please note: *If Physics or Chemistry is taken*:

- Physical Sciences 4

1st year (credits = minimum 132, maximum 140)

Compulsory modules (credits = 44)

Computer Skills	171(4)
Mathematics	114(16), 144(16)
Scientific Communication Skills	172(8)

plus

Elective modules (credits = 88 to 96)

Choose at least 2 of the following 3 subjects:

Applied Mathematics	144(16) Must be combined with Probability Theory and Statistics 114.
Computer Science	114(16) AND 144(16)
Physics	114(16) AND 144(16)
Probability Theory and Statistics	114(16)

plus

More modules may be chosen from the list below to make up the required credits.

Only modules that do not lead to timetable clashes may be chosen

Biology	124(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
Financial Accounting	188(24)
General Linguistics	178(24)
Geo-Environmental Science	124(16), 154(16)
Music Technology	122(12), 152(12) Please note: Due to the possibility of timetable clashes, the Music Technology modules are not necessarily available each year in this programme. Therefore, students who want to register for these modules have to apply individually in writing to the Department of Music in advance.

2nd year (credits = minimum 125, maximum 133)

Compulsory modules (credits = 37)

Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus

Elective modules (credits = 88 to 96)

Applied Mathematics	214(16), 244(16)
Biomathematics	214(16)
Computer Science	214(16), 244(16)
Mathematical Statistics	214(16), 244(16)

Operations Research	214(16), 244(16)
Physics	214(16), 224(16), 244(16), 254(16)

More modules to a maximum of 32 credits may be chosen from the list below to make up the required total credits. Only modules that do not lead to timetable clashes may be chosen. Please note that the modules in the list below have prerequisite modules that are elective modules in the first year.

Chemistry	234(16), 254(16)
Economics	214(16), 244(16)
Financial Accounting	288(32)
General Linguistics	278(32)
Genetics	214(16), 244(16)
Geographical Information Technology	211(16), 241(16), 242(16)
Geography and Environmental Studies	214(16)
Mathematics	278(32)
Music Technology	222(8), 252(8)

3rd year (credits = 133)
Compulsory modules (credits = 69)

Mathematics	314(16), 324(16) plus two modules (credits = 32) from Mathematics 344(16) or 354(16) plus 365(16)
Scientific Computing	372(5)

plus
Elective modules (credits = 64)
Any of the modules listed below that follow on second-year modules. Only modules that do not lead to timetable clashes may be chosen.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	314(16), 344(16), 374(16)
Chemistry	324(16), 364(16)
Computer Science	314(16), 315(16), 334(16), 344(16), 354(16), 364(16)
Economics	318(24), 388(24)
Financial Accounting	389(48)
Financial Mathematics	378(32)
General Linguistics	379(48)
Genetics	314(16), 324(16), 344(16), 354(16)
Mathematics	378(32)
Mathematical Statistics	318(32), 344(16), 354(16), 364(16)
Music Technology	379(48)
Operations Research	324(16), 354(16)
Physics	314(16), 334(16), 342(8), 344(16), 352(8), 384(16)

Please note:
The following additional elective modules are proposed, but currently clash on the timetable with compulsory modules and can only be followed in exceptional cases (e.g. repeaters) and in consultation with the Department: Geography and Environmental Studies 358(16); Operations Research 314(16), 344(16).

3.1.5 Stream: Mathematical Statistics

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 6
- A 4 in any other subject from the designated list of subjects for university admission

OR

Please note: *If Physics or Chemistry is taken*:

- Physical Sciences 4

1st year (credits = minimum 132, maximum 140)

Compulsory modules (credits = 76)

Applied Mathematics	144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

plus

Elective modules (credits = 56 to 64)

Choose at least 1 of the following 2 subjects:

Computer Science	114(16) AND 144(16)
Physics	114(16) AND 144(16)

plus

More modules may be chosen from the list below to make up the required credits. Only modules that do not lead to timetable clashes may be chosen.

Biology	124(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
Financial Accounting	188(24)
General Linguistics	178(24)
Geo-Environmental Science	124(16), 154(16)
Music Technology	122(12), 152(12) Please note: Due to the possibility of timetable clashes the Music Technology modules are not necessarily available each year in this programme. Therefore students who want to register for these modules have to apply individually in writing to the Department of Music in advance.

2nd year (credits = minimum 125, maximum 133)

Compulsory modules (credits = 69)

Mathematical Statistics	214(16), 244(16)
Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus

Elective modules (credits = 56 to 64)

Applied Mathematics	214(16), 244(16)
Biomathematics	214(16)
Computer Science	214(16), 244(16)
Operations Research	214(16), 244(16)

Physics	224(16), 254(16)

More modules to a maximum of 32 credits may be chosen from the list below to make up the required total credits. Only modules that do not lead to timetable clashes may be chosen. Please note that the modules in the list below have prerequisite modules that are elective modules in the first year.

Economics	214(16), 244(16)
Financial Accounting	288(32)
General Linguistics	278(32)
Genetics	214(16), 244(16)
Geography and Environmental Studies	214(16)
Geographical Information Technology	211(16), 241(16), 242(16)
Mathematics	278(32)
Music Technology	222(8), 252(8)
Physics	224(16), 254(16)

3rd year (credits = 133)
Compulsory modules (credits = 69)

Mathematical Statistics	318(32), 344(16), 364(16)
Scientific Computing	372(5)

plus
Elective modules (credits = 64)
Any of the modules listed below that follow on from second-year modules. Only modules that do not lead to timetable clashes may be chosen.

Biomathematics	314(16), 344(16), 374(16)
Computer Science	314(16), 315(16), 334(16), 344(16), 364(16)
Economics	318(24), 388(24)
Financial Accounting	389(48)
Financial Mathematics	378(32)
Genetics	314(16), 324(16), 344(16), 354(16)
Geography and Environmental Studies	358(16)
Mathematics	314(16), 324(16), 344(16), 354(16), 365(16), 378(32)
Music Technology	379(48)
Operations Research	314(16), 324(16), 344(16), 354(16)
Physics	314(16), 344(16), 384(16)

Please note:
The following additional suggested elective modules clash on the timetable with compulsory modules and can only be followed in exceptional cases (e.g. repeaters) and in consultation with the Department: General Linguistics 379(48); Physics 334(16), 342(8), 352(8); Computer Science 354(16); Applied Mathematics 314(16), 324(16), 354(16), 364(16).

3.1.6 Stream: Operations Research

Admission Requirements
• Afrikaans or English (Home Language or First Additional Language) 4
• Mathematics 6
• A 4 in any other subject from the designated list for university admission
OR
Please note: *If Physics or Chemistry is taken*:
• Physical Sciences 4

1st year (credits = minimum 132, maximum 140)
Compulsory modules (credits = 76)

Applied Mathematics	144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Scientific Communication Skills	172(8)

plus
Elective modules (credits = 56 to 64)
Choose at least 1 of the following 2 subjects:

Computer Science	114(16) AND 144(16)
Physics	114(16) AND 144(16)

plus
More modules may be chosen from the list below to make up the required credits. Only modules that do not lead to timetable clashes may be chosen.

Biology	124(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
Financial Accounting	188(24)
General Linguistics	178(24)
Geo-Environmental Science	124(16), 154(16)
Music Technology	122(12), 152(12) Please note: Due to the possibility of timetable clashes, the Music Technology modules are not necessarily available each year in this programme. Therefore, students who want to register for these modules have to apply individually in writing to the Department of Music in advance.

2nd year (credits = minimum 125, maximum 133)
Compulsory modules (credits = 37)

Operations Research	214(16), 244(16)
Scientific Computing	272(5)

plus
Elective modules (credits = 88 to 96)

Applied Mathematics	214(16), 244(16)
Biomathematics	214(16)
Computer Science	214(16), 244(16)
Mathematical Statistics	214(16), 244(16)
Mathematics	214(16), 244(16)
Physics	214(16), 224(16), 244(16), 254(16)

More modules to a maximum of 32 credits may be chosen from the list below to make up the required total credits. Only modules that do not lead to timetable clashes may be chosen. Please note that the modules in the list below have prerequisite modules that are elective modules in the first year.

Economics	214(16), 244(16)
Financial Accounting	288(32)
General Linguistics	278(32)
Genetics	214(16), 244(16)

Geographical Information Technology	211(16), 241(16), 242(16)
Geography and Environmental Studies	214(16)
Mathematics	278(32)
Music Technology	222(8), 252(8)

3rd year (credits = 133)
Compulsory modules (credits = 69)

Operations Research	314(16), 324(16), 344(16), 354(16)
Scientific Computing	372(5)

plus
Elective modules (credits = 64)
Any of the modules listed below that follow on second-year modules. Only modules that do not lead to timetable clashes may be chosen.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	314(16), 344(16), 374(16)
Computer Science	314(16), 334(16), 344(16), 354(16)
Economics	388(24)
Financial Accounting	389(48)
Financial Mathematics	378(32)
General Linguistics	379(48)
Genetics	314(16), 324(16), 344(16), 354(16)
Mathematics	378(32)
Mathematical Statistics	318(32), 344(16), 354(16), 364(16)
Music Technology	379(48)
Physics	314(16), 334(16), 342(8), 344(16), 352(8), 384(16)

Please note:
The following additional elective modules are proposed, but currently clash on the timetable with compulsory modules and can only be followed in exceptional cases (e.g. repeaters) and in consultation with the department concerned: Economics 318(24); Geography and Environmental Studies 358(16); Computer Science 315(16), 364(16); Mathematics 314(16), 324(16), 344(16), 354(16), 365(16).

3.1.7 Stream: Biomathematics Option 1: Molecular Biology

Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) 4
- Physical Sciences 4
- Mathematics 6

1st year (credits = 140)
Compulsory modules (credits = 108)

Biology	124(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	144(16)
Scientific Communication Skills	172(8)

plus

Elective modules (credits = 32)

Computer Science	114(16), 144(16) or
Physics	114(16), 144(16)

2nd year (credits = minimum 133, maximum 149)
Compulsory modules (credits = 117)

Biomathematics	214(16)
Biochemistry	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus
Elective modules (credits = minimum 16, maximum 32)
A choice of at least one other 16-credit module from the Mathematical Sciences. Only modules that do not lead to timetable clashes may be chosen.

3rd year (credits = minimum 133, maximum 149)
Compulsory modules (credits = 101)

Biomathematics	314(16), 344(16), 374(16)
Biochemistry	314(16), 345(16)
Biotechnology	314(16)
Scientific Computing	372(5)

plus
Elective modules (credits = minimum 32, maximum 48)
A choice of at least two further modules, subject to admission requirements and provided that there are no timetable clashes. Students are particularly encouraged to take Biochemistry 355. Note that this is a selection module and admission to it is subject to prior achievement.

3.1.7.1 Stream: Biomathematics Option 2: Ecology
Admission Requirements
• Afrikaans or English (Home Language or First Additional Language) 4
• Physical Sciences 4
• Mathematics 6

1st year (credits = 140)
Compulsory modules

Biology	124(16), 144(16), 154(16)
Computer Skills	171(4)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	144(16)
Scientific Communication Skills	172(8)

2nd year (credits = minimum 133, maximum 149)
Compulsory modules (credits = 117)

Biodiversity and Ecology	214(16), 264(16)
Biomathematics	214(16)
Mathematics	214(16), 244(16)
Mathematical Statistics	214(16), 244(16)
Scientific Computing	272(5)

plus
Elective modules (credits = minimum 16, maximum 32)
A choice of at least one of the following modules that do not lead to timetable clashes:

Applied Mathematics	214(16), 244(16)
Mathematics	278(32)

3rd year (credits = minimum 133, maximum 149)
Compulsory modules (credits = 101)

Biomathematics	314(16), 344(16), 374(16)
Biodiversity and Ecology	324(16)
Mathematical Statistics	318(32)
Scientific Computing	372(5)

plus
Elective modules (credits = minimum 32, maximum 48)
A choice of at least two and at most three of the following modules that do not lead to timetable clashes:

Biodiversity and Ecology	364(16)
Applied Mathematics	354(16), 364(16)
Mathematics	378(32)
Mathematical Statistics	344(16) or 354(16) or 364(16)

Please note:
Biodiversity 364 and Mathematical Statistics 344 clash on the timetable and may not be taken together.

3.2 BSc (Ed) (four-year)

3.2.1 Stream: Mathematics

NO FIRST-YEAR REGISTRATION FROM 2011
Enquiries about modules should be directed to Ms W Wagener, Dean's Office, AI Perold Building, tel. 021 808 3063 or e-mail ww@sun.ac.za.
4th year (credits = 98)
School visits take place during the whole of the third school term.

Education Governance, Leadership and Management [PGCE]	174(12)
Teaching Practice	175(26)
Mathematics	324(16)
Philosophy of Education [PGCE]	174(12)
Diversity and Inclusivity [PGCE]	174(12)
Learning and Learning Support [PGCE]	174(12)
Introduction to Educational Research [PGCE]	172(8)

Subjects, modules and module contents

Abbreviation and numbering system
All subjects are represented by a subject number of 5 digits. Each module of the subject is represented by a three-digit module code, in which the year of study and semester of presentation (unless otherwise stated) are combined. The number following the module code represents the credit value of the module. The subjects, with their composite modules, credits, module subjects, teaching loads, language specifications, module contents and module requisites are specified below.

Example:

11053 BIOCHEMISTRY				
214	16	**Structure, Function Relationships**	3L, 3P	A

Explanation:
11053 is the subject number; it refers to the subject Biochemistry.
214(16) (the 16 will normally be written in brackets) is the module code of the module Biochemistry 214(16) with the module subject Structure, Function Relationships.
The module code 214(16) has the following meaning:

First digit: 2 – refers to the year of study in which the module is presented;
Second digit: 1 – is a number to discriminate between modules of the same subject in the same year of study and refers to the semester (unless stated otherwise), according to the following pattern:
1, 2 or 3: modules offered in the first semester;
4, 5 or 6: modules offered in the second semester;
7, 8 or 9: modules offered over two semesters, i.e. a year module.
Third digit: 4 – has no specific meaning, but can be used to discriminate between different modules of the same subject in the same semester of the same year of study.
Please note that in this Part of the Calendar there is a deviation from the above pattern with regards to some postgraduate modules, with the five-digit subject number and the three-digit module code indicated together in the first square.

The number in the second square (otherwise in brackets): 16 – indicates the credit value of the module. Biochemistry 214(16) is therefore offered as module during the first semester of the second year and a student will acquire 16 credits on completion thereof.
The teaching load of each module is indicated in the square following the module subject.
The following abbreviations are used:

L – lectures lasting 50 minutes each
P – practical periods lasting 50 minutes each (e.g. 1P, 2P, 3P)
S – seminar lasting 50 minutes
T – tutorials lasting 50 minutes each (e.g. 1T, 2T)

The teaching load of Biochemistry 214(16) amounts to three lectures plus three practicals per week for the duration of the module, i.e. one semester.
The letter or letters in the last square indicates the language specification of the module.
The following language specifications are used:

A Specification

- Prescribed textbooks are in Afrikaans and/or English.
- Class notes drawn up by the lecturer are

(i) fully in Afrikaans, or

(ii) or where possible, fully in Afrikaans and fully/partially (e.g. core class notes) also in English.

- Other compulsory reading material (e.g. scholarly journals, books, etc.) is in Afrikaans and/or English.
- Module frameworks and study guides drawn up by the lecturer are in Afrikaans and, where possible, are provided in Afrikaans and English to students whose language of preference for study is English.
- Transparencies and data-projector contents used by the lecturer in lectures, seminars, tutorials and practicals are in Afrikaans and/or English.
- The oral communication language of the lecturer in lectures, seminars, tutorials and practicals is primarily Afrikaans, but key terms and concepts may be explained briefly in English. Students asking questions in English may be answered in English by the lecturer.
- Guest lectures by overseas and/or South African lecturers with an inadequate academic language proficiency in Afrikaans may be delivered in English.
- Test and examination question papers are fully in Afrikaans and fully in English on the same question paper.
- Written assignments from lecturers for tutorials, seminars and practicals, when used for assessment purposes, are fully in Afrikaans and fully in English on the same handout.
- Written answers by students to test and examination questions and assignments may be in Afrikaans or English.
- Oral presentations by students in lectures, seminars, tutorials and practicals may be in Afrikaans or English.

T Specification

- Class notes drawn up by the lecturer are
  (i) fully in Afrikaans and fully in English, or
  (ii) alternately in Afrikaans and English
- Other compulsory reading material (e.g. scholarly journals, books, etc.) is in Afrikaans and/or English.
- Module frameworks and study guides are
  (i) fully in Afrikaans and fully in English, or
  (ii) alternately in Afrikaans and English depending on the language of oral communication of the lecturer in the particular classes.
- Transparencies and data-projector contents used by the lecturers in lectures, seminar classes, tutorials and practicals are in Afrikaans.
- The oral communication language of the lecturer in lectures, seminars, tutorials and practicals is
  (i) in the same class Afrikaans and English, with the proviso that the use of Afrikaans must be at least 50%, or
  (ii) alternately Afrikaans and English in different classes of the module or programme, with the proviso that the use of Afrikaans must be at least 50%.
- Test and examination question papers are fully in Afrikaans and fully in English on the same question paper.
- Written assignments from lecturers for tutorials, seminars and practicals, when used for assessment purposes, are
  (i) fully in Afrikaans and fully in English in the same handout, or
  (ii) alternately in Afrikaans and English depending on the material not for assessment purposes (class notes, module frameworks, study guides, etc.) where the average use of Afrikaans must be at least 50%.

- Written answers by students to test and examination questions and assignments may be in Afrikaans or English.
- Oral presentations by students in lectures, seminars, tutorials and practicals in the T Specification may be in Afrikaans or English according to their preferred academic language.

E Specification

- Prescribed textbooks are in English.
- Class notes drawn up by the lecturer are fully in English or, where possible, fully in English and fully/partially (e.g. core class notes) also in Afrikaans.
- Other compulsory reading material (e.g. scholarly journals, books etc.) is in English and/or Afrikaans.
- Module frameworks and study guides drawn up by the lecturer are in English and, where possible, are provided in English and Afrikaans to students whose language of preference for study is Afrikaans.
- Transparencies and data-projector contents used by the lecturer in lectures, seminars, tutorials and practicals are in English.
- The oral communication language of the lecturer in lectures, seminars, tutorials and practicals is primarily English, but key terms and concepts may be explained briefly in Afrikaans. Students asking questions in Afrikaans may be answered in Afrikaans by the lecturer. Afrikaans is not compulsory in the case of overseas lecturers.
- Test and examination question papers are fully in English and fully in Afrikaans on the same question paper.
- Written assignments from lecturers for tutorials, seminars and practicals, when used for assessment purposes, are fully in English and fully in Afrikaans on the same handout.
- Written answers by students to test and examination questions and assignments may be in Afrikaans or English.
- Oral presentations by students in lectures, seminars, tutorials and practicals may be in English or Afrikaans.

A & E Specification

The A & E Specification entails that separate 'streams' are offered in Afrikaans and English. Consult the characteristics of the A and the E language specifications.

Prerequisite pass, prerequisite and corequisite modules.

After the description of the content of the module, the prerequisite pass, prerequisite and corequisite modules, where applicable, are given for that module. The following abbreviations are used:

PP - prerequisite pass module.
P - prerequisite module.
C - corequisite module.

The following definitions apply:

A prerequisite pass module is a module which students must have passed before they are allowed to take the module(s) for which it is a prerequisite pass module.

A prerequisite module is a module in which students must have achieved a class mark of at least 40, or a final mark of at least 40 in the case of a module subject to continuous assessment, before they are allowed to take the module for which it is a prerequisite module.

A corequisite module is a module that students has to take in the same academic year as the module for which it is a corequisite, or in an earlier academic year.

Please note:

No qualification shall be awarded unless the candidate has passed all the relevant prerequisite and corequisite modules

SUBJECTS PRESENTED BY VARIOUS DEPARTMENTS

25046 BIOLOGY

124	**16**	**Cell Biology**	3L, 3P	**A & E**

Origin and early history of life. Cytology. Cell chemistry, biological membranes and cellular respiration. Fixation, transfer and expression of genetic information. Evolution.

Presented by the Departments of Biochemistry, of Botany and Zoology and of Genetics

144	**16**	**Biodiversity and Ecology**	3L, 3P	**A & E**

Classification of organisms. Diversity of microorganisms, plants and animals. Ecological principles and global changes.

Presented by the Department of Botany and Zoology and of Microbiology
C Biology 124 and
C Chemistry 124, 144

146	**16**	**Biosystematics**	3L, 3P	**T**

For BSc (Extended Degree Programme) students.
Classification and evolutionary relationships of vertebrates. Scientific background to evolutionary arguments. Development of vertebrate organic systems to organism levels.

Responsible department: Botany and Zoology

154	**16**	**Functional Biology**	3L, 3P	**A & E**

Plant anatomy and morphology. Photosynthesis. Water relations and phloem transport. Functional biology of animals. Introduction to biotechnology.

Presented by the Department of Botany and Zoology and of Genetics
C Biology 124 and
C Chemistry 124, 144 (not applicable to Stream Biomathematics, option 2: Ecology)

312	**8**	**Bioinformatics and Mathematical Modelling of Biological Systems**	1L, 1P	**T**

Accessing nucleic acid sequence information from international databases, searches for gene sequences using the BLAST algorithm, sequence alignment, sequence comparison by basic phylogenetic analysis.
Mathematical modelling: Introduction to construction, simulation and analysis of mathematical models for biological systems. Focus lies on the application possibilities of mathematical models and is illustrated for different biological disciplines.

Responsible department: Biochemistry
Continuous assessment

12545 BIOLOGY (OCC)

111	**18**	**Basic Biology**	5L, 4P	**T**

Introduction. Classification of organisms; the cell and cell division; genetics of reproduction; basic human genetics; autosome and hereditary chromosome variation; dominant, recessive and hereditary genetic variation. Ecology, evolution, embryology, introduction to mammal biology. Medically important plants and animals.

Presented by the Department of Botany and Zoology.

153	**14**	**Biology**	4L	**T**

Cell chemistry, membrane structure, biosynthesis of nucleic acids and proteins, metabolism, introduction to the principles of microbiology.

25534 BIOLOGY (MEDICINE)				
197	**12**	**Biology (Medicine)**	4L	**T**

A supplementary module for students in Life Forms and Functions of Clinical Importance 111. It covers the organism kingdom as well as cell structure and functions and an introduction to organ systems and function.

Responsible department: Botany and Zoology in cooperation with the Centre for Teaching and Learning (CTL)

54410 BIOTECHNOLOGY				
244	**16**	**Introductory Biotechnology**	3L, 3P	**T**

Biotechnology is an applied science, aimed at utilising biological systems and organisms. Biotechnologists therefore use their knowledge of biological systems to generate products or deliver services. This module introduces the student to biotechnology by focussing on the most important aspects of first- and second-generation biotechnology. First-generation biotechnology entails the use of organisms/ biological systems as they are, e.g. the use of yeast to ferment grape juice or extracting pharmaceutical products from plants. In contrast, second-generation biotechnology focuses on more specialised techniques, e.g. *in vitro* propagation, mutagenesis and breeding. Themes that will be discussed include bio-prospecting, the identification, characterisation and production of useful natural products, fermentation and bioreactors, plant tissue culture and micro propagation, aquaculture, drug discovery and development, stem cell research, assisted reproduction and embryo manipulation.

Presented by Department of Genetics, of Microbiology and of Biochemistry

314	**16**	**Advanced Biotechnology**	3L, 3P	**E**

This module focuses on the most important aspects of third-generation biotechnology. Third-generation biotechnology can also be described as molecular biotechnology and the themes covered include genetic fingerprinting and molecular forensics, molecular diagnostics, genetic engineering, gene therapy, bio-processing, metabolic engineering (integrated metabolism), bioinformatics and mathematical modelling of biological systems, applied "-omics" and nano-biotechnology.

Presented by the Department of Genetics, Faculty of AgriSciences

344	**16**	**Economical and Legal Aspects of Biology**	3L, 3P	**T**

This module is aimed at introducing the biotechnology student to the non-biological (non-natural science) aspects of biotechnology. Students will be introduced to concepts such as the generation and development of creative ideas, entrepreneurship, market research, feasibility studies, the generation of a business plan, financing, profitability, the South African legal system, intellectual property law, patents, plant breeders rights, trade marks and copyright, licensing agreements, regulatory measures and prerequisites in terms of research practice and GMOs, good laboratory practice, quality control and project management in a research environment.

Presented by the Department of Genetics, Faculty of AgriSciences

DEPARTMENT OF BIOCHEMISTRY

Biochemistry: General information

Please note:
Students intending to take Biochemistry as a subject are required to take modules in Physics and Mathematics during their first year. Chemistry 114 plus Chemistry 154 (124 and 144 from 2014) are taken as the first-year equivalent of Biochemistry.

11053 BIOCHEMISTRY				
214	**16**	**Structure, Function Relationships**	3L, 3P	**A**
Structures, characteristics and functions of bio-molecules (bio-elements, water, nucleic acids, proteins, enzymes, coenzymes, carbohydrates, lipids). *Continuous assessment* *PP Chemistry 114 or 154 and a final mark of at least 40% in the remaining Chemistry module* *PP Biology 124*				
244	**16**	**Intermediary Metabolism**	3L, 3P	**A**
Bioenergetics; metabolism of carbohydrates, lipids and nitrogenous compounds; integration of metabolism. *Continuous assessment* *P Biochemistry 214*				
314	**16**	**Specialised Biochemical Topics I**	3L, 3P	**A**
Advanced protein biochemistry: Basic protein purification techniques and structure/ function relationships studied in the context of a number of specialised complex protein systems. Intracellular signal transduction pathways; receptors; hormones; cAMP; networks and cross talk; biochemistry of vision, biochemistry of smell. *Continuous assessment* *PP Biochemistry 214, 244*				
345	**16**	**Specialised Biochemical Topics II**	3L, 3P	**T**
Bioinformatics of proteins: Amino acid sequence alignment of proteins by means of suitable software packages, amino acid sequence searches through GenBank using Blastp and tBlastx for specific protein motifs, protein motif visualisation and three-dimensional modelling, protein structure/function relationships. The biochemistry of certain antibiotics and anti-microbial agents. Immunology: Innate and specific acquired immunity; antibody structure and function; defence mechanisms against pathogenic organisms; vaccinations; allergies; immune disorders; Aids. *Continuous assessment* *P Biochemistry 314*				
355	**16**	**Physical and Structural Biochemistry**	3L, 3P	**A**
Thermodynamics and kinetics of biochemical processes; enzyme kinetics; kinetics of membrane transport processes; kinetics of coupled reaction systems; metabolic control analysis; supply-demand analysis of metabolic regulation. Analysis of biological molecules and processes with light, fluorescence, infrared, Raman and nuclear magnetic resonance spectroscopy, mass spectrometry, circular dichroism, optical rotatory dispersion, isotope-dependent techniques, advanced gel electrophoresis				

and chromatographic techniques.
Practicals: Purification of proteins with gel permeation and ion exchange chromatography; analysis of proteins with SDS-PAGE; enzyme kinetic determinations; immunodetection techniques. The practicals are presented in the week before the official start of the second semester.
Selection: *Only 60 students will be selected for this module according to performance in Biochemistry 214, 244 and 314. To be considered for selection for BScHons in Biochemistry this module must be passed.*

Continuous assessment
P Biochemistry 314

11053 BIOCHEMISTRY				
778	**120**	**BScHons in Biochemistry**		

Admission requirements
An applicable BSc degree with Biochemistry 214, 244, 314, and 355. An average final mark of at least 60% for Biochemistry 3 is required. Proficiency is both written and spoken English is required. Application in written (addressed to the departmental chair and preferably by the end of November of the preceding year).
Duration and commencement
The duration of the programme is normally one year and it commences two weeks before the general start of classes.
Programme composition
The Honours programme in Biochemistry is compiled annually and consists of a research project (741(60)), a seminar (742(10)) and five modules of ten credits each on topics selected by the Department from modules 711-718. This selection is compulsory for the students of the particular year.
Modules in the Honours programme in Biochemistry:
10519 - 711(10) Advanced protein separation and analytical techniques
10621 - 712(10) Research approaches to investigate the mechanism of action of steroid hormones
62367 - 713(10) The cytochrome P450-dependent hydroxylase
10672 - 714(10) Computational systems biology
10398 - 715(10) Control of gene expression of the immunoglobulin genes
10446 - 716(10) Energy metabolism in sport
10483 - 717(10) Selected topics [Specialised topic by visiting professor]
62375 - 718(10) Selected bio-organic chemistry topic
54895 - 741(60) Research project in Biochemistry
18325 - 742(10) Seminar
The programme is subject to *continuous assessment* with the final mark calculated based on the relative weights of the modules as expressed in the credits of each module.

11053 BIOCHEMISTRY				
878	**180**	**MSc in Biochemistry**		

Admission requirements
An applicable BScHons degree or other qualification approved by the Senate.
General information
1. Independent research on a specific subject as determined by the supervisor(s). After completion of the investigation the candidate is required to hand in a thesis for examination and to present a seminar. An oral examination may be required.
2. In certain cases additional studies may be required by the supervisor(s) to expand the background of a candidate.

66206 - 818	180	Thesis Biochemistry		
Independent research on a specific subject as determined by the supervisor(s). After completion of the investigation the candidate is required to hand in a thesis for examination and to present a seminar. An oral examination may be required.				

11053 BIOCHEMISTRY				
978	360	PhD in Biochemistry		
For the PhD degree a dissertation that contains the results of independent research is required (See Higher Degrees in Science for further information).				

11053 BIOCHEMISTRY				
998	360	DSc in Biochemistry		
For the DSc degree a number of published scientific papers of exceptional standard which contributed significantly to the knowledge and expansion of Biochemistry, are required (See Higher Degrees in Science for further information).				

DEPARTMENT OF BOTANY AND ZOOLOGY

General

The teaching, training and research conducted by the Department of Botany and Zoology is designed to foster an appreciation and an understanding of the evolution and functioning of plants and animals, as well as their roles in natural and managed ecosystems. The undergraduate and postgraduate modules provide a solid background in the biological sciences, with particular emphasis on developing expertise in biodiversity, conservation ecology, evolutionary ecology, conservation genetics and environmental biology. The Department is involved in a large number of research programmes. It has at its disposal excellent eco- and plant physiology laboratories, a student herbarium and a herbarium specialising in flora of the Stellenbosch district, as well as ultramodern molecular biology laboratories catering for zoological and botanical research interests. The Department also has access to the Duthie reserve and the Botanical Garden of the University.

For more information, visit the web page at http://www.sun.ac.za/botzoo.

53953 BIODIVERSITY AND ECOLOGY				
212	16	Statistics and Other Tools for Biologists	3L, 3P	T
This module is a thorough introduction to the key numerical skills and processes underpinning the good practice of biological sciences. It covers statistical analyses; the concept of null and alternative hypotheses, data handling and logical interpretation; data presentation and scientific communication; advanced use of Microsoft Excel and PowerPoint and the use of Statsoft Statistica. Hands-on statistical exercises cover a range of parametric, non-parametric and contingency-based analyses from descriptive statistics through to combinations of analysis of variance and regression analysis. Applied scientific investigatory principles to biology are explored using experimental design, ethics, scientific and popular publication processes, and the use of scientific literature.				
C Computer Skills 171				
214	16	Principles of Ecology	3L, 3P	E
The basics of aquatic biology and population ecology are taught by integrating theory and practical field work. Topics will focus on population growth and life history strategies used by organisms to maximise fitness. This module will be closely integrated with Biodiversity and Ecology 212 where students will be taught how to analyse ecological data. There will be a three-day, compulsory field course where students conduct their				

own research projects.

Continuous assessment
PP Biology 144
P Mathematics (Bio) 124 or
P Mathematics 114 and 144
C Biodiversity and Ecology 212 or
C Probability Theory and Statistics 114 or 144

224	**16**	**Diversity and Function of Invertebrates**	3L, 3P	**T**

The focus is invertebrate diversity and physiology. Major evolutionary morphological features (form) within each of the phyla that allow animals to survive in their respective habitats and eventually colonise the terrestrial environment will be explored. Within each environment (marine, freshwater and terrestrial), students will be exposed to the physiological challenges animals have to endure in order to survive. Major physiological changes within major invertebrate phyla will be explored in relation to their evolution. The practical component of the module will entail both laboratory and field work.

Continuous assessment
PP Biology 144 or 154 and a final mark of at least 40% in the remaining Biology module

244	**16**	**Principles of Evolution**	3L, 3P	**E**

The principal evolutionary mechanisms which shape the biological world will be dealt with. It provides a historical perspective on the development of the major ideas in evolutionary thinking and tackles the interface between evolutionary research and the public's perception of it. Topics covered include theoretical genetic models which underlie modern molecular genetic approaches, natural selection and how it operates, the distinctions and links between micro- and macroevolution and how species are formed and lost. In addition to theoretical understanding, students will be exposed to the design and execution of experiments in evolution.

PP Biology 124 and 144 or 154 and a final mark of at least 40% in the remaining Biology module
P Mathematics (Bio) 124 or
P Mathematics 114 and 144
C Biodiversity and Ecology 212, 224, 254, 264

254	**16**	**Vertebrate Life**	3L, 3P	**T**

The vertebrate story: where they originated, present diversity, how they evolved, what they do and how they work. Topics include characteristic features of vertebrates and their body plans; the broad pattern of the evolutionary relationships of vertebrates; ontogeny of vertebrates and the evolutionary implications of developmental mechanisms; basic anatomy, physiology and evolution of vertebrate organ systems; reproductive biology and strategies: sex determination; hormonal control; seasonal cycles; evolution of viviparity; thermo-energetics; water balance, osmoregulation and excretion; surviving in extreme environments. This module includes practical sessions/workshops and a research project with data collected in the laboratory or during a field excursion.

Continuous assessment
PP Biology 124 or 154 and a final mark of at least 40% in the remaining Biology module
P Chemistry 114, 154

264	16	**Diversity of Plant Form and Function**	3L, 3P	**T**

Plants occupy the most diverse habitats on earth. A wide range of morphological and physiological adaptations are required to conquer these habitats. The diversity of plant form and function will be explored as interlinked themes to understand how plants grow, respond to natural cycles, capture resources and survive in adverse conditions. The theory and practicals will explore each theme in a complimentary way that will include formal lectures, group discussions, laboratory and field experiments.

PP Biology 144 or 154 and a final mark of at least 40% in the remaining Biology module

315	16	**Ecology Field Course**	3L, 3P	**E**

This is a field-based module. The location of the module will change from year to year. The module will be timed to fall outside of the formal lecture periods – typically two weeks during January. The aim of the module is to bring ecological and evolutionary theory to life in the field. The main foci are biotic interactions (e.g. pollination, competition, facilitation), animal behaviour and ecosystem-level ecology. Lectures, assignments and discussion groups will be conducted in the field, as well as during the normal university term time.
This module is a restricted module and largely limited to students registered in the Biodiversity and Ecology programme. Participants maybe selected from other programmes based on past performance and available places.

Continuous assessment
PP Biodiversity and Ecology 212, 214

324	16	**Angiosperm Diversity and Evolution**	3L, 3P	**T**

The theory investigates the origin and phylogenetic relationships among angiosperms, as determined through different classification systems. Angiosperm diversification and classification is studied through the use of morphological, anatomical, embryological, palynological and molecular characters. The role of hybridization and polyploidy in the diversification of the angiosperm lineage is assessed. Specialized morphological and physiological adaptations to suboptimal environments and the effect of such adaptations on the diversification of angiosperms are discussed.
The practical series focuses on Fynbos taxa and plant identification up to the family level.

PP Biodiversity and Ecology 264

334	16	**Global Change Biology**	3L, 3P	**T**

The study of global change with a biological perspective, which brings together historical and current evidence for such change and summarises the main drivers thereof. Topics include global climate change, anthropogenic change such as pollution, land use, and the spread of invasive species. Data at different spatial and temporal scales and at different levels of biological organisation are covered, highlighting the technologies and numerical techniques used to study these processes. Finally, ways of ameliorating the process are covered, as is communication about all of the above topics both between scientists, and between science and the public.

Prerequisite pass: any 5 of the following 6 modules:
PP Biodiversity and Ecology 212, 214, 224, 244, 254, 264

344	16	Evolutionary Ecology	3L, 3P	E

Topical themes in evolutionary ecology will be covered, namely the evolution of behaviour, biotic interactions and physiology. This module will deal with the following, as well as related, topics: game theory; optimal-foraging theory; life history evolution; evolution of sex; sexual selection and sex ratios; altruism and the evolution of sociality. Evolutionary arms races with mimicry and sexual conflict as examples; coevolution of plant animal interactions. The link between behaviour and physiology and physiological tolerances and constraints on survival, life histories and reproductive strategies. Appropriate field and statistical techniques used in evolutionary ecology research will be covered during practical sessions.

Continuous assessment

PP Biodiversity and Ecology 212, 214, 244

354	16	Evolutionary Patterns and Processes	3L, 3P	T

Evolutionary theory underpins all of modern biology and is used and applied to generate hypotheses pertinent to the understanding of biodiversity and ecology. By adopting a multi-level approach the module focus on the following topics: Time tree of life, evolutionary biogeography, genetic diversity and differentiation among populations, gene flow, terrestrial and marine phylogeography, reconstruction of a phylogeny, gene trees/species trees, coalescent, rates of evolution, taxonomy, evolutionary classification, conservation genetics, molecular ecology, invasion genetics, genome evolution, cytogenetics/chromosomal evolution, evolutionary development.

PP Biodiversity and Ecology 244

364	16	Conservation Biology	3L, 3P	T

A variety of topics relevant to conservation biology will be covered, and will draw from the fields of ecology and genetics. It aims to equip young biologists and conservation managers with a working knowledge on modern conservation biology principles, and will cover topics such as the relevance of genetic diversity, adaptive evolution, genetic and ecological consequences of fragmentation, relevant policy framework, and units for conservation.

53953 BIODIVERSITY AND ECOLOGY

778	120	BScHons in Biodiversity and Ecology		

Admission requirements

A BSc degree approved by the Departmental Postgraduate and Academic Committees, with an average final mark of at least 60% for the appropriate modules at third-year level. Additional work may be prescribed, depending on the student's background.

Programme composition and duration

The primary aim of the BScHons programme in Biodiversity and Ecology is to provide students with training and experience of the process of identifying research questions, making original discoveries in science and effectively communicating the findings. In addition, students will receive practical training in relevant modern experimental techniques and theoretical training in a number of biological sub-disciplines. The programme provides an effective bridging year for students interested in pursuing advanced postgraduate degrees in various biological fields, but also provides students with key skills applicable to different market-orientated career choices. Emphasis is placed on three aspects in the educational process: (a) the development of a satisfactory knowledge base; (b) the development of a wide-ranging practical and theoretical capability and (c) the development of a professional scientific methodology and ethics.

The minimum duration of the programme is one year.
The programme comprises theoretical work, seminars, practical tasks, independent research work and independent consultation of the broader biological literature. Assessment takes a variety of forms including two oral examinations, written exams, assignments, book reviews, seminars, a research project and a poster on the research project, and the production of a popular article. For successful completion of the Honours programme, students are required to successfully complete the generic scientific skills module, a module on theoretical topics in biodiversity science and a research project (an average of 50% must be obtained for each of the three components). Honours students are required to attend departmental seminars and to serve as undergraduate demonstrators.
Programme structure
The programme comprises three components: (i) A research project, (ii) A generic scientific skills module, and (iii) theoretical topics in biodiversity science.
66184 – 715(24) Generic Scientific Skills
55867 – 717(60) Research Project
12249 – 796(36) Theoretical Topics in Biodiversity Science

66184 - 715	**24**	**Generic Scientific Skills**		

The aim of this module is to provide honours students with the philosophical background and tools required to perform independent research, from planning through implementation and analysis to reporting. All students attend a natural-history field excursion and participate in short workshops on topics which may include: (1) Science methodology and statistical analysis; (2) Philosophy of Biology; (3) Communication skills; (4) Reading and reviewing popular scientific literature (5) Writing of project proposals; (6) Research and funding structures; (7) Applying for a job; (8) GIS; (9) Microscopy; and (10) General molecular skills.

55867 - 717	**60**	**Research Project**		

Each student selects a research project proposed by an academic staff member and will be involved in the design and execution of the research under close direction of the supervisor. This component consists of the research project, a research proposal, research seminars, a poster, a popular article and an oral. The results shall be submitted in the form of a scientific paper and presented at a seminar to a scientific audience.

12249 - 796	**36**	**Theoretical Topics in Biodiversity Sciences**		

Members of the academic staff present focused, integrated, interactive modules in their fields of expertise designed to provide in-depth exposure to theory and/or relevant techniques in the Biodiversity Sciences. Students choose topics from four broad subject areas:
(1) Biodiversity and Systematics
(2) Functional Ecology and Environmental Stress
(3) Evolutionary Ecology of Plants and Animals
(4) Conservation and utilisation of natural resources – applying molecular and other tools.
More information on these topics can be found at academic.sun.ac.za/botzoo/

59404 BOTANY

878	**180**	**MSc in Botany**		

Research on an approved topic is required and must be presented in the form of a publication quality thesis. In addition, supplementary studies (formal classes or seminars) on specific aspects may be required. An oral examination is taken. (Please see Higher

Degrees in Science for further information)				
66303 - 818	**180**	**Thesis Botany**		
Research on an approved topic is required and must be presented in the form of a publication quality thesis.				

59404 BOTANY				
978	**360**	**PhD in Botany**		
A publication-quality dissertation comprising the results of independent research is required (Please see Higher Degrees in Science for further information).				

59404 BOTANY				
998	**360**	**DSc in Botany**		
Published research articles of a high international standard that significantly contribute to botanical knowledge are required (Please see Higher Degrees in Science for further information).				

59412 ZOOLOGY				
878	**180**	**MSc in Zoology**		
Research on an approved topic is required and must be presented in the form of a publication quality thesis. In addition, supplementary studies (formal classes and/or seminars) on specific aspects may be required. An oral examination is taken. (See Higher Degrees in Science for further information.)				
66338 - 818	**180**	**Thesis Zoology**		
Research on an approved topic is required and must be presented in the form of a publication quality thesis.				

59412 ZOOLOGY				
978	**360**	**PhD in Zoology**		
A publication-quality dissertation comprising the results of independent research is required. (See Higher Degrees in Science for further information.)				

59412 ZOOLOGY				
998	**360**	**DSc in Zoology**		
Published research articles of a high international standard that significantly contribute to zoological knowledge are required. (See Higher Degrees in Science for further information.)				

DEPARTMENT OF CHEMISTRY AND POLYMER SCIENCE

Chemistry:

Please note:

Students who wish to continue their studies in Chemistry 3 or further, shall present Chemistry 124, 144 and Mathematics 114, 144 on first-year level.

11479 CHEMISTRY				
124	**16**	**Fundamental Principles of Chemistry I**	3L, 3P	**A & E**
Matter and its properties; chemical formulae; stoichiometry; solution stoichiometry and reactions in aqueous solution; thermodynamics: energy, enthalpy, entropy and Gibbs free energy; atomic structure and bonding; molecular geometry and structure according to Lewis and VSEPR; intermolecular forces; chemical kinetics.				

144	**16**	**Fundamental Principles of Chemistry II**	3L, 3P	**A & E**
Chemical equilibrium (both quantitative and qualitative), with applications in acid-base and precipitation reactions of aqueous solutions; an introductory study of organic compounds with a variety of functional groups; reaction mechanisms; stereochemistry; polymerisation. *C Chemistry 124*				
176	**32**	**Introduction to Chemistry**	3L, 3P	**A & E**
For students in the BSc (Extended Degree Programme). This module deals with the following themes: Classification of matter; atoms, molecules and ions; stoichiometry; reactions in aqueous solutions; atomic structure; chemical bonding; acid and bases; the periodic table. Examples that illustrate the importance and relevance of science as an everyday phenomenon.				
214	**16**	**Organic Chemistry**	3L, 3P	**T**
Reaction mechanisms, including nucleophilic addition and substitution, elimination, electrophilic addition, electrophilic aromatic substitution; stereochemistry. *PP Chemistry 114, 154*				
234	**16**	**Inorganic Chemistry**	3L, 3P	**E**
Periodic trends; structure and bonding in molecules; structure and bonding in solids; chemistry in solution; main group elements. Coordination chemistry: Introduction, types of ligands, nomenclature; isomerism in coordination compounds; different geometries; formation constants; crystal field theory. *PP Chemistry 114*				
254	**16**	**Physical Chemistry**	3L, 3P	**A**
Chemical thermodynamics; colligative properties; phase diagrams; reaction kinetics; electrochemistry. *P Mathematics 114, 144*				
264	**16**	**Analytical Chemistry**	3L, 3P	**T**
Introduction to chemical analysis; basic classical analytical chemistry; errors and uncertainty in analytical data; basic statistical methods; volumetric methods (acid-base, redox and complexometric analysis); solvent extraction; introduction to chromatographic separation; introduction to analytical molecular spectroscopy: fundamental principles and quantitative aspects of UV/visible spectrophotometry. *PP Chemistry 114, 154 and* *P Mathematics 114, 144 or* *P Mathematics (Bio) 124 or* *P Engineering Mathematics 115, 145*				
314	**16**	**Analytical Chemistry**	3L, 3P	**E**
Introduction to instrumental analysis. Error theory in quantitative chemical analysis, calibration in instrumental analysis and figures of merit. Introduction to atomic spectroscopy: atomic absorption and atomic emission spectroscopy for quantitative elemental analysis. Molecular spectroscopy: basic principles and application of ^{1}H and ^{13}C nuclear magnetic resonance spectroscopy (NMR); introduction to infrared spectroscopy; introduction to analytical mass spectrometry; instrumental chromatographic methods. *P Chemistry 224*				

324	**16**	**Physical Chemistry**	3L, 3P	**A**
Quantum mechanical description of atoms and molecules; vibrational and rotational spectra; statistical thermodynamics. *P Chemistry 254* *PP Mathematics 114, 144*				
344	**16**	**Organic Chemistry**	3L, 3P	**T**
Advanced systematic acyclic and aromatic chemistry; stereochemistry; syntheses. *PP Chemistry 214*				
364	**16**	**Inorganic Chemistry**	3L, 3P	**E**
Stereochemical non-rigidity; structure and strength correlations for acids and bases; industrial importance; structure and reactivity of transition metal complexes; selective complexation; kinetics and mechanisms of selected reactions; bio-inorganic chemistry and the role of metal complexes in biological systems; introduction to organometallic chemistry; the synthesis and characterisation of inorganic compounds (practicals). *PP Chemistry 244*				

Chemistry as major for the BSc Degree

The following modules are required for honours in 2013: Chemistry 114(16), 154(16), 214(16), 224(16), 244(16), 254(16), 324(16), 334(16), 344(16) and 354(16).

11479 CHEMISTRY				
778	**120**	**BScHons in Chemistry**		
Admission requirements The minimum requirements are a BSc degree with Chemistry as major, an average final mark of at least 60% for Chemistry 3 and pass marks in Mathematics 114 and 144. Final approval of admission rests with the Departmental Committee and additional requirements may be imposed, for example in the case of poor performance by the student in a particular module. The programme usually commences one week before the general commencement of classes *Programme composition* For departmental purposes the programme is divided into the following modules: - 10382 - 711(20) Analytical techniques Molecular spectroscopy: NMR, IR, MS; separation science. - 10638 - 712(10) Organic chemistry Modern synthetic methods. - 10462 - 713(10) Physical chemistry Theoretical molecular models, applications of symmetry. - 10384 - 714(10) Inorganic chemistry Macrocyclic chemistry; advanced classical coordination chemistry; advanced organometallic chemistry and application in homogeneous catalysis; X-ray crystallography; supramolecular chemistry. - 56030 - 741(10) Special topics in Chemistry - 63258 - 744(30) Research project in Chemistry - 10438 - 771 (30) Experimental chemistry				

11479 CHEMISTRY				
878	**180**	**MSc in Chemistry**		
Research on an approved topic, as determined by the supervisor(s) concerned. On completion of the investigative work, a satisfactory thesis shall be handed in and an oral				

presentation made. Additional study (as determined by the supervisor(s) in each case) may be required.				
66214 - 818	**180**	**Thesis Chemistry**		
Research on an approved topic, as determined by the supervisor(s) concerned. On completion of the investigative work, a satisfactory thesis shall be handed in and an oral presentation made.				

11479 CHEMISTRY				
978	**360**	**PhD in Chemistry**		
A dissertation containing the results of independent research is required (For further information see Higher Degrees in Science).				

11479 CHEMISTRY				
998	**360**	**DSc in Chemistry**		
For the DSc degree one or more published scientific works of high standard is required. The published work should have made a significant and outstanding contribution to the furthering of knowledge of Chemistry (For further information see Higher Degrees in Science)				

Applied Chemistry: General information

Please note:

Applied Chemistry 3 can be taken as a third-year subject in combination with Chemistry 3 for the BSc degree.

52078 APPLIED CHEMISTRY				
324	**16**	**Polymer Chemistry**	3L, 3P	**A**
Introduction to polymers as materials; chemistry of polymerisation reactions (theory and examples): step and ring-opening polymerisation reactions, polyesters, polyamides, phenolic resins and epoxy resins; addition polymerisation reactions: free-radical polymerisation reactions, ionic polymerisation reactions, transition metal-catalysed polymerisation reactions; reactions of polymers; degradation reactions: chemistry and case studies; stabilisation of polymer systems; industrial processes, recycling and biodegradabliltiy, polymers and the environment. *Practicals*: laboratory work, seminars and tasks				
344	**16**	**Analytical Polymer Science**	3L, 3P	**E**
Introduction to polymer structure and morphology: classification of polymers, polymers in solution, molecular weight and molecular weight distributions, structure/ property relationship of polymers; introduction to polymer analysis and characterisation: measurement of polymer molecular masses, spectroscopic techniques for polymer analysis; thermal analysis; physical testing of polymers; measurement of crystallinity in polymers. *Practicals*: laboratory work, seminars and tasks.				

48321 CHEMISTRY C				
224	**15**	**Industrial Chemistry I**	4L, 2P	**A & E**
8 Practicals per semester Bonding models; solid-state chemistry; chemistry in solution; introduction to coordination chemistry. Thermochemistry, chemical and phase equilibrium, ideal and electrolyte solutions, electrochemistry, colligative properties. *PP Engineering Chemistry 123*				

254	15	Industrial Chemistry II	4L, 2P	A & E

8 Practicals per semester

Organic chemistry: Basic nomenclature, introduction to preparation and reactions of *inter alia* alkenes, alkynes, alkyl halides, alcohols, ketones, carboxylic acids and esters; Introduction to polymer chemistry: Chemistry of polymerisation reactions, *inter alia* polyesters, polyamides.

PP Engineering Chemistry 123

25518 CHEMISTRY (MEDICINE)				
197	**12**	**Chemistry for EDP Students**	4L, 1P	**E**

This module is an aid to the mainstream module Chemistry 111 (Health Sciences) and provides an introduction to chemistry for students who are aiming at careers in the health sciences. It is offered parallel to the mainstream module. This module is offered only to qualifying students.

Chemistry for the Health Sciences

Please note:

The module Chemistry for the Health Sciences 111(17) caters for the special needs of students in the Faculty of Medicine and Health Sciences.

65692 CHEMISTRY FOR HEALTH SCIENCES				
111	**17**	**Chemistry for Health Sciences**	5L, 3P	**T**

The module covers areas of general chemistry required as a foundation for studying further in the health sciences. It comprises atomic structure and bonding; stoichiometry; gas laws; properties of solutions; chemical kinetics; chemical equilibria; acids, bases and buffer solutions; electrochemistry; organic chemistry and biomolecules.

40789 POLYMER SCIENCE				
778	**120**	**BScHons in Polymer Science**		

This programme has two streams, namely

- *Polymer Science*
- *Textile and Polymer Science*

Admission requirements

The minimum requirements are a BSc degree with Chemistry as major and an average final mark of at least 60% for Chemistry 3, or a BEng degree (Chemical Engineering). In the case where a student has, due to the specific requirements of the degree in question, not done (as a maximum) one of the third-year modules (Chemistry 324, 334, 344 or 354), the final marks of the other major subject(s) of the degree programme in question will be taken into consideration. Final approval of admission rests with the Departmental Committee, and additional requirements may be imposed.

Duration

The programme normally extends over one year, starting one week before the normal commencement of classes.

The curricula of the two streams are as follows, with the module contents given below:

Polymer Science stream:

10490 – 712(15), 10658 – 724(15), 10463 – 744(15), 56030 – 754(15), 64440 – 714(60)

Textile and Polymer Science stream:

10490 – 712(15), 10658 – 724(15), 10463 – 744(15), 12237 – 764(15), 12236 – 734(60)

10490 - 712	**15**	**Advanced Analytical Polymer Science**	5L, 8P	
Application of analytical techniques for polymers; atomic force microscopy, gel permeation chromatography and liquid chromatography; dynamic mechanical analysis and dielectric analysis; crystallisation analysis by fractionation; thermal and thermogravimetric techniques; mechanical testing.				
64440 - 714	**60**	**Research Project in Polymer Science**		
This module comprises the completion of a research project by the student (under supervision).				
10658 - 724	**15**	**Polymer Chemistry**	5L, 8P	**E**
Structure/property relationships; polymer morphology; synthesis of polymers; degradation and stabilisation of polymer materials; inorganic polymers.				
10463 - 744	**15**	**Physical Polymer Chemistry**	5L, 8P	**T**
Phase diagrams; classification systems; crystallisation; morphology; flow; the glassy state; viscoelasticity; refraction; yield; fatigue; complex rheology; reinforcement; environmental stress resistance of polymers.				
56030 - 754	**15**	**Special Topics in Polymer Science**	5L, 8P	**E**
The composition, processing and degradation of plastics; elastomer technology and advanced analytical techniques. *Capita Selecta* from other topics like polymer blends, biopolymers and medical polymers, organometallic chemistry, reinforced polymers and material applications.				
12236 - 734	**60**	**Research Project in Textile and Polymer Science**		**T**
Individual research project on a topic in textile and polymer science, chosen and conducted under the supervision of a study leader according to a fixed reporting programme.				
12237 - 764	**15**	**Special Topics in Textile Science**		**T**
Capita selecta of subjects covering the latest research and developments in textile science and textile related study fields, including advanced textile finishing, colouration and colour physics, modification of textile behavioural properties, and micro- and nanofibre technology.				

40789 POLYMER SCIENCE				
878	**180**	**MSc in Polymer Science**		
Research on an approved topic, as decided by the supervisor(s) concerned. On completion of the research, a thesis shall be handed in and an oral examination completed. Additional study as decided on by the supervisor(s) may be required.				
66230 - 818	**180**	**Thesis Polymer Science**		
Research on an approved topic, as decided by the supervisor(s) concerned. On completion of the research, a thesis shall be handed in and an oral examination completed				

40789 POLYMER SCIENCE				
978	**360**	**PhD in Polymer Science**		
A dissertation containing the results of independent research is required (For further information see Higher Degrees in Science).				

40789 POLYMER SCIENCE				
998	**360**	**DSc in Polymer Science**		
For the DSc degree published one or more scientific works of high standard is required. The published work should have made a significant and outstanding contribution to the furthering of knowledge of Polymer Science (For further information see Higher Degrees in Science).				

50563 TEXTILE SCIENCE				
254	**16**	**Fibre Science**	3L, 3P	**T**
Introduction to the textile industry, textile terminology and the history of textiles. The classification, composition, morphology, chemical and physical structure of textile fibres as well as molecular arrangements within fibres and its effect on the behaviour characteristics of specific textile fibres and fabrics. New developments in textile fibre modifications especially with regard to behaviour characteristics and functional textiles for niche markets. *P Chemistry 114, 154*				
314	**16**	**Textile Production Processes**	3L, 3P	**T**
A study of the technology of the manufacturing of textile structures, as well as new developments in this regard. Introduction to the basic colouring and finishing processes and the design of technical textiles. Practical experience to the analyses and description of textile products and the laboratory testing of specific textile product properties. *C Textile Science 254*				
344	**16**	**Functional Textiles**	3L, 3P	**T**
An overview of the basic disciplines and principles pertaining to the chemical and mechanical finishing of textiles, the different colorants and finishing agents, their morphology and chemical orientations and the factors that influence their absorption and retention. The second half of the module focuses on the development of functional and technical textiles. *P Textile Science 254, 314* *C Chemistry 344*				

DEPARTMENT OF EARTH SCIENCES

64165 GEO-ENVIRONMENTAL SCIENCE				
154	**16**	**Introduction to Earth Systems Science**	3L, 3P	**T**
Introduction to Earth systems science; Star-forming processes; The solar system and the earth; Internal earth processes; Mineral- and rock-forming processes; Origin of magma and igneous rocks; External structure of the earth; Formation of continents; Plate tectonics; Sedimentary rocks and the geological record; Geological time scale; Metamorphic rocks and mountain building; Humans and tectonics: earthquakes and volcanoes; The hydrosphere; Surface water processes; Groundwater processes; Theory of the origin and evolution of life; Practical mapping.				

12239 EARTH SCIENCE FIELD SKILLS				
172	**8**	**Earth Science Field Skills**	2P	**E**
Students taking the Earth Science Programme must enrol in this module. The module is composed of eight days' field or practical work spread throughout the year which may be scheduled during holidays or on weekends. These field trips will cover the following				

aspects of geological field skills: Defining lithological packages, recognizing map scale; working with topographic maps and aerial photos to record information and to locate yourself; identification of sedimentary, metamorphic and igneous rocks and structures and their depositional or emplacement significance, practical consideration of natural environment.

Continuous assessment
C Geo-Environmental Science 124, 154

272	**16**	**Earth Science Field Skills**	2P	**E**

A compulsory module for students taking the Earth Science Programme The module is composed of eight days' compulsory field work spread over one year. Field work will cover the following aspects of geological field skills: Defining lithological packages, recognizing map scale; the use of structural compasses to record structural information and geological map construction; working with topographic maps and aerial photos whilst in the field to record information and to locate yourself; identification of sedimentary, metamorphic and igneous rocks and structures in the field and their depositional or emplacement significance; ore deposit indicators and rock associations; practical consideration of environmental systems to understand the consequences of anthropogenic activities.

Continuous assessment
PP Earth Science Field Skills 172
P Geo-Environmental Science 124
PP Geo-Environmental Science 154
C Geology 224, 244, 254
C Environmental Geochemistry 214

374	**16**	**Earth Science Field Skills**	3.5P	**E**

A compulsory module for students taking the Earth Science Programme. The module is composed of sixteen days' compulsory field work spread over one year. These field trips will cover the following aspects of geological field skills: Defining lithological packages, recognizing map scale; the use of structural compasses to record structural information and geological map construction; working with topographic maps and aerial photos whilst in the field to record information and to locate yourself; identification of sedimentary, metamorphic and igneous rocks and structures in the field and their depositional or emplacement significance; ore deposit indicators and rock associations; practical consideration of environmental systems to understand the consequences of anthropogenic activities.
Students must obtain a sub-minimum of 50% in order to gain admission to the final examination.

PP Earth Science Field Skills 272
PP Geology 224, 244, 254
C Geology 314, 324, 344, 354

13374 GEOLOGY				
224	**16**	**Introduction to Mineralogy**	3L, 3P	**E**
Introduction to mineralogy and crystallography; mineral chemistry; chemical families of minerals; mineral identification, properties and classification. *Students must obtain a 50% sub-minimum on the combined mark of practical 1 and the practical test.* *Continuous assessment* *P Geo-Environmental Science 124* *PP Geo-Environmental Science 154* *P Chemistry 114*				
244	**16**	**Physical Earth Sciences and Structural Geology**	3L, 3P	**T**
Physical Earth Sciences. Planar and linear elements in structural geology. Uses of the geological compass. Principles of stereographic projection, content of topographic and geological maps, classification of fabrics, folds and fault zones, structural interpretation of geological maps, block diagrams, cross sections and strike-parallel sections. Geological mapping techniques, plane table, theodolite, GPS, photo geology. Structural geology. Forces, stress and strain, rheology of geological materials, fissures and fracture planes, foliations and lineations, faults and fault zones, folding and boudinage, halokinesis, intrusion mechanisms, structural control of fluid flow, introduction to plate-tectonic principles, relationship between tectonics, metamorphism and sedimentation. *A 50% sub-minimum for practical work is required for admission to the examination.* *PP Geo-Environmental Science 124, 154* *PP Geology 224*				
254	**16**	**Optical Mineralogy and Petrography**	3L, 3P	**E**
Introduction to the petrographic microscope; optical properties of minerals in thin-sections; the description of rocks in hand-specimen and thin-section; classification of rocks using petrological principles; relationships between mineral associations, rock textures and tectonic environments. *Students must obtain a 50% sub-minimum on the practical test.* *Continuous assessment* *PP Geo-Environmental Science 124, 154* *PP Geology 224* *PP Chemistry 114*				
314	**16**	**Igneous Petrology**	3L, 3P	**E**
Tools used to study igneous rocks (physical and chemical diagrams, thin-sections, geochemistry – major and trace elements, isotopes, experimental petrology); processes and conditions from partial melting to ascent, emplacement, and final solidification that have lead to the formation of igneous rocks; important associations of igneous rocks (granites, ophiolites and oceanic crust, layered intrusions, andesites and arc magmas, intra-plate and rift-related rocks, Archaean magmatic rocks) – investigated and discussed in the context of their tectonic environments. *A 50% sub-minimum for practical work is required for admission to examinations.* *PP Geology 224, 244, 254* *PP Chemistry 114, 154*				

324	16	Sedimentology and Stratigraphy	3L, 3P	T
Origin, composition and classification of sedimentary rocks. Sedimentary textures and structures. Facies analysis and depositional environments. Basin analysis and palaeo-geography. Sequence analysis and cyclicity. Stratigraphic principles. South African stratigraphy. Well log/core correlation/interpretation. Sedimentary log description. *A 50% sub-minimum for practical work is required for admission to the examination.* *PP Geology 224, 244, 254* *PP Chemistry 114, 154*				
344	**16**	**Economic Geology**	3L, 3P	**T**
Classification, global distribution and genesis of mineral deposits. Introduction to mineral economics. Mineral deposits and the environment. Mineral exploration including geochemistry, geophysics and project management. Introduction to ore microscopy. *A 50% sub-minimum for practical work is required for admission to the examination.* *PP Geology 224, 244, 254* *PP Chemistry 114, 154*				
354	**16**	**Metamorphic Petrology and Tectonics**	3L, 3P	**E**
Introduction to metamorphism, environments of metamorphism, compositional types of metamorphic rocks**,** metamorphic minerals, metamorphic grade, progressive metamorphism and metamorphic zones, the metamorphic facies concept, chemical processes of metamorphism, types of metamorphic reactions, the fluid phase in metamorphism, graphical representation of metamorphic assemblages, analysis of the details of assemblage change during metamorphism in common rock types, practical analysis of the pressure-temperature history of metamorphic rocks, geothermobarometry. Tectonics: Rheological stratification of the lithosphere and mantle; types of heat and material transport; absolute and relative plate motions; types of plate margins; processes at and architecture of divergent and convergent plate margins; collisional tectonics and collisional belts; magmatic, metamorphic, structural and sedimentary signatures of tectonic environments. *A 50% sub-minimum for practical work is required for admission to the examination.* *PP Geology 224, 244, 254* *PP Chemistry 114, 154*				

63991 ENVIRONMENTAL GEOCHEMISTRY				
214	**16**	**Introduction to Environmental Geochemistry**	3L, 3P	**T**
The natural geochemical cycles of elements at the surface of the Earth, as well as effects of human activities upon these cycles; the distribution and transport of chemical substances between the atmospheric, continental and marine environments; interactions between chemical, geological, physical and biological environmental processes; analysis of environmental geochemical data (geochemical modelling techniques and methods). *P Geo-Environmental Science 124* *PP Geo-Environmental Science 154* *P Chemistry 114, 154*				
314	**16**	**Environmental Geochemistry**	3L, 3P	**E**
Application of redox, acid-base chemistry, thermodynamics and kinetic principles to environmental geochemistry. Soil chemistry; chemical and physical weathering; soil formation and classification; surface complexation reactions; contaminants in soils;				

chemical evolution of surface and subsurface water; wastewater evolution; contaminant transport processes and reactions; sampling and monitoring of air, soils and water; a brief introduction to physics and chemistry of the atmosphere.
PP Environmental Geochemistry 214
PP Chemistry 214, 244
PP Mathematics 114 or
PP Mathematics (Bio) 124

Geology as major for the BSc degree
The following modules are compulsory: Earth Science Field Skills 172(8), 272(16), 374(16), Geo-Environmental Science 124(16), 154(16), Geology 224(16), 244(16), 254(16), 314(16), 324(16), 344(16) and 354(16) and Environmental Geochemistry 214(16).

12918 EARTH SCIENCES				
778	**120**	**BScHons in Earth Sciences**		

Admission requirements
A BSc degree with Geology as major. An average final mark of at least 60% for Geology 3 is required, but the Department of Earth Sciences reserves the right to evaluate each case individually. Basic computer skills are required. Applications for admission should reach the Head of the Department not later than 1 October of the preceding year.
Commencement and duration
The duration of the programme is one year, commencing on the first weekday in February.
Programme structure
The honours programme in Earth Sciences is composed of three compulsory modules, a research project and two further modules from one of three streams. Streams are: (1) Applied Geology; (2) Environmental Geochemistry; and (3) Petroleum Geology. The content of each of these modules is further divided into sections at the departmental level and may vary from year to year. The specific content of modules for each year is provided prior to commencement of the honours year. It is possible for students to take elements of different modules in consultation with their supervisor and the honours co-ordinator.

Compulsory modules (credits = 80)
12240 - 771(15) Geology of Southern Africa
12241 - 772(15) Research Methods in Earth Sciences
12242 - 773(15) Special Topics in Earth Sciences
54895 - 795(35) Research Project

Choice of one stream (credits = 40)
Stream A – Applied Geology (credits = 40)
12243 - 712(20) Concepts in Crustal Evolution
12247 - 742(20) Economic Geology

Stream B – Environmental Geochemistry (credits = 40)
12244 - 714(20) Hazardous Waste Site Assessment
12275 - 744(20) Environmental Systems

Stream C – Petroleum Geology (credits = 40)
12547 - 716(20) Facies and Basin Analysis
12549 - 746(20) Reservoir Characterisation and Upscaling

All modules in the honours programme, with the exception of the research project, are assessed through a combination of theory and practical work and an examination. The research project is assessed through submission of a final research report and an oral

presentation. Students must pass all modules with a 45% sub-minimum in order to pass the honours year.				
12240 - 771	**15**	**Geology of Southern Africa**		
Plate tectonic scenarios in the evolution of Southern Africa; geological settings, structural and lithological inventories; interpretation of geological maps and sections; practical application of geological concepts to field-based problems; advanced field techniques; field-based stratigraphic concepts and relationship to tectonic models. Includes 3 weeks' fieldwork.				
12241 - 772	**15**	**Research Methods in Earth Sciences**		
Theoretical and practical techniques in Earth Sciences, including sample selection and characterisation, sample preparation and analytical techniques, geostatistical analysis of datasets, data presentation, report writing, spatial analysis and modelling with GIS; application of GIS to understanding geological problems.				
12242 - 773	**15**	**Special Topics in Earth Science**		
Examination of new ideas in Earth Science research; evolution of Earth Science concepts and theories; special topics offered on an *ad hoc* basis by the Department.				
54895 - 795	**35**	**Research project**		
An independent research project involving approximately 14 weeks of data acquisition and manipulation. The project is normally organised in collaboration with industry or with the aim of furthering the research goals of the Department. Each project is designed according to the interests of an individual student and supervisor. If a student wishes to include vacation work preceding the honours year, this must be arranged beforehand with the specific honours supervisor. A project report is submitted at the end of this module and an oral presentation made to the Department.				
12243 - 712	**20**	**Concepts in Crustal Evolution**		
Advanced petrological concepts in igneous, metamorphic and sedimentary rocks; modelling of whole-rock and mineral-geochemical datasets in the interpretation of rock suites and physicochemical conditions of formation; techniques in geochronology and application to solving geological problems, applied structural geology, analysis of complexly deformed terrains.				
12247 - 742	**20**	**Economic Geology**		
Mineral markets and commodities, ore reserve calculations, ore microscopy, genetic implications of ore textures and paragenesis, geophysical exploration for ore deposits, introduction to geological modelling software, mine data-management systems.				
12244 - 714	**20**	**Hazardous Waste Site Assessment**		
Geological, geophysical and engineering techniques for reconnaissance, sampling and assessment of hazardous waste sites, analytical techniques relevant to hazardous environmental systems, construction and monitoring of hazardous waste sites.				
12275 - 744	**20**	**Environmental Systems**		
The fates and mobility of organic and inorganic contaminants in the regolith; environmental sampling, analysis and interpretation of environmental datasets, hydrogeological concepts, use of isotope tracers to understand element movement in the regolith and water systems.				
12547 - 716	**20**	**Facies and Basin Analysis**		
Application of facies analysis to aid basin analysis and to reconstruct the regional geological setting and history of a sedimentary basins and to understand the three-dimensional distribution of its elements.				

12549 - 746	**20**	**Reservoir Characterisation and Upscaling**		
Introduction to petroleum systems, source-rock characteristics, characterization of petroleum reservoirs, sampling and upscaling of small-scale heterogeneities to understand reservoir properties and reconstruct a reservoir model.				

13374 GEOLOGY				
878	**180**	**MSc in Geology**		
Admission requirements A BScHons degree in Geology or an equivalent qualification. Further studies may be required prior to commencing research. *Programme composition* A thesis on a research project that may include field and/or laboratory research, as required by the supervisor(s), shall be submitted. An oral examination is compulsory.				
66273 - 818	**180**	**Thesis Geology**		
A thesis on a research project that may include field and/or laboratory research, as required by the supervisor(s), shall be submitted. An oral examination is compulsory.				

13374 GEOLOGY				
978	**360**	**PhD in Geology**		
A dissertation that is the product of personal and independent research is required (see Higher Degrees in Science).				

13374 GEOLOGY				
998	**360**	**DSc in Geology**		
A compilation of scientific publications contributing substantially and at a high level to the body of knowledge in Geology is required (see Higher Degrees in Science).				

59552 ENGINEERING GEOLOGY				
214	**15**	**Geology for Civil Engineers**	3L, 3P	**T**
This module does not grant admission to Geology 224, 244 and 254. Introduction to the Earth system: internal structure, plate tectonics; Crystallography introductory; Mineralogy: physical properties of common minerals; Petrology: magma, igneous, sedimentary and metamorphic rocks; Structural geology: strike and dip of layers, folds and faults, tectonic forms, foliation, lineation, geological mapping. *P Engineering Chemistry 123*				

DEPARTMENT OF MATHEMATICAL SCIENCES
Division: Mathematics

21539 MATHEMATICS				
114	**16**	**Calculus**	5L, 2T	**A & E**
Induction and the binomial theorem. Functions, limits and continuity; derivatives and rules of differentiation; applications of differentiation; the definite and indefinite integral; integration of elementary functions.				
144	**16**	**Calculus and Linear Algebra**	5L, 2T	**A & E**
Complex numbers; transcendental functions; techniques of integration; improper integrals; conic sections; partial derivatives; introduction to matrices and determinants. *P Mathematics 114*				

186	32	Introductory Mathematics	3L, 3T	A & E
For BSc (Extended Degree Programme) and BEng (Extended Degree Programme) students. An introduction to calculus, linear algebra and mathematical reasoning: Different presentations of functions in terms of formulas, graphs, tables and stories; inverse of a function; exponential and logarithmic functions; trigonometric functions and their inverse functions; modelling with functions. Gradual progression from average to instantaneous rate of change; limits; basic integration. Systems of equations; analytic geometry; mathematical induction; binomial theorem.				
214	**16**	**Analysis and Linear Algebra I**	4L, 2T	**A**
Analysis: improper integrals, sequences and series, power series and Taylor's theorem, second-order linear differential equations. Linear algebra: vectors in n dimensions: linear transformations of real vector spaces and their matrices; geometric transformations: rotation, reflection, dilation, projection; composition of transformations. General real vector spaces: subspaces, linear independence, basis, dimension; rank and nullity of a matrix. General inner-product matrices; orthogonality, orthonormal bases, projections, the Gram-Schmidt process; QR factorisation of a matrix; least squares approximations; orthogonal matrices. *PP Mathematics 114, 144*				
244	**16**	**Analysis and Linear Algebra II**	4L, 2T	**A**
Analysis: functions of more than one real variable, multiple integrals, line integrals, surface integrals, the divergence theorem. Linear algebra: eigenvalues and eigenvectors, diagonalisation of a real matrix; orthogonal diagonalisation; linear transformations of general real vector spaces; matrix representation of linear transformations between general finite dimensional vector spaces; change of basis; systems of first order differential equations and other applications. *P Mathematics 214*				
278	**32**	**Foundations of Abstract Mathematics I**	3L, 2P	**T**
The purpose of this module is to give an insight to the conceptual view of modern mathematics, rather than the computational one. Some foundational topics from set theory, logic, abstract algebra and topology will be covered with an emphasis on the deep connections between different mathematical constructions throughout these fields. In the process, the art of mathematical reasoning will be thoroughly exhibited, which will give opportunity to deliver a rigorous understanding of historically challenging conceptual themes such as infinity and continuity. This module is ideal for students who would like pursue an academic career in mathematics, or simply those who would like to obtain a broad but relatively thorough picture of contemporary mathematics				
314	**16**	**Algebra**	3L, 3T	**A**
This module is an introduction to the basic axiomatic structures of algebra. These structures provide the natural surroundings for the discussion of many of the most important results in number theory, algebraic geometry and computational algebra. Among others, the following are studied: groups, rings, residue classes modulo n, quotient rings and fields, rings of polynomials, Euclidean domains, unique factorisation domains, extensions of fields, applications to straight-edge and compass constructions, finite fields and their applications. *PP Mathematics 214, 244*				

324	**16**	**Analysis I (Introductory Topology and Complex Analysis)**	3L, 3T	**A**

Metric spaces: Basic topological concepts, continuity, compactness, sequences, the limsup of sequences in **R**.
Complex analysis: Types of sets in **C**, convergence of series, point wise and uniform convergence of sequences and series of functions, paths, Cauchy-Riemann equations, determination of the radius of convergence and coefficients of a power series, the complex exponential and trigonometric functions, arguments, complex logarithms and exponentiation, integration of continuous functions along piecewise smooth paths, Cauchy's theorem and formula, Taylor series expansion of differentiable functions, analytic functions, zeros, Liouville's theorem, proof of the Fundamental Theorem of Algebra, Laurent series, identification and classification of isolated singularities, calculation of residues, the Residue theorem, applications.

PP Mathematics 214, 244

344	**16**	**Discrete Mathematics**	3L, 3T	**E**

Discrete Mathematics, or "Concrete Mathematics", as it is called in a famous book, deals with concrete objects that are inherently discrete is, such as permutations, sets, trees and words. Emphasis will be placed on enumeration techniques. An introduction to elementary number theory will also be presented. In this part of the module, classical topics such as Fermat's theorem, Wilson's theorem or Lagrange's theorem on sums of four squares are treated.

PP Mathematics 214, 244 or equivalent modules

354	**16**	**Computational Mathematics and Approximation Theory**	3L, 3T	**A**

The existence and uniqueness of best approximations in normed linear spaces and inner-product spaces; the Lesbesgue inequality; polynomial interpolation: the Lagrange formula, Newton's divided differences formula, the Vandermonde matrix; Bernstein polynomials and the theorem of Weierstrass; best Chebyshev polynomial approximation; best approximation in an inner-product space: a characterisation theorem; orthogonal polynomials; interpolating quadrature: Newton-Cotes and Gauss formulae; Fourier series and their convergence; splines: the truncated powers basis, the B-spline basis, the Schoenberg-Whitney theorem, local spline approximation operators.

PP Mathematics 214, 244 or equivalent modules

364	**16**	**Euclidean and Non-Euclidean Geometry**	3L, 3T	**A**

(This module is not a mainstream Mathematics 3 module and is only available within the BSc (Ed) programme.)
One of the oldest and historically most important parts of mathematics is presented from a strong historical perspective. Beginning with Euclid's postulates, his geometry is constructed as an axiomatic system. Hilbert's work in making it into a consistent, independent and complete system of axioms is covered. The introduction of non-Euclidean geometry and the resultant reformulation of the fundamental results of Euclidean geometry are also covered. In the presentation of the module a great deal of emphasis is placed on the independence and self-exertion of the student.

PP Mathematics 114, 144

365	16	Analysis II (Introductory Topology and Real Analysis)	3L, 3T	A

Metric and topological spaces: building on concepts covered in Mathematics 324. Some concepts and results from analysis (among others real analysis) and topology will be covered.

PP Mathematics 214, 244

378	32	Foundations of Abstract Mathematics II	1L, 3P	T

This module continues from Foundations of Abstract Mathematics I, going to higher levels of modern conceptual mathematics. The module will be chiefly based on group discussions led by the lecturer and it involves work on a project in any field of contemporary mathematics selected by the student in consultation with the Department. This shall give excellent preparation for postgraduate study in mathematics. The module will be also useful for those who do not intend to carry on with mathematics, as it will enrich them with the mathematical culture of thinking and logical reasoning.

PP Mathematics 278 or
C Mathematics 314 and 324 or 364

Mathematics as major for the BSc degree

The following modules are required: Mathematics 114(16), 144(16), 214(16), 244(16), and Mathematics 314(16), 324(16) together with two modules from Mathematics 344(16), 354(16), 365(16), or Mathematics 324(16), Financial Mathematics 378(32) together with one module from Mathematics 314(16), 344(16), 354(16) or 365(16) or Biomathematics 214(16), 314(16), 344(16), 374(16).

21539 MATHEMATICS

778	120	BScHons in Mathematics		

With focus in one of: Traditional Mathematics, Biomathematics or Financial Mathematics.

Admission requirements

BSc degree with Mathematics as major or an equivalent qualification. An average final mark of at least 60% for Mathematics 3 is required.

For the Biomathematics focus, a BSc degree approved by the Biomathematics programme committee with a final mark of at least 60% for the appropriate third-year modules. Applications should reach the Registrar or the Departmental Chairperson by the end of November of the previous year.

Length and start

This is typically a one-year programme with lectures starting in the first week of February.

Programme structure

For each student a programme is developed taking into account the student's background and preferences. A student may, subject to approval by the Mathematics Division, take a maximum of the equivalent of half of the programme outside the Mathematics Division. In each semester, honours modules, totalling at least 64 credits, are taken. In the second semester one of these modules is a research project. The module choices that are made give a focus for the BScHons in Mathematics. This focus is discussed with each individual student to design the appropriate curriculum.

Please note:

More information about the honours programme is available on the web site of the

Department of Mathematical Sciences at http://mathsci.sun.ac.za.

***Modules** for focus in Traditional Mathematics*
First Semester:
10378 – 711(16) Algebra (3L)
(PP Mathematics 314)
11202 – 712(16) Functional Analysis and Measure Theory (3L)
(PP Mathematics 324, 365)
62987 – 713(16) Real and Complex Analysis (3L)
(PP Mathematics 324, 365)
62871 – 714(16) Set Theory and Topology (3L)
(PP Mathematics 365)

Second Semester:
Depending on the interest shown and the availability of lecturers the following modules will be presented
10379 – 747(8) Algebraic Number Theory (2L)
62995 – 748(8) Computational Algebra (2L)
20405 – 749(8) Wavelet Analysis (2L)
66389 – 751(8) Functional Analysis II (2L)
66397 – 752(8) Measure Theory II (2L)
64400 – 753(8) Category Theory (2L)
66419 – 754(8) Logic (2L)
66427 – 755(8) Concrete Mathematics (2L)
66435 – 756(8) Topics in Algebra (2L)
12250 – 757(8) Complex Analysis II (2L)
12251 – 758(8) Hilbert Spaces (2L)
12252 – 759(8) Topological Vector Spaces (2L)

Additionally, *Capita selecta* modules are offered each year, subject to the research interests of students, teachers and visiting academics. Such modules are introduced in the first semester. (See departmental web site at http://mathsci.sun.ac.za for current offering.)
62928 – 741(8) Capita selecta I
62979 – 742(8) Capita selecta II
62936 – 743(8) Capita selecta III
11204 – 744(8) Capita selecta IV
63002 – 745(8) Capita selecta V
11203 – 760(8) Advanced Analysis
12550 – 761(8) Advanced Abstract Algebra
12551 – 762(8) Number Theory
12552 – 763(8) Topics in Financial Mathematics
An honours project that introduces the student to a research theme is completed in the second semester.
62944 – 746(32) Mathematics: Honours project

Modules *for focus in Biomathematics*
First Semester: (Specific modules are offered in conjunction with AIMS)
11779 – 721(16) Computational and Discrete Methods in Biomathematics (26 lectures) (E)
11780 – 722(16) Non-linear Dynamical Systems in Biomathematics (26 lectures) (E)
11781 – 723(8) Advanced Topics in Biomathematics I (26 lectures) (E)
11782 – 724(8) Advanced Topics in Biomathematics II (26 lectures) (E)
11785 – 725(8) Selected Topics from Biological Sciences (26 lectures) (E)
11786 – 726(8) Selected Topics from Biomedical Sciences (26 lectures) (E)

These modules are offered in conjunction with AIMS (African Institute for Mathematical Sciences) at AIMS itself in Muizenberg.

Second Semester:
A honours project on a research topic involving the application of mathematical, computational and/or statistical methods to analyse and solve problems in biological sciences, environmental sciences and biomedical sciences
11787 – 747(32) Biomathematics: Honours project
12553 – 748(16) Advanced Topics in Biomathematics III (E)
12554 – 749(8) Advanced Topics in Biomathematics IV (E)
plus
Elective modules (8 credits)
Any honours module may be taken subject to approval of the Biomathematics Programme Committee and to the prerequisites.

Modules *for focus in Financial Mathematics*
These modules are offered in conjunction with AIMS (African Institute for Mathematical Sciences) and the University of Cape Town. The specific descriptions are available on the website http://math.sun.ac.za/.
First Semester:
56847 – 716 (12) Financial Mathematics 1 (E)
56847 – 765 (12) Financial Mathematics 2 (E)
56847 – 766 (12) Financial Mathematics 3 (E)
56847 – 767 (12) Financial Mathematics 4 (E)
56847 – 768 (12) Financial Mathematics 5 (E)

Second Semester:
56847 – 769 (10) Financial Mathematics 6 (E)
56847 – 770 (10) Financial Mathematics 7 (E)
56847 – 771 (8) Financial Mathematics 8 (E)
56847 – 772 (8) Financial Mathematics 9 (E)
56847 – 773 (32) Financial Mathematics: Project

21539 MATHEMATICS				
878	**180**	**MSc in Mathematics**		
For each student, the Department, in consultation with the student, appoints a supervisor. The supervisor provides direction as regards the student's thesis. In addition supplementary studies (as prescribed by the Department in consultation with the supervisor and student) may be required. An oral examination is required. Further details are obtainable from the Chair of the Department of Mathematical Sciences. (See also Higher Degrees in Science.)				
11201 - 818	**180**	**Thesis Mathematics**		
For each student, the Department, in consultation with the student, appoints a supervisor. The supervisor provides direction as regards the student's thesis.				

21539 MATHEMATICS				
978	**360**	**PhD in Mathematics**		
A dissertation containing the results of independent research is required. (See Higher Degrees in Science for further information.)				

21539 MATHEMATICS				
998	**360**	**DSc in Mathematics**		
For this degree one or more published scientific works of a high standard, which have made a substantial and outstanding contribution to the knowledge of Mathematics, is required. (See Higher Degrees in Science for further information.)				

66176 BIOMATHEMATICS				
214	**16**	**Mathematical Applications in Biology and Medicine**	4L, 2T	**E**
Introduction to simple deterministic mathematical models in biology and medicine. One-species exponential and logistic population growth. Models with age distribution; population projection. Two-species models; phase plane and stability analysis. Predator-prey; Lotka-Volterra models. Introduction to mathematical epidemiology. Compartmental analysis; SIR models. Modelling metabolic processes. *PP Mathematics 114, 144*				
314	**16**	**An Introduction to Biological Modelling I**	3L, 3T	**E**
Selection of models including: discrete models, probabilistic models, deterministic models, stochastic models, Bayesian models. Discussion and illustration of their applications on the basis of computer lab activities. *PP Biomathematics 214* *PP Mathematics 214, 244*				
344	**16**	**An Introduction to Biological Modelling II**	3L, 3T	**E**
Methods for discrete and continuous optimization. Discussion and illustration of their limitations and applications in biology. *P Biomathematics 314*				
374	**16**	**Project on Biological Modelling**	1P	**E**
Research project on a topic in biomathematics designed to provide students with experience in applying mathematical and statistical models. *C Biomathematics 314*				

12263 SCIENTIFIC COMPUTING				
272	**5**	**Scientific Computing**	2L	**T**
Study load: 35 lectures in total Introduction to Linux; Linux commands; Linux file systems; editors; process control. Introduction to programming in Python: variables, types, control structures, loop structures, functions, files and directories, strings, unit testing, basic data processing. Introduction to numerical computing using Numpy; plotting and curve fitting. *Continuous assessment*				
372	**5**	**Scientific Computing**	2L	**T**
Study load: 35 lectures in total Scientific-document construction and presentations in LaTeX. Regular expressions. Important algorithms including sorting, searching and random-number generation. Advanced computing in Python with Numpy and Scipy; applications including pattern searching, processing of large empirical data sets and constructing data-processing pipelines. Other scientific tools in Linux.				

Continuous assessment
P Scientific Computing 272

56847 FINANCIAL MATHEMATICS				
378	**32**	**Financial Mathematics**	3L, 3T	**A**

Matrix algebra and matrix differentiation. Taylor's theorem for functions of more than one variable, differential equations and numerical methods, Riemann-Stieltjes integrals, introduction to measure and probability spaces, Radon-Nikodym derivatives, L2 spaces and Hilbert spaces, mathematical modelling of financial markets, the Black-Scholes model.

PP Mathematics 214, 244
P Mathematical Statistics 214, 244

58378 MATHEMATICS FOR STATISTICS				
214	**16**	**Mathematics for Statistics**	3L, 2T	**A**

Calculus:
Introductory concepts about functions, exponential functions, logarithmic functions, limits, continuity, derivatives, higher order derivatives, the derivative as a rate of change, optimisation problems, indefinite and definite integrals, the Fundamental Theorem of Calculus, areas between curves, substitution, integration by parts.
Linear algebra:
Gauss elimination, matrix algebra, inverse of a matrix, determinants of matrices, vectors in $\mathbf{R}^3$: rules of computation, unit vectors, linear combinations of vectors, linear independence and bases, dot product. The binomial theorem.
C Statistics 214

21547 MATHEMATICS (BIO)				
124	**16**	**Mathematics for the Biological Sciences**	4L, 2T	**A & E**

Functions and their inverses: polynomial functions, rational functions, power functions, exponential functions, trigonometric functions. Solution of trigonometric equations. Composition of functions. Limits. Definition of the derivative of a function. Continuity. Rules of differentiation, certain formulae. Higher order derivatives. Implicit differentiation. Applications of differentiation: processes of growth and decay, graph sketching, optimisation problems. Indefinite integrals. Techniques of integration: substitution, integration by parts. The definite integral as the limit of a sum. The Fundamental Theorem of Calculus. Definite integrals as areas. Solution and use of simple differential equations.

176	**32**	**Introductory Mathematics for the Biological Sciences**	3L, 3P	**A & E**

For BSc (Extended Degree Programme) students.
Different presentations of functions in terms of formulas, graphs, tables and stories; inverse of a function; exponential and logarithmic functions; trigonometric functions and their inverse functions; modelling with functions; gradual progression from average to instantaneous rate of change; limits. Simple two-dimensional Euclidean geometry, as applied to polygons and circles; co-ordinate geometry; linear programming: optimising a function in two variables subject to linear constraints; introduction to data handling and probability.

38571 ENGINEERING MATHEMATICS				
115	**15**	**Introductory Differential and Integral Calculus**	5L, 2T	**A & E**
Mathematical induction and the binomial theorem; functions; limits and continuity; derivatives and rules of differentiation; applications of differentiation; the definite and indefinite integral; integration of simple functions				
145	**15**	**Further Differential and Integral Calculus**	5L, 2T	**A & E**
Complex numbers; transcendental functions; integration techniques; improper integrals; conic sections; polar coordinates; partial derivatives; introduction to matrices and determinants. *P Engineering Mathematics 115*				
214	**15**	**Differential Equations and Linear Algebra**	4L, 2T	**A & E**
Ordinary differential equations of first order; linear differential equations of higher orders; Laplace transforms and applications. Matrices: linear independence, rank, eigenvalues. Laplace transforms and applications. *PP Engineering Mathematics 115 or 145* *P Engineering Mathematics 145*				
242	**8**	**Series and Partial Differential Equations**	2L, 1T	**A & E**
Infinite series and Taylor series; Fourier series; introduction to partial differential equations; Fourier transforms. *PP Engineering Mathematics 145 or 214* *P Engineering Mathematics 214*				
252	**8**	**Galerkin Finite Element Method**	2L, 1T	**A & E**
Infinite series, Taylor series. Weighted residuals; introduction to the Galerkin finite element method for problems in one and two dimensions. *PP Engineering Mathematics 145 or 214* *P Engineering Mathematics 214*				

53759 LINEAR ALGEBRA B				
812	**8**	**Linear Algebra**		
Vector spaces, subspaces, bases. Matrix factorization. Diagonalization. Application to the solution of systems of ordinary differential equations. Introduction to iterative methods for the solution of large systems of algebraic equations.				

Engineering Mathematics E: General information

Please note: Students who take Engineering Mathematics E as part of their programme, take Engineering Mathematics 115(16) and 145(16) in their first year and Engineering Mathematics 214(16) in the first semester of their second year.

47953 ENGINEERING MATHEMATICS E				
244	**15**	**Series and Complex Functions**	4L, 2T	**A & E**
Infinite series; Taylor series; Fourier series; introduction to partial differential equations; Fourier transforms. Differentiation and integration of complex functions; Cauchy's integral formula; residues. Bessel functions.				

PP Engineering Mathematics 145 or 214
P Engineering Mathematics 214

Division: Applied Mathematics

56820 PROBABILITY THEORY AND STATISTICS				
114	**16**	**Probability Theory and Statistics**	3L, 3T	**T**

(For BSc students)
Combinatorial analysis; the basic counting principles; permutations and combinations. Random phenomena; sample spaces and events; the probability axioms; the probability of an event; random selection; probability rules; conditional probability; the rule of Bayes; stochastic independence. Discrete and continuous stochastic variables; expected value and variance of stochastic variables; important discrete distributions: binomial, Poisson, geometric, hyper-geometric, negative binomial; important continuous distributions; uniform, exponential, normal.

Please note:
This module is identical to Probability Theory and Statistics 144(16), which is offered in the second semester by the Department of Statistics and Actuarial Science for BComm students.

20710 APPLIED MATHEMATICS				
144	**16**	**Modelling in Mechanics**	3L, 3T	**T**

Development of the skilled use of vector, differential and integral calculus in the modelling of dynamics of simple physical systems, including the analysis of force fields, motion and modelling assumptions.

P Mathematics 114
C Mathematics 144

214	**16**	**Applied Matrix Methods**	3L, 3T	**A**

Linear systems. Orthogonality: application to curve fitting. Eigenvalues and eigenvectors: Application to systems of difference and differential equations. Singular values: application to image processing. Numerical computations with matrices like LU and QR decomposition and the calculation of eigenvalues and eigenvectors. Matrix norms. Sensitivity of linear systems; condition numbers. The use of MATLAB for matrix computations.

Continuous assessment
P Mathematics 144

244	**16**	**Applied Differential Equations**	3L, 3T	**A**

Modelling of a wide variety of applications using ordinary differential equations. Linear, non-linear, separable and homogeneous differential equations and systems are used. Analytic and numeric methods, as well as Laplace transforms, are used to solve the mathematical models. The various steps of the modelling process are emphasised.

Continuous assessment
P Mathematics 114, 144
P Applied Mathematics 214

314	**16**	**Applied Discrete Mathematics**	3L, 3T	**A**

Applications of prime factorisation, divisibility, greatest common divisors; the Euler phi function, modular arithmetic, multiplicative inverses, algebraic groups and elementary combinatorics in cryptology (the protection of information) and coding theory (the integrity of information). Introductory graph theory: planarity, colourings, Hamilton and

Euler graphs.

Continuous assessment
P Applied Mathematics 214 or
P Mathematics 214

324	**16**	**Numerical Methods**	3L, 3T	**A**

Methods for the solution of nonlinear equations; analysis of convergence. Interpolation with polynomials and splines; error analysis. Numerical differentiation and integration. Case studies. The use of MATLAB or PYTHON for numerical calculations.

Continuous assessment.
P Mathematics 114

354	**16**	**Flow Modelling**	3L, 3T	**A**

Modelling of the dynamics of continuous systems; convective and diffusive transport as special cases of the general transport theorem; stress dyadic; energy and heat transport, constitutive equations for fluids; derivation and solution of the Navier-Stokes equation; ideal flow; potential flow; numerical flow simulation.

P Applied Mathematics 144

364	**16**	**Applied Fourier Analysis**	3L, 3T	**A**

Fourier series, Continuous and Discrete Fourier transforms, Convolution, Laplace transform, Sturm-Liouville theory, Orthogonal functions. Applications in signal and image processing, as well as in the solution of ordinary and partial differential equations. Numerical Fourier analysis and the FFT.

Continuous assessment
PP Mathematics 114, 144 or
PP Engineering Mathematics 115, 145

Applied Mathematics as major for the BSc degree

The following modules are required: Probability Theory and Statistics 114(16), Applied Mathematics 144(16), 214(16), 244(16), 314(16), 324(16), 354(16) and 364(16).

20710 APPLIED MATHEMATICS				
778	**120**	**BScHons in Applied Mathematics**		

Admission requirements
A BSc degree with Applied Mathematics as major or another qualification recognised as equivalent by the Senate. An average final mark of at least 60% for Applied Mathematics 3 is required.
Modules offered
Some modules may be taken at other departments with the permission of the Division Applied Mathematics. The following modules are offered:
10381 – 781(16) Analytical Methods of Applied Mathematics
36323 – 776(16) Numerical methods
10643 – 774(16) Partial Differential Equations
(Students who have taken Applied Mathematics 364 are not allowed to take Partial Differential Equations 774 as well).
10542 – 782(19) Graph Theory
62782 – 784(16) Coding Theory
10728 – 794(16) Tensor Analysis
62820 – 775(16) Numerical Simulation of Fluids
62839 – 791(16) Porous Media

62812 – 773(16) Numerical Modelling
64572 – 793(16) Digital Image Processing
62847 – 792(16) Computer Vision
62855 – 796(16) Statistical Pattern Recognition
11380 – 711(8) X-Ray Tomography
12253 – 761(8) Capita Selecta I
12255 – 762(8) Capita Selecta II
12256 – 763(16) Capita Selecta III
12257 – 764(16) Capita Selecta IV
10557 – 772(32) Research Project in Applied Mathematics
The Research Project in Applied Mathematics is compulsory. All the other modules will not necessarily be offered every year, and the Division reserves the right make certain modules compulsory.

20710 APPLIED MATHEMATICS				
878	**180**	**MSc in Applied Mathematics**		
The programme entails a thesis on an approved topic. An oral examination is required. Supplementary studies may be required, which may be considered when calculating the final mark. (See also Higher Degrees in Science.)				
66354 - 818	**180**	**Thesis Applied Mathematics**		
A thesis on an approved topic. An oral examination is required.				

20710 APPLIED MATHEMATICS				
978	**360**	**PhD in Applied Mathematics**		
A dissertation containing the results of original research on a topic in Applied Mathematics is required (See Higher Degrees in Science).				

20710 APPLIED MATHEMATICS				
998	**360**	**DSc in Applied Mathematics**		
Previously published work of a high standard is required, constituting a substantial and outstanding contribution to Applied Mathematics (See Higher Degrees in Science)				

20753 APPLIED MATHEMATICS B				
124	**15**	**Statics**	4L, 2T	**A & E**
Vectors; forces; sum of forces at a point; direction cosines and direction angles; components and component vectors; scalar products; vector products; moment of a force; force systems on rigid bodies; equivalent force systems; couples; line of action of the resultant; equilibrium of a rigid body; friction; centre of mass; centroid; volumes; definite integration; moment of inertia of areas.				
154	**15**	**Dynamics**	4L, 2T	**A & E**
Kinematics in one and two dimensions; relative velocities; the equations of motion; rectilinear motion with constant forces; forces in a plane; parabolic motion; circular motion; the principle of work and energy; power; conservation laws; impulse and momentum; angle impulse and angle momentum; kinetics of particle systems. *C Engineering Mathematics 115* *P Applied Mathematics B 124*				
224	**15**	**Dynamics of Rigid Bodies**	3L, 3T	**A & E**
Plane kinetics of rigid bodies; rotation and translation; absolute motion; relative motion; instantaneous centre of zero velocity. Properties of rigid bodies; definite and multiple integrals; Cartesian, polar, cylindrical and spherical coordinate systems; areas, volumes,				

centres of mass and moments of inertia. Plane kinetics of rigid bodies; Newton's laws; energy methods. Introduction into three-dimensional dynamics of rigid bodies. Vibrations of rigid bodies.

P Applied Mathematics 144 or
P Applied Mathematics B 154

242	**8**	**Vector Analysis**	2L, 1.5T	**A & E**

The straight line and the plane; space curves, derivatives and integrals of vectors, curves, the unit tangent, arc length; surfaces, partial derivatives of vectors, the gradient vector, vector fields, vector differential operators; line integrals, gradient fields; surface integrals in the plane, Green's theorem, surface integrals in space, Stokes' theorem; volume integrals; Gauss' divergence theorem; centres of mass and moments of inertia of 1-, 2- and 3-dimensional bodies.

C Applied Mathematics B 224
P Engineering Mathematics 145

264	**15**	**Applied Mathematics for Civil Engineers**	4L, 2T	**A & E**

Setting up of differential equations (ordinary and partial); analytic solutions; computer-aided geometric design (CAGD); applications of linear algebra to analytical geometry.

P Applied Mathematics B 154

20753 APPLIED MATHEMATICS B

834	**15**	**Partial Differential Equations**		

Derivation of simple PDEs from first principles, Fourier analysis, separation of variables and transform techniques for linear second-order PDEs, characteristics, Lagrange's method for first-order PDEs, finite differences.

36323 NUMERICAL METHODS

262	**8**	**Numerical Methods**	2L, 1T	**A & E**

Introduction to MATLAB; zeros of functions; solving of systems of linear equations; numerical differentiation and integration; interpolation and curve-fitting; numerical methods for solving ordinary and partial differential equations.

P Engineering Mathematics 214

Division: Computer Science

18139 COMPUTER SCIENCE

114	**16**	**Introductory Computer Science**	3L, 3P	**T**

Introduction to basic computer programming; formulation and solution of problems by means of computer programming; data representation and variable types (including character strings, integers, floating point numbers and Boolean variables); assignment statements; conditional execution and iteration; static data structures (arrays and records); input and output (including graphics and sound); modular programming; recursion; testing and debugging; introduction to object-oriented programming (including abstraction, encapsulation and use of existing object implementations).

Continuous assessment
C Mathematics 114

144	**16**	**Introductory Computer Science**	3L, 3P	**T**

Further formulation and solution of problems by means of computer programming; introductory data structures and algorithms in an object-oriented set-up; key concepts in

object orientation: inheritance and polymorphism; design patterns as abstractions for the creation of reusable object-oriented designs; searching and sorting algorithms; complexity theory for the analysis of algorithms; fundamental methods in the design of algorithms; dynamic data structures; regular expressions and finite automata.

Continuous assessment
P Computer Science 114

146	**16**	**Preparatory Computer Science**	3L, 3T	**T**

Module will only be presented if a minimum of 10 students register for this module.
For BSc (Extended Degree Programme) students.
Introduction to algorithmic thinking, abstract problem-solving skills and programming.

Continuous assessment
C Mathematics 186

214	**16**	**Data Structures and Algorithms**	3L, 3T	**T**

The classical data structures and algorithms in an object-oriented set-up. Advanced techniques for the analysis of algorithms.

Continuous assessment
PP Computer Science 144
P Mathematics 114, 144

244	**16**	**Computer Architecture**	3L, 3P	**T**

Basic computer architecture. Programming in machine language and assembly language. Assemblers, binders and loaders. Basic concepts of operating systems; memory management, process management and file systems.

Continuous assessment
C Computer Science 214

314	**16**	**Concurrency**	3L, 3P	**T**

Introduction to programming techniques and principles of concurrent systems, from operating systems to application programs. This includes communication, synchronisation, scheduling and load balancing. Several parallel and distributed architectures will be covered.

Continuous assessment
P Computer Science 214, 244

For programmes in Engineering:
P Computer Science E 214
P Computer Systems 245

315	**16**	**Machine Learning**	3L, 3T	**T**

Dimension reduction techniques; machine-learning techniques based on maximum-likelihood, maximum-posterior and expectation-maximization estimates; modelling using logistic regression, Gaussian mixtures and hidden Markov models.

Continuous assessment
PP Computer Science 144 or
P Computer Science E 214
P Mathematical Statistics 244 or
P Systems and Signals 344

334	**16**	**Databases and Web Centric Programming**	3L, 3P	**T**

Introduction to relational databases. Mapping relational model onto object model. Implementing a database application in the context of the web. Web services.

Server-side scalability. Virtualization. Cloud Computing.

Continuous assessment
P Computer Science 214, 244

For programmes in Engineering:
P Computer Science E 214
P Computer Systems 245

344	**16**	**Program Design**	3L, 3P	**T**

Program specifications as guidelines for program design; reusable frameworks for program design; testability of program designs; development of a medium-sized system to illustrate the practical application of the principles of program design.

Continuous assessment
P Computer Science 214, 244

For programmes in Engineering:
P Computer Science E 214
P Computer Systems 245

354	**16**	**Computer Networks**	3L, 3P	**T**

Introduction to networks in general and the internet in particular. Architecture and protocols. Allocation of resources and congestion control. Network security. Applications.

Continuous assessment
P Computer Science 214, 244

For programmes in Engineering:
P Computer Science E 214
P Computer Systems 245

364	**16**	**Computer Vision**	3L, 3P	**T**

Projective geometry and transformations of 2D and 3D. Camera models, the projective camera. Computation of the camera matrix using a calibration object. Removal of radial distortion. Epipolar geometry, the fundamental and essential matrices. Camera rectification and 3D reconstruction methods.

Continuous assessment
P Computer Science 214 or
P Computer Science E 214
P Applied Mathematics 214 or
P Applied Mathematics B 242

Computer Science as a major for the BSc degree

The following modules are required: Computer Science 114(16), 144(16), 214(16), 244(16), 314(16), 334(16), 344(16) and 354(16).

18139 COMPUTER SCIENCE

778	**120**	**BScHons in Computer Science**		

Admission requirements
BSc degree with Computer Science as major or an equivalent qualification. An average final mark of at least 60% for Computer Science 3 is required.
Programme composition
The programme consists of 6 modules (16 credits each) and a compulsory programming project (32 credits). At most two modules may be taken from other departments with the consent of the Department of Mathematical Sciences (Division Computer Science).

Examination is done through continuous assessment and a final mark of at least 50% must be achieved for each module, as well as for the programming project.
Modules:
63452 – 711(16) Automata Theory and Applications
64947 – 712(16) Advanced Algorithms
64955 – 713(16) Theoretical Computer Science
64963 – 714(16) Concurrent Programming 1
63401 – 715(16) Databases
64971 – 716(16) Advanced Topics in Computer Science 1
11788 – 741(16) Machine Learning
64998 – 742(16) Computer Graphics
65005 – 743(16) Simulation of Networks
65013 – 744(16) Concurrent Programming 2
65021 – 745(16) Software Construction
65048 – 746(16) Advanced Topics in Computer Science 2
12264 – 747(16) Biological Sequence Analysis
11261 – 748(16) Software Development for Mobile Devices
62847 – 792(16) Computer Vision
64572 – 793(16) Digital Image Processing
62855 – 796(16) Statistical Pattern Recognition
63444 – 771(32) Honours Project in Computer Science
Not all modules are necessarily offered each year.

63452 - 711	**16**	**Automata Theory and Applications**		

A broad overview of efficient implementation methods for automata, for application in selected fields from Computer Science and Applied Computer Science. Such fields include physical modelling, image processing, compression, random number generation, graphics animation, pattern matching and system design.

64947 - 712	**16**	**Advanced Algorithms**		

This module continues from Computer Science 214 and covers advanced topics in the design and analysis of algorithms and associated data structures. Topics include approximation algorithms, randomized algorithms, probabilistic algorithms, heuristics, parallel algorithms, number-theoretic algorithms, cryptanalysis, computational geometry, computational biology and network algorithms.

64955 - 713	**16**	**Theoretical Computer Science**		

The module continues from Computer Science 324 and covers time and space complexity, NP completeness, probabilistic algorithms, interactive proofs, and zero knowledge proofs. It concludes with a overview of quantum computers and quantum algorithms.

64963 - 714	**16**	**Concurrent Programming 1**		

This module covers an overview of the field of concurrency, its theoretical principles, the design, implementation and verification of concurrent systems, and practical aspects of distributed and parallel programming. It is focused around selected important topics.

63401 - 715	**16**	**Databases**		

This module covers advanced database management system design principles and techniques. Possible topics include access methods, query processing and optimization, transaction processing, distributed databases, object-oriented and object-relational databases, data warehousing and data mining.

64971 - 716	**16**	**Advanced Topics in Computer Science 1**		
Selected topics of current interest presented by lecturers or visiting researchers.				
11788 - 741	**16**	**Machine Learning**		
This module is an introduction to selected topics in machine learning.				
64998 - 742	**16**	**Computer Graphics**		
This module offers a broad introduction to computer graphics. Its contents include mathematical background for graphics (such as vector algebra) and a study of the data structures and algorithms used for object representation, transformation, and rendering. In addition to the theoretical work, there is a strong emphasis on implementation and the use of libraries.				
65005 - 743	**16**	**Simulation of Networks**		
This module investigates the theoretical and practical aspects of the simulation of telecommunication networks for the performance evaluation, optimisation and control of networks. Topics include traffic measurement, statistical analysis and modelling, in both circuit-switched and packet-switched networks.				
65013 - 744	**16**	**Concurrent Programming 2**		
This module continues from Computer Science 714. The focus is much narrower and one or two selected topics are covered in depth. Possible topics include: implementation of model checkers, concurrency in operating systems, formal methods, the use of a specific tool for concurrency and case studies.				
65021 - 745	**16**	**Software Construction**		
One of a range of possible topics centred on software construction. Examples include aspect-oriented software development, object-oriented software development, agile methods, XP (extreme programming), as well as specialised application areas such as game programming and compiler construction.				
65048 - 746	**16**	**Advanced Topics in Computer Science 2**		
Selected topics of current interest presented by lecturers or visiting researchers.				
12264 - 747	**16**	**Biological Sequence Analysis**		
The use of probability modelling for modelling and analysis of sequential data, with emphasis on application to biological sequences (DNA and protein sequences). Introduction to basic molecular biology and probability modelling; algorithms for sequence alignment; hidden Markov models (with biological applications); phylogenetic models; inference in both the maximum likelihood and Bayesian frameworks.				
11261 - 748	**16**	**Software Development for Mobile Devices**		
This module exposes students to software engineering principles applicable to software development for mobile devices, by using current, popular mobile-software development platforms. The practical component of the module, which consists of writing applications for Android and/or iOS and/or other platforms, exposes students to the software stack and standard application programming interfaces of the platforms under consideration.				
62847 - 792	**16**	**Computer Vision**		
Module at honours level presented by the Department of Mathematical Sciences, Division: Applied Mathematics.				
64572 - 793	**16**	**Digital Image Processing**		
Module at honours level presented by the Department of Mathematical Sciences, Division: Applied Mathematics.				

62855 - 796	**16**	**Statistical Pattern Recognition**		
Module at honours level presented by the Department of Mathematical Sciences, division: Applied Mathematics.				
63444 - 771	**32**	**Honours Project in Computer Science**		
The Honours project consists of the independent development of a larger computer application. The project must illustrate the student's expertise with regards to all aspects of software engineering, including formal specification, prototype development, testing and documentation.				

18139 COMPUTER SCIENCE				
878	**180**	**MSc in Computer Science**		
The programme comprises a report on research or development work done by the student. In addition, supplementary studies (as determined by the supervisor(s) on a case-by-case basis) may be required. A separate programme is compiled for each student. Examinations are done in the modules and an oral examination is taken on the thesis. (See also Higher Degrees in Science.)				
66362 - 818	**180**	**Thesis Computer Science**		
A thesis containing a report on research or development work done by the student. An oral examination is taken on the thesis. (See also Higher Degrees in Science.)				

18139 COMPUTER SCIENCE				
978	**360**	**PhD in Computer Science**		
A dissertation, containing the results of independent research, is required. (See also Higher Degrees in Science.)				

18139 COMPUTER SCIENCE				
998	**360**	**DSc in Computer Science**		
Published scientific work of high quality, which contributes substantially to the knowledge of Computer Science, is required for this degree. (See also Higher Degrees in Science.)				

50040 COMPUTER SKILLS				
171	**4**	**Computer Skills**	1L	**T**
Study load: 26 lectures in total, presented as 2L per week for 13 weeks, distributed over the year Introduction to general computer usage with the focus on the development of skills in using software for word processing, skills in using spreadsheets to perform calculations in creating meaningful graphs and skills in using presentation software. An optional test can be written during the first term to obtain exemption from the module. *The class mark will serve as the final mark*.				
176	**8**	**Computer Skills**	1L, 4T	**A & E**
This module is taken by students in the BSc Extended Degree Programme. Utilisation of computers in computers users' areas on campus. Introduction to the operating system, Internet, E-mail, word processing, spreadsheet and presentation software. *The class mark will serve as the final mark*				

272	5	Computer Skills	2L	T

Study load: 35 lectures in total
The main objective of this module is to equip the student with the relevant skills required to successfully and efficiently perform tasks identified as fundamental to the scientific process. Each topic is presented using an appropriate computer software package. Specific attention is given to the following topics: obtaining relevant literature, data capturing and analysis, creation and technical maintenance of electronic documents for reporting and presentation.

Continuous assessment
P Computer Skills 171

372	5	Computer Skills	2L	T

Study load: 35 lectures in total
Component 1:
(22 lectures): Introduction to Computer Programming using Visual Basic: Programming Code, Data Types, Variables, Decision Structures, Iteration, Strings, Arrays, Files
Component 2:
(13 lectures): Problem solving using programming. Designing applications in Microsoft Office using *Visual Basic Applications* (VBA). Customise/Enhance Microsoft Office by creating Macros, Procedures and Functions.
For more information see http://www.sun.ac.za/rv
The class mark will be used as the final mark

P Computer Skills 272

59536 COMPUTER SCIENCE E

214	15	Object-Oriented Programming	3L, 3P	A & E

Formulation and solution of problems by means of computer programming in an object-oriented set-up; principles of testing and debugging; key concepts in object orientation: abstraction, encapsulation, inheritance and polymorphism; design patterns as abstractions for the creation of reusable object oriented designs; searching and sorting algorithms; complexity theory for the analysis of algorithms; fundamental methods in the design of algorithms; dynamic data structures.

Continuous assessment
PP Computer Programming 143
P Engineering Mathematics 115, 145

64007 UNIVERSITY PRACTICE IN THE NATURAL SCIENCES

116	8	University Practice in the Natural Sciences	4L	A & E

For students in the BSc (Extended Degree Programme). It is followed up during the second semester in the different subject-specific modules of Mathematics 176, Physics 146, Chemistry 176 and Biology 146. Basic terminology and concepts are addressed. Study and life skills receive attention. Natural Sciences and specifically the subjects taken by the students serve as a context.
Continuous assessment

DEPARTMENT OF MICROBIOLOGY

16284 MICROBIOLOGY				
214	**16**	**Introductory Microbiology**	3L, 3P	**T**
History, microscopy, classification, structure and function, nutritional requirements and growth factors, nutrient uptake, energy generation, culture media, growth curves, yields and effect of nutrient limitation, continuous culture, physical and chemical control, environmental factors, antimicrobial therapy, eukaryotic cell structure and function. Microbes in the dairy and meat industry, beer, wine and bread microbes as food source, microbial taxonomy. *PP Biology 124 or 144* *P Chemistry 114 and 154*				
244	**16**	**Microbial Diversity**	3L, 3P	**T**
Prokaryotes, kingdoms of life and modern classification, Archaeal cell structure and function, Gram-positive bacteria, Gram-negative bacteria, actinomycetes, cyanobacteria. Fungal divisions, cell structure and function. Structure of viruses and virus taxonomy, bacteriophages, human viruses. Microbiology of air, water and soil environments, different metabolic types of micro-organisms, the role of micro-organisms in biogeochemical cycles and energy flow in the food web, the dependence of animals and plants on micro-organisms, including symbiotic associations, microbe-plant associations and microbe-insect associations, interactions between micro-organisms. *PP Biology 124 or 144*				
314	**16**	**Microbial Molecular Biology**	3L, 3P	**T**
Genome organisation of prokaryotes versus eukaryotes, advanced aspects of DNA replication in bacteria e.g. multiple replication forks and genome segregation, advanced aspects of transcription and translation using *Escherichia coli* (bacterium) and *Saccharomyces cerevisiae* (yeast) as model organisms, principles of gene regulation from single gene to global regulation levels, including operons, regulons, networks and signal transduction in bacteria, influence of mutagenesis, recombination and transposons on genome dynamics of bacteria, advanced gene regulation of bacteriophages and M13. *PP Microbiology 214* *P Biochemistry 214, 244*				
344	**16**	**Microbial Physiology and Metabolism (with Applied Aspects)**	3L, 3P	**T**
Elemental composition, carbon and energy flows, oxidation-reduction reactions, energy production through fermentation, respiration and photosynthesis, variety of molecules used as electron donors and acceptors and the micro-organisms involved, membrane transport, chemotaxis, sources and assimilation of nitrogen, sulphate and phosphate, assimilation of carbon dioxide. Biosynthesis of amino acids and other monomers. Application of metabolism to industrial processes, Pasteur and Crabtree effects, deregulation of metabolism that leads to the overproduction of citric acid and lysine. Iron-oxidizing bacteria and bio-mining. *PP Microbiology 214* *P Biochemistry 214, 244*				
354	**16**	**Industrial Microbiology**	3L, 3P	**T**
Food fermentations, traditional microbial processes: beer, wine, bread, cheese, yoghurt, salami, etc. Specialised food fermentations, e.g. biological preservatives, preparation and the role of micro-organisms. Quality control measures: HACCP, ISO 9000, etc. The				

occurrence of pathogens and food-spoiling bacteria and their control. Industrial production of non-food products: selected examples of industrial production of enzymes, antibiotics, pharmaceutical products, influence of substrate on production levels.

PP Microbiology 214

Microbiology as a major for the BSc degree

The following modules are required: Microbiology 214(16), 244(16), 314(16) and 344(16) or 354(16).

16284 MICROBIOLOGY				
778	**120**	**BScHons in Microbiology**		

Admission requirements

A BSc degree with Microbiology as a major, i.e. Microbiology 314 and 344 or 354. An average final mark of at least 60% for Microbiology 3 is required. Applications are made in writing (addressed to the Registrar or departmental chair) towards the end of September of the preceding year.

The number of students taken in each year is limited by the number of places available in the research laboratories. Additional work may be required where a prospective student's background is lacking.

Duration and commencement

The programme usually runs for one year.

Programme composition

The programme includes formal modules in Microbiology (10721 – 733 Techniques in Molecular Microbiology I, 10722 – 763 Techniques in Molecular Microbiology II and 10483 – 774 Selected Topics) as well as seminars, self-study and experimental work (10439 – 772 Experimental Microbiology). The programme is subject to continuous assessment with an oral examination at the end.

10721 - 733	**12**	**Techniques in Molecular Microbiology I**	2L, 8P, 1T	

Theory and practicals on techniques in molecular biology such as DNA cloning, bacterial and yeast transformations, plasmid isolations, isolation of genomic DNA from bacteria and fungi, specialised computer programs and databases via the internet.

PP Microbiology 314 and 344 or 354
PP Biochemistry 214, 244

10722 - 763	**12**	**Techniques in Molecular Microbiology II**	2L, 8P, 1T	

Theory and practicals on advanced techniques in molecular biology, e.g. DNA sequencing, isolation and analysis of gDNA, mRNA and proteins, construction of DNA libraries.

PP Microbiology 314 and 344 or 354
PP Biochemistry 214, 244
PP Techniques in Molecular Microbiology 1 733

10439 - 772	**64**	**Experimental Microbiology**		

Research Projects: Students are allocated to a research laboratory where they conduct an independent research project. Assessment is based on presentations of proposed research, independent research in the laboratory and oral presentation of results.
Literature Review: A written literature review and oral presentation on a Microbiology related topic.

PP Microbiology 314 and 344 or 354
PP Biochemistry 214, 244

10483 - 774	**32**	**Selected Topics**	3L, 4P	
Selected topics are presented as mini-modules by lecturers or visiting researchers. Topics such as plasmid biology, genome dynamics, biology of yeasts, transcriptional control of eukaryotic genes, taxonomy of yeasts, antimicrobial resistance and bacteriocins are covered. *PP Microbiology 314 and 344 or 354* *PP Biochemistry 214, 244*				

16284 MICROBIOLOGY				
878	**180**	**MSc in Microbiology**		
Research on an approved project is carried out and a thesis is submitted which must satisfy the requirements of the appointed examiners. In addition, extra study on specific subjects may be required where background is lacking. Any additional work is decided individually for each student by the supervisor(s) involved. An oral examination and/or thesis presentation are/is required. (See also Higher Degrees in Science.)				
66281 - 818	**180**	**Thesis Microbiology**		
Research on an approved project is carried out and a thesis is submitted which must satisfy the requirements of the appointed examiners.				

16284 MICROBIOLOGY				
978	**360**	**PhD in Microbiology**		
A dissertation on the results of independent scientific research is required. (See also Higher Degrees in Science.)				

16284 MICROBIOLOGY				
998	**360**	**DSc in Microbiology**		
For this degree, one or more previously published research works of high standard that has made a substantial and important contribution to the furthering of knowledge in Microbiology is required. (See also Higher Degrees in Science.)				

DEPARTMENT OF PHYSICS

12998 PHYSICS				
114	**16**	**Introductory Physics A**	3L, 3P	**T**
A calculus-based introductory systematic treatment of Newton mechanics that serves as the foundation for more advanced physics modules and eventual specialisation in physics. Measurement, vectors, kinematics, dynamics of translation, work and energy, rotational motion, statics, conservation laws. *C Mathematics 114*				
144	**16**	**Introductory Physics B**	3L, 3P	**T**
An introductory physics module with a mathematical approach and emphasis on the fundamental concepts, with contents: Heat and thermodynamics, electrostatics, electrodynamics and magnetism. *P Physics 114* *C Mathematics 114, 144*				

146	**16**	**Preparatory Physics**	3L, 3P	**A & E**
For BSc (Extended Degree Programme) students. The module focuses on the nature of physics with the following themes as content: Mechanics, electromagnetism, modern physics. *Continuous assessment*				
214	**16**	**Computational Physics A (Stochastic Simulation)**	3L, 3P	**T**
Computer-based projects in stochastic (non-deterministic) physical systems. Topics change annually and include neutron transport, polymers, percolation and stochastic growth. *Continuous assessment* *PP Physics 114, 144* *C Scientific Computing 272*				
224	**16**	**Classical Mechanics, Wave Theory and Optics**	3L, 3P	**T**
Velocity-dependent non-conservative force, conservative systems in three-dimensional space, central force motion, planetary and satellite motion, scattering of particles, multi-particle systems, dynamics of rigid bodies, geometrical optics, free and forced linear oscillations with damping, one-dimensional wave motion with boundary conditions, Doppler effect, interference and diffraction, physical optics. *Continuous assessment* *PP Physics 114* *PP Mathematics 114, 144* *P Physics 144*				
244	**16**	**Computational Physics B (Deterministic Simulation)**	3L, 3P	**T**
Computer-based projects for deterministic physical systems. Topics change annually and include the chaotic pendulum, quantum mechanics, planetary motion and waves. *Continuous assessment* *PP Physics 114, 144* *C Scientific Computing 272*				
254	**16**	**Electromagnetism and Introduction to Quantum Physics**	3L, 3P	**T**
Electrostatic fields; magnetic fields; electromagnetic induction and alternating currents, Maxwell's equations and electromagnetic waves. Quantum properties and wave-particle duality. Schrödinger equation in one dimension, eigenvalues and eigenfunctions for piecewise constant potentials and the harmonic oscillator. Time dependence, wave packets and tunnelling. *Continuous assessment* *PP Mathematics 114, 144* *P Physics 224*				
314	**16**	**Statistical Physics A (Introductory Thermodynamics and Statistical Mechanics)**	3L, 3P	**T**
The three laws of thermodynamics are formulated, analysed and applied to simple thermodynamical systems; statistical and thermodynamic functions; phase equilibrium; statistical basis of thermodynamics. Fermi and Bose statistics, the ideal gas, blackbody				

radiation and other applications.

Continuous assessment
P Physics 244 or 254
P Mathematics 214, 244

334	**16**	**Quantum Mechanics A (Quantum Mechanics with applications)**	3L, 3P	**T**

Schrödinger equation in three dimensions; particle in a box; spherically symmetric potentials, orbital angular momentum: Eigenvalues and spherical harmonic functions. The hydrogen atom. Electrons in periodic crystal potentials, time-independent perturbation theory, spin and application to the atom.

Continuous assessment
PP Physics 224
P Physics 254
P Mathematics 214, 244

342	**8**	**Electromagnetism and Relativity**	1.5L, 1.5P	**T**

Polarisation and magnetisation of materials, electromagnetic waves and their transitions between different media. Theory of relativity.

Continuous assessment.
PP Physics 224, 254
P Mathematics 244

344	**16**	**Computational Physics C (Monte Carlo Methods in Physics)**	3L, 3P	**T**

Generation and testing of random numbers. Statistics of data analysis. Analytic solutions, computer simulation and analysis of random systems such as random walks and the Ising model.

Continuous assessment
P Physics 214 or 314

352	**8**	**Atomic and Nuclear Physics**	1.5L, 1.5P	**T**

Magnetic dipole moments, spin-orbit coupling, radiation transition rates, Zeeman effect, Helium atom. Nuclear structure and properties, radioactive decay, the nuclear force, introduction to nuclear models, apparatus of nuclear physics, elementary particles.

Continuous assessment
P Physics 254, 334

384	**16**	**Experimental Work in Physics**	3L, 3P	**T**

(This module cannot be taken simultaneously with Chemistry 2.)
Practical laboratory work in Physics. Selected experiments in modern Physics, which are related to the experimental research in the Department, are carried out introducing the student to experimental design and analysis of data.

Continuous assessment
C Physics 342, 352

Physics as major for the BSc degree

The following modules are required: Physics 114(16), 144(16), 224(16), 254(16), 314(16), 334(16), 342(8), 352(8), 384(16).

For specialisation in Theoretical Physics the following third-year modules are required: Physics 314(16), 334(16), 342(8), 344(16) and Project (Physical and Mathematical Analysis) 372(8).

12998 PHYSICS				
778	**120**	**BScHons in Physics**		

Admission requirements
A BSc degree in the appropriate discipline (See the Physics programme curricula earlier in this part of the Calendar) with an average final mark of at least 60% in the Physics component of the final year is required. Application for studies must be in writing (directed to the Chair of the Department). Any departure from the requirements listed, e.g. for a person having obtained a degree elsewhere, will only be considered on recommendation of the Department and approval by the Faculty Committee. Additional or supplemental work may be required, depending on a student's background.
Duration
The duration of the programme is normally one year and it commences a week before the general commencement of classes.
Promotion rules
The degree is obtained with an average of 50% or more, provided that a subminimum of 45% is achieved in every module. If at least 40% is achieved in a module or modules of 16 credits or less, a second assessment opportunity in such modules will be afforded. Students in the Radiation and Health Physics stream should note that a final mark of at least 50% in Physics 718, 750, 751, 752 and 753 is required to be admitted to an internship as a medical physicist.

The following streams are offered:
Physics 778:
BScHons in Physics (Laser Physics stream)
BScHons in Physics (Nuclear Physics stream)
BScHons in Physics (Radiation and Health Physics stream)

The curricula of the respective streams are as follows with the contents of the modules listed further on:

PROGRAMME CURRICULA
Stream Laser Physics: 711(8), 712(8), 713(8), 714(16), 716(8), 741(32), 744(8), 745(16), 747(8), 772(16).

Stream Nuclear Physics: 711(8), 712(8), 713(8), 714(16), 719(8), 721(16), 741(32), 748(8), 754(8), 755(16).

Stream Radiation and Health Physics: 711(8), 712(8), 713(8), 714(16), 716(8), 718(8), 741(32), 748(8), 750(8), 751(8), 752(8), 753(8).

12998 PHYSICS				
788	**128**	**BScHons in Theoretical Physics**		

Admission requirements
A BSc degree in the appropriate discipline (See the undergraduate Physics programme curricula earlier in this part of the Calendar) with an average final mark of at least 60% in the Physics component of the final year is required. Application for studies must be in

writing (directed to the Chair of the Department). Any departure from the requirements listed, e.g. for a person having obtained a degree elsewhere, will only be considered on recommendation of the Department and approval by the Faculty Committee. Additional or supplemental work may be required, depending on a student's background.

Duration

The duration of the programme is normally one year and it commences a week before the general commencement of classes.

Physics 788:

BScHons in Theoretical Physics (Complex systems and the applications of quantum field theory)

The curriculum of the stream is as follows with the contents of the modules listed further on:

Programme in Theoretical Physics: 711(8), 712(8), 713(8), 714(16), 719(8), 721(16), 741(32), 754(8), 755(16) plus a choice of 8 credits from Physics 757 and 758 and modules from Mathematics or Applied Mathematics made in consultation with the Theoretical Physics Coordinator.

10445 - 711	**8**	**Electromagnetism**	1.5L, 1.5P	
Electrostatics and applications to boundary value problems; electric multipoles and electric fields in media. Similar topics for magnetostatics. Time-dependent fields, gauge transformations. Electromagnetic waves, their absorption in and transition between different media. Relativity and electromagnetism. Theory of radiation.				
10590 - 712	**8**	**Lagrange and Hamilton Mechanics**	1.5L, 1.5P	
Degrees of freedom, generalised co-ordinates, Lagrange equations of the first and second kind, applications, small oscillations, variational calculus, Hamilton's principle, Noether's theorem.				
10752 - 713	**8**	**Solid State Physics**	1.5L, 1.5P	
Diffraction by crystals and the reciprocal lattice. Periodic crystal potentials, the tight-binding model, semi-conductors. Magnetism: para-, dia-, ferro- and antiferromagnetism. Superconductivity.				
10586 - 714	**16**	**Quantum Mechanics B (Advanced Formalism and Applications)**	3L, 3P	
Bra-ket notation, the axioms of quantum mechanics, basis transformations and unitary operators, position and momentum representations, Schrödinger and Heisenberg images, spin, formal theory of angular momentum, time-dependent perturbation theory, scattering theory, identical particles.				
10390 - 716	**8**	**Atomic Physics**	1.5L, 1.5P	
Multi-electron atoms, exclusion principle, electrostatic interaction and exchange degeneracy, Hartree model, angular momentum coupling: L-S and j-j coupling, transition probability and selection rules.				
10708 - 718	**8**	**Radiation Interaction**	1.5L, 1.5P	
Radiation sources, the process of radioactive decay as source of radiation, interaction of photons and neutrons with matter, isotope production with reactors and accelerators, nuclear fission as a source of radiation, lasers and microwaves as sources of radiation.				

10587 - 719	**8**	**Quantum Mechanics C (Functional Integral Formulation)**	1.5L, 1.5P	
Discrete and continuous stochastic processes, diffusion and Brownian motion, functional calculus, Feynman-Kac theorem, propagators and their functional integral representation, free particle and harmonic oscillator, determinants, correlation functions and generating functionals, perturbation theory and saddle point approximation.				
10702 - 721	**16**	**Statistical Physics B (Introduction to Interacting and Non-equilibrium Systems)**	3L, 3P	
Phase transitions and critical phenomena, phenomenological theories (Landau-Ginsburg, scaling hypothesis), simple model systems, approximation methods (mean field theory, self-consistent approach). Statistical physics of liquid crystals and polymers. Simulation methods. Dynamic correlation and response functions, Langevin theory, stochastic differential equations (Fokker-Planck equations).				
63274 - 741	**32**	**Physics Project**	6L, 6P	
Independent work on a topic that forms part of Physics, chosen in consultation with lecturers in the Department of Physics. The project should form part of the research activities of the Physics Department under supervision of a suitable supervisor. The project must be approved by the research committee of the Physics Department. A written report has to be submitted and an oral presentation must be given. Each student must also complete an oral examination.				
12546 - 744	**8**	**Laser Spectroscopy**	1.5L, 1.5P	
Optical spectroscopic diagnostic instrumentation and techniques. Laser spectroscopy techniques for atoms, molecules and plasmas. High-frequency and time-resolved spectroscopy and related diagnostic instrumentation and methods.				
10589 - 745	**16**	**Quantum Optics and Laser Technology**	3L, 3P	
Stimulated emission and absorption, introduction to lasers, laser rate equations, population inversion, threshold gain and saturation; laser output calculations by means of the uniform field approach, multi- and single-mode oscillations, mode locking, laser resonator theory, introduction to non-linear optics. Laser media: solid state, gas and dye lasers. Excitation techniques: optical, discharge, chemical. Resonator types and designs. Q-switching, gain switching, mode locking, single-mode operation, wavelength tuning. Current laser systems: Flash lamp an diode-pumped solid-state lasers, gas lasers, diode lasers, ultra-short pulse lasers, high-intensity laser systems. Applications: Scientific, industrial, communications, medical, military.				
10610 - 747	**8**	**Molecular Physics**	1.5L, 1.5P	
Quantum mechanics of rotational and vibrational degrees of freedom of molecules. Electronic spectra of molecules. The use of symmetries in molecular physics. The interaction of light with molecules. Kinetics and dynamics of elementary molecular reactions.				
10563 - 748	**8**	**Nuclear Reactions and Nuclear Structure**	1.5L, 1.5P	
Nuclear reactions: scattering kinematics basic concepts. Elastic scattering, the optical model. The study of reaction mechanisms, e.g. compound nucleus formation, direct reactions, pre-equilibrium processes. Reactions with light projectiles, e.g. inelastic scattering, transfer reactions, knockout reactions. Heavy ion reactions, fragmentation. Electron scattering.				

Nuclear structure: two nucleon systems (e.g. deuteron): interaction of nucleons and the inclusion of properties like charge independence and spin dependence. The Yukawa theory of meson exchange. Multiple nucleon systems: the nuclear shell model (single and multi-particle, introductory). Rotational and vibrational effects in nuclei (the collective model).				
10467 - 750	**8**	**Physics of Radiation Dosimetry/Radiology**	1.5L, 1.5P	
Radiation Dosimetry: Measurement of radiation, definitions of physical quantities, energy transfer, electronic equilibrium, Bragg-Gray cavity, interaction of charged particles with matter, radiation quality and range, proton dosimetry, interaction with human tissue. *Physics of Radiology*: The X-ray machine, conventional radiography, computer tomography, ultrasound, magnetic resonance imaging.				
10465 - 751	**8**	**Physics of Nuclear Medicine**	1.5L, 1.5P	
Radiation detectors, the gamma camera, quality control of the gamma camera, computers in nuclear medicine, principles of SPECT, principles of PET, statistics of counting, basic principles of tracer studies, whole body counters.				
10466 - 752	**8**	**Physics of Radiotherapy**	1.5L, 1.5P	
Dosimetry of teletherapy, filters, treatment planning, geometry of the beam, teletherapy units, quality assurance, electron therapy, brachytherapy, unsealed sources and beta irradiators.				
10706 - 753	**8**	**Radiation Protection**	1.5L, 1.5P	
Radiological protection, the shielding of neutrons and gamma rays.				
10753 - 754	**8**	**Many-body Theory**	1.5L, 1.5P	
Multi-particle wave functions and the symmetrisation postulate; creation and annihilation operators for fermions and bosons (second quantisation); boson realisations; variational principles and the Hartree-Fock approximation; propagators and Feynman-diagrams, with applications.				
10674 - 755	**16**	**Relativistic Quantum Mechanics and Quantum Field Theory**	3L, 3P	
Module introduces concepts from relativistic quantum mechanics and field theory. Dispersion relations and quantum mechanics. Klein-Gordon, Dirac and Maxwell equations, free-particle solutions, non-relativistic limit. Covariance of the Dirac equation, chirality. Lagrange formalism in field theory, Noether currents. Gauge symmetries and electromagnetic interactions. Relativistic treatment of hydrogen atom. Quantisation of Klein-Gordon, Dirac and Maxwell fields. Particle interpretation, spin and statistics. Perturbation theory and Feynman rules. Cross-sections and decay widths in particle physics. Further alternatives in response to student demand: Higgs mechanism and standard model or renormalisation.				
10539 - 757	**8**	**Entropy and Information**	1.5L, 1.5P	
(Presentation subject to staff availability and student numbers.) Introduction to the Bayesian world view. Conditional probability, product rule, Bayes' Theorem. Multivariate Bernoulli and multinomial distributions. Parameter estimation and model comparison using Bayesian inference. Information and entropy as a limiting case of inference. Hartley, Shannon, conditional and mutual information; Information Gain. Principle of Maximum Entropy under the influence of information. Applications, varying additional topics.				

10424 - 758	**8**	**Dynamic Systems and Complexity**	1.5L, 1.5P	
(Presentation subject to staff availability and student numbers) Introduction to non-linear dynamical systems: continuous and discrete mappings, intermittency, chaos, strange attractors. Computer simulation. Interdisciplinary topics from the world of complexity.				
17221 - 772	**16**	**Optics**	3L, 3P	
Geometrical, physical and quantum formalisms, polarisation (Stokes and Jones vectors), reflection, transmission and dispersion (Fresnel, Brewster, total internal reflection, double refraction), geometric-optical description of paraxial optical systems (matrix optics), diffraction and interference (three-dimensional), interferometry, non-linear optics. Diffraction theory. Fourier optics, diffractive optics. Anisotropy, optical modulation: Electro-optical, magneto-optical and acousto-optical modulation. Non-linear polarisation, non-linear optical coefficients, harmonic generation and phase matching.				

12998 PHYSICS				
878	**180**	**MSc in Physics**		
Admission requirements A suitable BScHons degree or an equivalent qualification that has been approved by Senate. *Programme composition* For each MSc student the Department will appoint a supervisor under whose guidance the student is expected to do an independent literature survey and suitable research. Upon completion of the research the student shall submit a thesis to be examined and approved by the appointed examiners. Each student must also complete an oral examination. Advanced seminar and/or coursework, as approved by the Department, forms an integral part of MSc studies and contributes towards the final mark for the programme.				
66249 - 818	**156**	**Thesis Physics**		
The student is expected to do an independent literature survey and suitable research under as supervisor's guidance. Upon completion of the research the student shall submit a thesis to be examined and approved by the appointed examiners. Each student must also complete an oral examination. Additional seminar and/or coursework as determined by the supervisor in consultation with the Department may be required in preparation of the research.				
12278 - 828	**24**	**Advanced Physics Seminar and Coursework**		
Relevant advanced seminar and coursework, as suggested by the supervisor and approved by the Department. The seminars and courses will be related to the specific research area of the thesis and supplement the thesis. The seminar and coursework will be examined by the appointed examiners. For the seminar work an oral examination must be completed.				

12998 PHYSICS				
978	**360**	**PhD in Physics**		
The degree PhD is awarded upon the receipt of a dissertation that contains the results of independent research (See also Higher Degrees in Science.).				

12998 PHYSICS				
998	**360**	**DSc in Physics**		
The degree DSc will be awarded for previously published scientific work that is judged to be of a high standard and makes a substantive and outstanding contribution to the				

discipline of Physics. (See also Higher Degrees in Science.)

56855 PHYSICAL AND MATHEMATICAL ANALYSIS				
778	**130/ 129**	**BScHons in Physical and Mathematical Analysis**		

Admission requirements
A BSc degree with suitable majors from the Mathematical Sciences as approved by the PMA programme committee, with an average of at least 60% in the applicable third-year modules.
Depending on student numbers and the availability of modules, the PMA programme committee may, in consultation with the relevant departments, substitute suitable alternatives for those listed below.

Stream A: Numerical Analysis and Complex Systems: (credits = 130)
Compulsory modules (credits = 74)
Physical and Mathematical Analysis: 63274 – 741(32) Physics Project (semester 1 and 2)
Physics: 10702 – 721(16) Statistical Physics B (semester 1)
Applied Mathematics: 62812 – 773(16) Numerical Modelling (semester 1)
Mathematics: 20405 – 749(10) Wavelet Analysis (semester 2)
plus
Elective modules (credits = 56)
Any honours modules offered in Computer Science, Mathematics, Applied Mathematics or Physics may, in consultation with the programme committee and subject to prerequisites, be taken.

Stream B: Data Security: (credits = 129)
Compulsory modules (credits = 113)
Physical and Mathematical Analysis: 63274 – 741(32) Physics Project (semester 1 and 2)
Computer Science:
64947 – 712(15) Advanced Algorithms (semester 1)
or
64971 – 716(15) Advanced topics in Computer Science 1 (semester 1)
Applied Mathematics: 62782 – 784(16) Coding Theory (semester 2)
Mathematics:
10378 – 711(15) Algebra (semester 1)
62871 – 714(15) Set Theory and Topology (semester 1)
10379 – 747(10) Algebraic Number Theory (semester 2)
62995 – 748(10) Computational Algebra (semester 2)
plus
Elective modules (credits = 16)
Any honours modules offered in Computer Science, Mathematics, Applied Mathematics or Physics may, in consultation with the programme committee and subject to prerequisites, be taken.

56855 PHYSICAL AND MATHEMATICAL ANALYSIS				
878	**180**	**MSc in Physical and Mathematical Analysis**		

Admission requirements
An honours degree in any of the following: Physical and Mathematical Analysis, Theoretical Physics, Mathematics, Numerical Mathematics, Applied Mathematics or an equivalent qualification approved by the Senate.
Programme composition
Additional study may be required before research can commence as determined by the supervisor(s) in each case.
Thesis: The topic for the thesis is drawn, in consultation with the PMA programme committee, from one of the following interdisciplinary focal areas:
1. Numerical Analysis
2. Complex Systems
3. Data Security

Supervision
The supervisor and co-supervisor, drawn from two of the participating departments and/or from an industrial partner, are approved by the PMA programme committee.
Enquiries
For further information, see http://pma.sun.ac.za. General provisions for the MSc degree may be found under Higher Degrees in Science.

66257 - 818	**180**	**Thesis Physical and Mathematical Analysis**		

The topic for the thesis is drawn, in consultation with the PMA programme committee, from one of the following interdisciplinary focal areas:
1. Numerical Analysis
2. Complex Systems
3. Data Security

Supervision
The supervisor and co-supervisor, drawn from two of the participating departments and/or from an industrial partner, are approved by the PMA programme committee.

56855 PHYSICAL AND MATHEMATICAL ANALYSIS				
978	**360**	**PhD in Physical and Mathematical Analysis**		

For the PhD a dissertation containing the results of independent research is required. (For more information see Higher Degrees in Science.)

Other modules in Physics

19267 SPECIAL PHYSICS				
142	**8**	**Physics for Health Sciences**	2L, 1T	**T**

Structure of matter, kinematics, statics, dynamics, heat, temperature, hydrostatics, hydrodynamics, wave motion and electricity.

13005 PHYSICS (BIO)				
134	**16**	**Introductory Physics for Biological Sciences A**	3L, 3P	**A & E**

Selected topics, relevant to the biological sciences, from introductory mechanics, hydrostatics and -dynamics, oscillations, waves, optics.

154	16	Introductory Physics for Biological Sciences B	3L, 3P	A & E
Selected topics, relevant to the biological sciences, from introductory electricity, magnetism, thermodynamics, gas laws, atomic physics, radioactivity. *P Physics (Bio) 134*				

53325 PROJECT (PHYSICAL AND MATHEMATICAL ANALYSIS)				
372	8	Project	0.7L, 0.7P	T
Applications of topics forming part of the BSc (PMA). *Continuous assessment*				

DEPARTMENT OF PHYSIOLOGICAL SCIENCES

13080 PHYSIOLOGY				
114	12	Introductory Overview of Physiology	3L	T
Basic overview of the following physiological principles, organs and systems: Homeostasis, organic molecules, the cell, tissue, special senses, nervous, endocrine, immune and reproductive systems. *(Offered for the programme BA with Sport Science)*				
144	12	Overview of Physiology	3L	T
Basic overview of the following physiological principles and systems: Acid/base balance, muscle, cardiovascular, respiratory, urinary and digestive systems. *(Offered for the programme BA with Sport Science)* *P Physiology 114*				
214	16	Physiological Principles and Systems	3L, 3P	T
Textbook-based overview of the following physiological principles and systems: Homeostasis and body fluids, cell membranes, general physiological control systems, nervous, muscle, respiratory, hormonal, digestive (basic single stomach) systems, and also typical diseases applicable to these systems. *PP Biology 124, 154 or* *PP Biology (OCC) 111 or* *PP Physiology 114, 144* *C Biochemistry 214*				
244	16	Systems in Physiology	3L, 3P	T
Textbook-based overview of the following physiological systems of the body: Special sense organs, acid/base balance, blood, cardiovascular, renal and reproductive systems. *P Physiology 214* *C Biochemistry 244*				
314	16	Integrated Physiology	3L, 3P	T
This module will concentrate mainly on integrated physiology and will cover a selection of the following topics: Systems physiology and homeostasis, endocrinology, metabolism of physiological conditions, cardiovascular physiology, reproductive physiology and neurophysiology. *PP Physiology and Animal Physiology 214, 244* *P Biochemistry 214, 244*				

334	16	Metabolic Physiology	3L, 3P	T
This module will concentrate on metabolic physiology and will cover the following topics: macronutrient uptake and utilisation, exercise and metabolism, energy balance, digestion, absorption, factors influencing carbohydrate metabolism, glycaemic index/load, fat metabolism, protein metabolism, mechanisms of hypertrophy. *PP Physiology and Animal Physiology 214 or 244* *P Biochemistry 214, 244*				
344	**16**	**Cellular Physiology**	3L, 3P	**T**
This module will concentrate mainly on cellular physiology and will cover a selection of the following topics: Membrane and cell communication, immunology, tissue hypoxia, muscle satellite cells and stem cells. *P Biochemistry 214, 244* *PP Physiology and Animal Physiology 214 for the Molecular Biology and Biotechnology programme* *P Physiology 314 for the Human Life Sciences and Sport Science programmes*				
364	**16**	**Clinical Applied Physiology**	3L, 3P	**T**
This module will concentrate mainly on diseases of lifestyle and the promotion of wellness. The physiological and cellular aspects of several chronic diseases will be covered and will include a selection of the following topics: Body composition, obesity, anorexia, bone tissue and density, osteoporosis, stress fractures, mechanisms of muscle atrophy and conditions leading to muscle atrophy, mild brain injury, ageing, chronic kidney disease, nutrition and kidney disease, clinical haematology, HIV, cancer and TB. *PP Physiology and Animal Physiology 214, 244* *P Biochemistry 214, 244*				

Physiology as major for the BSc degree

The following modules are required: Physiology and Animal Physiology 214(16), 244(16) [or Physiology 214(16), 244(16) from 2013] and Physiology 314(16), 344(16).

59803 PHYSIOLOGICAL SCIENCES				
778	**120**	**BScHons (Physiological Sciences)**		
Admission requirements A BSc degree with Physiology 314 and 344 with an average of at least 60% for the two modules. Applicants with Physiology from another university with a final mark of at least 60% will be considered as well. In such cases the marks achieved in Biochemistry courses at another university will also be taken into account. *Closing date for applications* Applications are accepted until the end of November of the preceding year. *Programme description* The Honours programme extends over one year and consists of interactive lectures, practical presentations, two seminars, a theory project and a research project. The lectures build on students' existing knowledge of selected topics in physiology that are relevant to lecturers' research programmes, and include modules that integrate whole body and systems physiology with cell biology and functional biochemistry. The practical component introduces students to current research techniques. One seminar is on a topic of theoretical (and sometimes controversial) interest in general physiology and the other presents the results of the student's research project, which is conducted under				

supervision in one of the Department's research laboratories. Students are also taught statistical methods, using the internet for research purposes, presentation skill and critical thinking.

Continuous assessment

10686 - 771	**10**	**Regenerative Physiology in Injury and Disease**		

Studying disease states and the use of regenerative physiology (including stem cells and gene therapy) to treat these disease states.

10614 - 772	**10**	**Physiology and Pathophysiology**		

Advanced physiology and biochemistry including adaptive responses to physiological and environmental perturbations such as exercise, injury and hypoxia.

10683 - 773	**10**	**Signal Transduction in Physiology and Pathophysiology**		

A selection of the signal transduction pathways involved in cellular physiology such as the mitogen-activated protein kinase (MAPK) and PI-3 Kinase/PKB pathways, as well as metabolic pathways (e.g. AMPK pathway) will be examined. Responses of these pathways to conditions of stress (e.g. hypoxia, injury, exercise and psychological) and the downstream cellular and tissue effects. Processes of cell death, including apoptosis, necrosis and autophagy, are also investigated. (Physiological and cellular responses to stress situations).

66443 - 774	**10**	**Metabolism in Health and Disease**		

In-depth study of metabolism in both healthy tissue and in various pathological states (e.g. diabetes).

11260 - 775	**10**	**Stress Physiology**		

Basic physiological responses to stress – both psychological and physiological – will be covered, in terms of both acute and chronic situations. Links to other systems will be highlighted, and the role of stress in the development of chronic disease will be discussed.

54895 - 776	**60**	**Research Project in Physiological Sciences**		

Students must carry out independent research on a subject determined by the teaching staff concerned. A manuscript on the research work shall be completed to the satisfaction of the teaching staff and examiners. An oral examination is also required. (See also Higher Degrees in Science.)

66192 - 781	**10**	**Research Methodology in Physiological Sciences**		

Introduction to scientific method, including research ethics (animal and human), experimental design, methods of data collection including laboratory practical methods and analysis and critical evaluation of literature. Use of animal models in understanding normal physiology and pathophysiology. Use of animal models to develop pharmacological interventions and biomedical devices. Current legislation in South Africa concerning the use of animals in research and teaching.

59803 PHYSIOLOGICAL SCIENCES

878	**180**	**MSc (Physiological Sciences)**		

Students must carry out independent research on a subject determined by the supervisor(s). A thesis on the research work shall be completed to the satisfaction of the supervisor(s) and examiners. An oral examination is also required. (See also Higher

Degrees in Science.)				
818	**180**	**Thesis: Physiological Sciences:**		
A thesis on the independent research work shall be completed to the satisfaction of the supervisor(s) and examiners.				

59803 PHYSIOLOGICAL SCIENCES				
978	**360**	**PhD (Physiological Sciences)**		
For the PhD degree a dissertation is required presenting the results of independent research. (See also Higher Degrees in Science.)				

59803 PHYSIOLOGICAL SCIENCES				
998	**360**	**DSc (Physiological Sciences)**		
For the DSc, already published scientific work of high standard that makes a contribution to the enrichment of knowledge in Physiology is required. (See also Higher Degrees in Science.)				

51489 EXERCISE SCIENCE				
887	**180**	**MSc in Exercise Science**		

Admission requirements

A four-year BSc degree or a three-year BSc degree followed by a BScHons degree in a related biological science or an equivalent qualification. Undergraduate modules in Physiology and Biochemistry are recommended. The right of admission rests with the programme co-ordinator and the Chair of the Department, taking into account the infrastructure of the Department.

General conditions

1. The programme will be offered over a period of two years.
2. For selection purposes, prospective students should apply for admission to the programme by 30 September of the previous year. Late applications will be considered until 31 October.

Examination and promotion conditions

1. The programme is subject to continuous assessment.
2. Examinations and assignments will constitute 33.3% of the final mark of the programme and a thesis the remaining 66.7%.
3. The thesis will be assessed by the programme co-ordinator, the supervisor(s) and two independent academics, one external to the University.
4. A minimum of 50% must be attained for the thesis and to pass the programme the student must attain a final mark of 50% for each module.

Programme structure

The programme is offered on a full-time basis and consists of a total of four theoretical modules that are offered over four semesters. Sessions, which vary from one to four weeks, are presented on a full-time basis and consist of intensive lectures, practical classes, demonstrations and seminars. Prescribed reading work, assignments and seminar preparations are given continuously to be prepared at home. In addition, a research project shall be completed and thesis written up.

General remarks

Continuous attention is given to professional development with regard to research methodology, computer and laboratory skills and statistics; communication skills regarding teaching and writing techniques; skills relevant for sport-related consultation services.

10630 - 882	**20**	**Exercise Immunology, Endocrinology and Haematology**		
Acute and long-term responses of the immune system, stress hormones and red cell systems to exercise and training. Theory and methodology of related exercise tests and laboratory analyses.				
10614 - 883	**20**	**Multidisciplinary Approach to Muscle Physiology**		
Advanced muscle physiology, including adaptive responses to exercise and injury. Muscle-structure function relationships and mechanisms of hypertrophy and atrophy. Applications of these topics illustrated in the current Exercise Physiology literature. Theory and methodology of exercise science testing.				
64548 - 884	**10**	**Metabolic Factors influencing Performance**		
Exercise performance, metabolism and muscle adaptation may be influenced by factors such as macronutrients, anabolic steroids and various supplements: Background and application. Bone density and muscle tissue catabolism are influenced in a variety of ways by exercise and chronic disease: Background and application. Theory and methodology of anthropometry (the science of body composition and the measurement thereof).				
62421 - 885	**10**	**Exercise Biochemistry**		
Metabolic responses to exercise at the whole body, intermediary and tissue levels. Integration of exercise physiology and biochemical knowledge to understand metabolism during exercise fatigue and metabolic adaptations to training. The scientific basis for the design of training programmes. Theory and methodology of metabolic tests and related analyses.				
12919 - 827	**120**	**Thesis in Exercise Science**		
The topic of a research project must be chosen in conjunction with the programme coordinator and other available study leaders. The research must be carried out reasonably independently and a thesis must be written up.				

FACULTY OF AGRISCIENCES

Department of Conservation Ecology and Entomology

34576 ENTOMOLOGY				
878	**180**	**Master's thesis**		
The programme is compiled for each student individually by the supervisor(s) concerned. The student shall carry out substantive research on an approved topic and present the results as a thesis. Supplementary study of specific topics may be required. An oral examination shall be taken by each student.				

34576 ENTOMOLOGY				
978	**360**	**Doctoral dissertation**		
A dissertation, containing the results of substantial research, is required (Refer to Higher Degrees in Science).				

34576 ENTOMOLOGY				
998	**360**	**DSc research collection**		
For this degree a series of published scientific works of high standard that contributes to the knowledge on entomology and pest control is required. (Refer to Higher Degrees in Science.)				

Department of Genetics

11061 BIOMETRY				
211	**8**	**Statistics in Biology**	1L, 1P	**T**
Role of statistics in research; principles of estimation, sampling, randomization and unbiasedness; methods of tabulation and graphical representation of data; descriptive measures of locality, variance and association; probability distributions and hypothesis testing; tests for homoscedasticity and normality; analysis of variance; T tests; simple and multiple linear regression; contingency tables and chi-square tests; non-parametric tests. All data will be analysed using Excel. *Continuous assessment*				

13285 GENETICS				
214	**16**	**Introductory Genetics**	3L, 3P	**T**
Part I: Principles of Heredity Molecular basis of genetic diversity and heredity; the cell cycle; mitosis and meiosis; chromosomes, genes and heredity; Mendelian genetics; linkage and crossing over of genes on a chromosome; linkage analysis and gene mapping; sexual reproduction and sex determining chromosomes; mutations that affect chromosome number and structure and their phenotypic effects. *Part II: Population Genetics* Introduction to population genetics; population diversity and genotype and allele frequencies; Hardy-Weinberg principle; quantitative genetics and heredity. *P Biology 124 or 144 or 154*				
244	**16**	**Introductory Molecular Biology**	3L, 3P	**T**
The biology of the molecule of life. The structure of double-stranded DNA; the processes of replication and recombination of DNA; the deciphering and nature of the genetic code; the processes of transcription and translation; protein structure and function; the regulation of gene expression in prokaryotes and eukaryotes; DNA mutations; DNA repair and transposable elements; the construction and analysis of DNA clones; applications and ethics of recombinant DNA technology; introduction to bio-informatics. *P Genetics 214*				
314	**16**	**Genomes and Genome Analysis**	3L, 3P	**T**
The module focuses on the organisation, structure and functionality of genomes and covers the following aspects: genome structure, genome organisation, genome function and methods to study genomes. Chromosome structure and organisation are also studied. Other complementary topics include: Introductory Bioinformatics to study genomes; chloroplast and mitochondrial genomes; genome models; genetics of development. *Continuous assessment* *PP Genetics 244*				

324	16	**Molecular Population Genetics**	3L, 3P	**T**

The genetic structure and dynamics of populations; frequencies of genes and genotypes; genetic polymorphisms; random mating and the Hardy-Weinberg principle; factors that determine genetic change and genetic equilibrium: mutation, migration, selection and population size; linkage disequilibrium, heterozygosity in subdivided populations; genetic relationships between populations; implications for genetic identification (DNA typing).

Continuous assessment
P Genetics 244

344	16	**Advanced Topics in Molecular Genetics**	3L, 3P	**T**

Various advanced topics are addressed in this module and include: DNA markers and applications in mapping of genes involved with genetic diseases; diagnostic applications in human genetics; marker-assisted selection in plant and animal breeding; DNA finger-printing and forensic science; applications from genome projects; personalised medicine and pharmacogenetics; epigenomics; genetic modification; cancer and apoptosis; gene therapy; genetics of behavioural traits.

Continuous assessment
PP Genetics 244

354	16	**Quantitative genetics**	3L, 3P	**T**

Genetic development of animals and crops. Quantitative traits and continuous variation; resemblance between relatives; estimation of heritability and breeding value; selection methods and genetic improvement; correlated traits; multiple traits selection; molecular assisted selection.

Continuous assessment
PP Genetics 324
P Biometry 274 or 212, 242 or
P Biology 212

13285 GENETICS

778	120	**BScHons in Genetics**		

Admission requirements
A BSc degree with Genetics 214, 244, 344 plus 314 or 324, or equivalent modules at other universities. An average mark of at least 65% in Genetics in the final year is required. The number of students admitted to this programme will be determined by available research laboratory space.
Commencement and duration
The programme extends over one academic year and commences at the start of the general academic year.
Programme composition
The following modules are taken in the programme:
10481 – 711(16) Genetics: Molecular Techniques
47295 – 712(8) Human Genetics
10478 – 713(8) Genetic Data Analysis
12555 – 714(8) Bioinformatics
18007 – 741(64) Honours Project in Genetics
12557 – 716(16) Plant Genomics
Strong emphasis is placed on acquiring laboratory skills. A research assignment has to be completed and the results presented in the form of a research publication.
Subject to departmental approval, students may substitute two of the 8-credit theory

modules with equivalent 8-credit modules from the BScHons in Plant Biotechnology programme.
The programme is subject to continuous assessment and an oral examination is required.

10481 - 711	**16**	**Genetics: Molecular Techniques**		

The advancement in the field of molecular genetic techniques has revolutionised Genetics and many of its applications. This module provides a theoretical platform (lectures, discussions, etc.) with concurrent hands-on practical sessions, which include DNA and RNA characterisation and manipulation.

47295 - 712	**8**	**Human Genetics**		

This module focuses on current medical and ethical aspects of human genetics in practice. By means of lectures, guest speakers, round-table discussions, a visit to a diagnostic laboratory, etc. the latest technology, applications and consequences of human genetics will be reviewed.

10478 - 713	**8**	**Genetic Data Analysis**		

The Genetic Data Analysis module is goal orientated and focused on the acquiring of practical skills by means of computer packages and web-based tasks, for the completion of basic genetic data analysis. Examples taken from case studies and data from relevant fields of application are used as a training-model on a continuous basis.

12555 - 714	**8**	**Bioinformatics**		

This module focuses on the use of web-based and other computer programs for the analysis of different types of conventional and high-throughput biological data. These include data mining, basic and advanced protein and nucleotide sequence analyses, different types of genomics applications (structural, functional and comparative), phylogenetic relationship reconstructions, as well as assembly and annotation of datasets generated by next-generation sequencing platforms. Students are also introduced to a number of different relevant databases.

18007 - 741	**64**	**Honours Project in Genetics**		

The research project is the main component of the Honours programme. This module involves the planning, execution, analysis and reporting of hands-on practical research which is performed within an established research group.

12557 - 716	**16**	**Plant Genomics**		

A good understanding of the plant genome, as well as the effective analysis thereof, is a prerequisite to succeed in plant improvement, especially considering the complexities associated with the diversity of plant genomes. This module aims to improve your understanding of the fundamentals in plant genetics and genomics. Concepts like genetic manipulation, gene regulation and expression, as well as technologies to study these concepts, will be discussed.

13285 GENETICS

878	**180**	**MSc in Genetics**		

Comprises research of an approved topic as determined by the Department. A satisfactory thesis shall be presented on completion of the work. Additional study may be required in the form of formal lectures and/or seminars as suggested by the lecturers concerned. An oral examination is also required.

13285 GENETICS				
978	**360**	**PhD in Genetics**		
A dissertation containing the results of independent research is required. (See also Higher Degrees in Science.)				

13285 GENETICS				
998	**360**	**DSc in Genetics**		
The degree DSc will be awarded for one or more previously published scientific works judged to be of a high standard and which has made a substantive and outstanding contribution to the discipline of Genetics. (See also Higher Degrees in Science.)				

53287 PLANT BIOTECHNOLOGY				
788	**120**	**BScHons (Plant Biotechnology)**		

Admission requirements

A BSc degree approved by the Departmental Postgraduate and Academic Committees, with an average final mark of at least 60% for the appropriate modules at third-year level. Suitable modules include Biotechnology, Biochemistry, Genetics and Microbiology. Additional work may be prescribed, depending on the student's background. The number of students admitted to this programme will be determined by available research laboratory space.

Commencement and duration

The programme extends over one academic year and commences at the start of the general academic year.

General information

The programme introduces students to advanced concepts and skills in Plant Biotechnology needed for a career as a plant biotechnologist or a researcher. Emphasis is placed on three aspects in the educational process: (a) the development of a satisfactory knowledge base; (b) the development of a wide-ranging practical and theoretical capability and (c) the development of professional scientific methodology and ethics. The duration of the programme is a minimum of one year.

The programme comprises theoretical work, seminars, practical tasks, independent research and independent consultation of the broader biological literature. Assessment takes a variety of forms including two oral examinations, written exams, assignments, book reviews, seminars, a research project and the production of a popular article and poster on the research project. For successful completion of the honours programme, students are required to successfully complete the compulsory generic skills module, all four theory modules and a research project (an average of 50% must be obtained for both the research component and theory component and in no module may less than 40% be obtained). Honours students are required to attend departmental seminars and undertake undergraduate demonstrating.

Programme structure

10481 – 715(16) Genetics: Molecular Techniques. The advancement in molecular genetic techniques has revolutionised Genetics and many of its applications. This module provides a theoretical platform (lectures, discussions, etc.) with concurrent hands-on practical sessions, which include DNA and RNA characterisation and manipulation.

12582 - 790(64) Research module: An approved research project is compulsory. This component consists of the research project, a research proposal, research seminars, a poster, a popular article and an oral. The results are submitted in the form of a scientific paper and presented at a seminar to a scientific audience.

Theory modules: The examined theory modules will consist of a series of contact

sessions at which information is exchanged by means of discussion groups, seminars, assignments and reading assignments. The module leaders will serve as facilitators guiding the students rather than teaching the students. Each theoretical module involves training in relevant techniques that are required to undertake experimental work that will lead to the development of theoretical knowledge about the module in question. The theoretical components are presented in the first semester.
17523 – 712(8) Plant Physiology
10475 – 713(8) Integrated Plant Metabolism
12555 – 714(8) Bioinformatics
12557 – 716(16) Plant Genomics
Subject to departmental approval, students may substitute two of the 8-credit theory modules with equivalent 8-credit modules from the BScHons in Genetics programme.

17523 - 712	**8**	**Plant Physiology**		

Plants are sessile and therefore they must be efficient in taking up mineral elements from the soil, and then using them to grow and reproduce. This requires the expenditure of energy and the utilisation of metabolites resulting in tight integration between carbon and nutritional metabolism. The first part of the module deals with the light and dark reactions of photosynthesis providing the energy required for the uptake and assimilation of minerals. The second part deals with plant nutrition and water uptake and their relation to crop productivity, whereas the third part deals with aspects of plant growth and development.

10475 - 713	**8**	**Integrated Plant Metabolism**		

The underlying principles and current status of the following topics will be discussed: source-sink relations, phloem loading and unloading; compartmentalisation of metabolism; interconversion of starch and sucrose; cell wall components; gluconeogenesis; protein phosphorylation and metabolism; integration of nitrogen and sugar metabolism; sugars as metabolic signals.

12555 - 714	**8**	**Bioinformatics**		

This module focuses on the use of web-based and other computer programs for the analysis of different types of conventional and high-throughput biological data. These include data mining, basic and advanced protein and nucleotide sequence analyses, different types of genomics applications (structural, functional and comparative), phylogenetic relationship reconstructions, as well as assembly and annotation of datasets generated by next-generation sequencing platforms. Students are also introduced to a number of different relevant databases.

12557 - 716	**16**	**Plant Genomics**		

A good understanding of the plant genome, as well as the effective analysis thereof, is a prerequisite to succeed in plant improvement, especially considering the complexities associated with the diversity of plant genomes. This module aims to improve your understanding of the fundamentals in plant genetics and genomics. Concepts like genetic manipulation, gene regulation and expression, as well as technologies to study these concepts, will be discussed.

53287 PLANT BIOTECHNOLOGY

878	**180**	**MSc in Plant Biotechnology**		

Admission requirements
An applicable honours degree preferably in Botany, Genetics, Microbiology, Biochemistry or Plant Biotechnology.
Programme composition
The programme is structured for each student according to a specific project and the

student's background. Additional modules may be prescribed depending on the student's background. Each student is required to submit a publication-quality thesis and pass an oral examination (See Higher Degrees in Science for more information).				
66311 - 818	**180**	**Thesis Plantbiotechnology**		
Each student is required to submit a publication-quality thesis and pass an oral examination. (See Higher Degrees in Science for more information.)				

53287 PLANT BIOTECHNOLOGY				
978	**360**	**PhD in Plant Biotechnology**		
A publication-quality dissertation, comprising the results of independent research, is required. (See Higher Degrees in Science for more information.)				

Department of Plantpathology

32891 PLANT PATHOLOGY				
778	**120**	**BScHons (Plant Pathology)**		
Admission requirements A BSc degree with Micriobiology or Genetics or Botany or Biotechnology as a major. An average final mark of 60% is required in the applicable modules. Supplementary study may be required. *Programme composition* Students will be required to complete the following four modules: Plant Pathology 771 (30): Advanced plant-disease dynamics Plant Pathology 772 (30): Advanced disease management Plant Pathology 773 (10): Research methodology Plant Pathology 774 (50): Project management and presentation				
771	**30**	**Advanced plant disease dynamics**		
Components of plant diseases, such as the plant pathogens that cause them, the host factors that influence their development and the environmental conditions that favour them. Diseases of national and international importance and the damage they cause to food production in the world. The dynamics of pathogens associated with seed and nursery plants, as well as those causing soil-borne, foliar and fruit diseases before harvest, and decay and damage after harvest.				
772	**30**	**Advanced disease management**		
The importance of epidemiology in control and management of plant diseases through the integration of cultivation practices, physical, biological and chemical strategies (seed technology, minimum manipulation, plant quarantine, sanitation practices and resistance). The mode of action of fungicides and the management of fungicide resistance in fungal populations. Biological control. Development and production of biocontrol systems for soil-borne, plant and fruit pathogens.				
773	**10**	**Research methodology**		
Relevant and current experimental approaches and methods of analysis used in plant pathology. Experimental design and statistical analysis, molecular methods, phylogenetic analysis, paper reviews. *Continuous assessment*				

774	50	**Project management and presentation**		
Course work will include lessons in project identification, planning and execution, writing of research proposals and reports, presentation of research findings, scientific collaboration and ethics in science. Exercises in project planning and execution will be conducted under supervision. A literature study and scientific findings will be presented as scientific manuscripts and as an oral presentation. *Continuous assessment*				

Department of Soil Science

14176 SOIL SCIENCE				
214	**16**	**Introduction to Soil Science**	3L, 3P	**T**
Soil as a three-dimensional unit; soil formation factors: climate, parent material, relief, organisms and time; weathering processes and products; physical properties of soil: texture, structure, colour, air-water-temperature relationships; chemical properties of soil: soil colloids, clay minerals, cation adsorption and exchange, soil reaction; formation and properties of soil organic material; elementary interpretation and evaluation of physical, chemical and morphological soil characteristics for resource use. *P Chemistry 154*				

Department of Viticulture and Oenology

Wine Biotechnology:
Wine Biotechnology comprises the integration of several subject disciplines and the use of research techniques that are aimed at the study and genetic improvement, on a molecular level, of vine- and wine-associated micro-organisms and the grapevine itself.

50997 WINE BIOTECHNOLOGY				
778	**120**	**BScHons (Wine Biotechnology)**		
The programme comprises formal lectures, as well as seminars, self-study and experimental work in Wine Biotechnology. Admission requirements are a suitable degree (e.g. BSc, BScAgric, BEng) with any applicable discipline as a major. The following topics are covered: Genetic properties and improvement of wine yeasts; grape-based beverages; alcoholic fermentation; chemical compounds of grapes and wine; techniques in wine and grapevine biotechnology; malolactic fermentation and microbial spoilage; enzymes in preparation of wine; grapevine structure and functions; as well as grapevine improvement with the aid of biotechnology. Students are required to carry out self study on the South African wine industry, as well as independent research in grapevine and wine biotechnology. Wine Biotechnology 771(40): Research methodology for grapevine and wine biotechnology Wine Biotechnology 772(25): Techniques in grapevine and wine biotechnology Wine Biotechnology 773(30): Biotechnology of wine related microbes Wine Biotechnology 774(20): Vine structure and functioning and grapevine improvement Wine Biotechnology 714(5): Chemical components of grapes and wine				

50997 WINE BIOTECHNOLOGY				
878	**180**	**Master's thesis**		
Admission requirements The BScHons (Wine Biotechnology) degree, or any BScHons or BEng degree that is				

acceptable to the Senate, provided that the prescribed modules from Wine Biotechnology 778 are passed during the first year.

Programme content

For the MSc degree, the student is required to carry out independent research on an approved topic in Wine Biotechnology and submit the results in the form of a publishable thesis. Supplementary studies on specific topics may be required. The programme for each student is determined by the supervisor(s) concerned. An oral examination is conducted. (See also Higher Degrees in Science.)

50997 WINE BIOTECHNOLOGY				
978	**360**	**PhD in Wine Biotechnology**		

Admission requirements

An MSc degree in Wine Biotechnology; or any MSc, MEng or MScEng degree that is acceptable to the Senate, provided that the prescribed modules for Wine Biotechnology 778 are passed during the first year.

Programme content

A dissertation on an approved topic in Wine Biotechnology that contains the results of original research is required for the PhD degree (See also Higher Degrees in Science).

50997 WINE BIOTECHNOLOGY				
998	**360**	**DSc research collection**		

One or more previously published scientific papers of a high standard that has made a fundamental and outstanding contribution to the enrichment of knowledge in Wine Biotechnology is required for the DSc degree (See also Higher Degrees in Science).

FACULTY OF ARTS AND SOCIAL SCIENCES

Department of General Linguistics

10294 GENERAL LINGUISTICS				
178	**24**	**Introduction to Linguistics**	3L, 1T	**T**

Nature and objectives; functions of language; construction of (a) language out of a sound system, a meaning system, and systems for forming words and sentences; principles of language use; language diversity and variation; interaction between linguistic and social phenomena; language change; language acquisition; language in the brain; language production and perception.

278	**32**	**Language and the Human Mind**	3L	**T**

Principles and practice of the analysis of language structure (syntax and phonology, other aspects of language structure); principles and practice of the analysis of language use (pragmatics/discourse analysis); sociolinguistic aspects of language; core questions about language acquisition and language processing; *capita selecta* which contribute to the realisation of the outcomes of the module.

Continuous assessment

379	**48**	**Advanced Linguistics**	4L	**T**

The role of linguistic principles in solving problems concerning language acquisition; principles and practice of pragmatic analysis/discourse analysis; theory formation in syntax and morphology and/or semantics; pragmatic and sociolinguistic perspectives on multilingualism, language policy and language planning; aspects of the dynamics of language (origin, evolution, change, decay of language(s)); *capita selecta* which contribute to the realisation of the outcomes of the module.

Continuous assessment

Department of Geography and Environmental Studies

64165 GEO-ENVIRONMENTAL SCIENCE				
124	**16**	**Introduction to Human-Environmental Systems**	3L, 3P	**T**
Nature of human geography; Demography of world population; Food resources; Urbanisation: models of urban structure, functional areas in cities, cities in developing countries; Politico-geographical organisation: nations and states in conflict, regions in the news; Environmental systems on a global scale: fluvial, arid, karst, coastal and glacial environments; Ecosystems and humans; Utilisation of environmental resources: global occurrence, use and depletion of non-renewable energy, water and soil resources; Practical mapping and graphics.				

Geography and Environmental Studies

Please note:

As general outcomes the subject foci and contents are aimed at delivering students who:

- Think critically about social and environmental issues and problems, and assist in finding innovative solutions;
- Have attained international standards in academic and operational thought;
- Understand social, human and environmental phenomena and the interactions between these elements;
- Have occupational skills applicable in the public and private management sectors and can compete professionally on a global level; and
- Have computer, information and analytical skills for effective participation in the wider information society.

56502 GEOGRAPHY AND ENVIRONMENTAL STUDIES				
214	**16**	**Geographical Information Systems**	3L, 3P	**E**
Introductory overview and comprehension of GIS in the context of geo-information science; the nature of geographical data, data models, coordinate systems and map projections; GIS processes: data capturing, ordering and storage, manipulation and analysis; map design and cartographical visualisation with a GIS; GIS applications. *Continuous assessment* *P Geo-Environmental Science 124* *C Mathematics 114 OR* *C Mathematics (Bio) 124*				
265	**16**	**Environmental Studies**	3L, 3P	**T**
Energy, moisture and wind as climatic elements; movement in the atmosphere: air circulation at global, regional and local scales; significant climatic phenomena to humans: El Niño, tropical cyclones and tornadoes; South African weather and climate; atmospheric environmental problems in South Africa: drought, air pollution, floods, hail and frost; analysis of climatic data: collection, processing and interpretation; synoptic maps and weather forecasting. Soil erosion, acid mine water drainage, water pollution, strategic risk management planning. *P Geo-Environmental Science 124*				
358	**16**	**Environmental Studies**	3L, 3P	**T**
Geomorphology of South African rivers and drainage basins: run-off regime, basin morphology, stream and channel patterns; human-induced changes in rivers and river basins: impoundment, canalisation, interbasin transfers; water quality in South Africa: interaction between humans and the environment with special reference to industrial and				

agricultural pollution; use, development and management of South African water resources: impact of the Water Act. South African environmental policies; Environmental impact assessment process.

P Geography and Environmental Studies 265 (from 2014)

Geography and Environmental Studies as major for a BSc degree

The following modules are required: Geo-Environmental Science 124(16), 154(16); Geography and Environmental Studies 214(16); Geographical Information Technology 211(16), 241(16), 242(16) 311(16), 312(16), 341(16), 342(16).

12923 GEOGRAPHICAL INFORMATION TECHNOLOGY				
211	**16**	**Earth Observation**	3L, 3P	**E**
Principles of remote sensing and earth observation; the electromagnetic spectrum; reflectance characteristics of various objects on the earth's surface; atmospherical interaction with electromagnetic energy; digital imagery; image resolution; satellite systems; image enhancement and pre-processing; unsupervised and supervised image classification; accuracy assessment; GIS integration. *Continuous assessment* *C Geography and Environmental Studies 214* *C Mathematics 114 or* *C Mathematics (Bio) 124*				
241	**16**	**Spatial Data Management**	3L, 3P	**E**
Map projections and coordinate systems; spatial data modelling (e.g. vector, raster, object-orientated); topology and topological dimensions; topological-dimension conversions; geodatabases; data model and format conversions; data generalisation and aggregation. *Continuous assessment* *P Geography and Environmental Studies 214*				
242	**16**	**Digital Photogrammetry**	3L, 3P	**E**
Principles of digital photogrammetry; stereo vision and parallax; types of photogrammetry; image sourcing and acquisition; flight planning; sensor orientation and image characteristics; interior and exterior orientation; ground control and tie-point collection; least-squares adjustment and coordinate transformations; image processing (contrast and spectral enhancement, image matching, mosaicing); topographical-map production; GIS integration. *Continuous assessment* *P Geographical Information Technology 211* *P Mathematics 114 or* *P Mathematics (Bio) 124*				
311	**16**	**Spatial Data Acquisition**	3L, 3P	**E**
Spatial data types and models, acquisition and creation of spatial data, digitizing and scanning, field data collection, global navigation satellite systems, uncertainty and error, data quality, national and international data providers and warehouses, metadata and standards, spatial data as property, data sharing. *Continuous assessment* *Geographical Information Technology 241*				
312	**16**	**Spatial Analysis**	3L, 3P	**E**
Query operations and query languages; Geometric measures; Spatial analytical operations; Surface analysis; Geostatistics; Network analysis; Analysis design; Fuzzy				

sets.

Continuous assessment
P Geography and Environmental Studies 214
P Geographical Information Technology 241

341	**16**	**Spatial Modelling**	3L, 3P	**E**

Models in science; Spatial models: types, construction, design and development; Cartographic modelling: terminology, methodology, in and outputs, functions.

Continuous assessment
P Geographical Information Technology 312

342	**16**	**Earth Observation**	3L, 3P	**E**

Image pre-processing techniques (e.g. geometric, radiometric, atmospheric and topographic corrections); image transforms; geographical object-based image analysis (GEOBIA); image classification approaches and algorithms; earth observation workflows; image acquisition; GIS integration

Continuous assessment
P Geographical Information Technology 211

12279 GEOINFORMATICS

778	**120**	**BScHons in Geoinformatics**		

Admission requirements
A BSc degree in Geoinformatics or a related discipline as major. An average of 60% is required for the major.
Programme structure and contents
Description of nature of programme
Outcomes
Capacity to recognise and assess scientific geographic paradigms and to identify a research specialisation
Ability to conduct research by exposure to a series of research skills and the formal departmental prescriptions for research reporting
Knowledge of vector, raster and object-oriented spatial data models and the ability to capture, manipulate, analyse and graphically display digital spatial data
Skill in the use of geographical technology such as GIS, GPS, database approaches in the context of GIS and the preparation of GIS projects
Ability to apply remote sensing techniques using knowledge of advanced remote sensing principles and satellite platforms, as well as the application of the latest software for image enhancement, pixel classification and pattern recognition.
Critical understanding of the principles, prescriptions and strategies for environmental management in South Africa and the application of a series of geographical analysis techniques such as GIS and satellite remote sensing to identify, demarcate and help resolve environmental problems.
Nature of programme
Application of GIS as an integrating tool for the analysis, understanding, management and resolution of spatial problems concerning human-environment interaction, environmental problems in special environments and the execution of spatial analyses and modelling
Assessment and formal provisions
Assessment is done by a system of continuous assessment, tests, assignments, a research project and examinations. A sub minimum of 50% is required in each module.
The programme is presented in English. All work may be presented in English or Afrikaans.

Modules
Compulsory modules
49611 – 713(30) Geographical Information Systems
12187 – 716(30) Spatial Modelling and Geographical Communication
63363 – 742(30) Environmental Geography Research Application
Elective modules (choose one module)
63371 – 711(30) Environmental Analysis and Synthesis
63398 – 712(30) Advanced Remote Sensing
12825 – 717(30) Disaster Risk Studies
Enquiries
Dr A van Niekerk
Tel: 021 808 3218/3101
E-mail: avn@sun.ac.za
Departmental web site: http://www.sun.ac.za/geography

49611 - 713	**30**	**Geographical Information Systems**		

Advanced spatial-database use, design and development; data quality assessment; global positioning systems (GPS); data generalisation and conflation; spatial queries; 2.5D data structures and visualisation.

P Geography and Environmental Studies 214

12187 - 716	**30**	**Spatial Modelling and Geographical Communication**		

Application and development of spatial models through the use of geographical information systems.

P Geographical Information Technology 341

63363 - 742	**30**	**Environmental Geography Research Application**		

Application of scientific-thinking skills and research methodologies. Data compilation and processing techniques according to departmental guidelines. Conducting an individual research project under supervision and according to a fixed reporting programme to a departmental panel and student peers.

63371 - 711	**30**	**Environmental Analysis and Synthesis**		

Environmental thought and South African environmental policy, management structures and instruments; Specialisation in environmental impact assessment; The application of GIS in environmental analysis and management of natural hazards, special environments such as mountains and coastal regions and the conduct of multicriterion decision-making.

63398 - 712	**30**	**Advanced Remote Sensing**		

Characteristics and use of the salient data sources and remote sensing platforms. Advanced techniques for enhancement of images for atmospheric and topographical correction and geographical registration. Advanced classification techniques and practical use of the latest software (Definiens Erdas, PCI).

P Geographical Information Technology 342

12825 - 717	**30**	**Disaster Risk Studies**		

Disaster risk and its implications for sustainable development in southern Africa. Interdisciplinary perspectives on disasters, risks, hazards and vulnerability. International and national disaster-risk management frameworks. Community-based disaster risk assessment and applications.

12279 GEOINFORMATICS				
878	**180**	**MSc in Geoinformatics**		

878 - After Honours (100% thesis)
Admission requirements
A BScHons degree with Geoinformatics as a major and GIS training, or a BScHons degree with training in GIS and an average mark of 60% for the major.
Programme structure and contents
Description of nature of programme
Outcomes
Specialised practical skills for the development and application of spatial technologies to the resolution and management of environmental problems, guided by advanced and progressive conceptual and theoretical thought needed to conduct scientific research
Ability to conduct independent empirical scientific research on geographical environmental or geo-information problems by the completion of a thesis.
Practical consultation skills, a broad theoretical background and a demonstrated ability to do independent research and problem resolution on environmental, or geo-information themes
Nature of programme
The development, implementation, management and application of spatial technologies for managing resources and for spatial analysis and modelling of environmental geographical phenomena and problems
Assessment and formal provisions
A thesis is required. The programme is presented in English. All work may be presented in English or Afrikaans. The 100% thesis (64475 – 874) is examined according to the University's provisions in Part 1 of the Calendar.
Enquiries
Dr A van Niekerk
Tel: 021 808 3218/3101
E-mail: avn@sun.ac.za
Departmental web site: http://www.sun.ac.za/geography

12280 - 874	**180**	**Thesis Geoinformatics**		

A thesis of 30 000 to 40 000 words, in which the ability to conduct research independently and to develop spatial technologies is demonstrated.

49913 GEOGRAPHY AND ENVIRONMENTAL STUDY B				
878	**180**	**MSc in Geography and Environmental Studies**		

878 - After Honours (100% thesis)

Admission requirements
A BScHons degree with Geography and Environmental Studies or appropriate discipline as major and an average of 60% for the major.

Programme structure and contents
Outcomes
Knowledge of the relevant specialised scientific theory about environmental problems specific to geography as discipline

Abilities of critical, analytical and synthesising thought about human-environment interactions and spatial environmental phenomena

Ability to identify and prioritise contemporary environmental problems and research topics relevant to South and southern Africa

Specialised practical skills to manage and resolve environmental problems, while retaining advanced and progressive conceptual theoretical thought needed for scientific research

Ability to undertake independent scientific research to resolve spatial environmental problems in a research thesis and demonstrate practical environmental consultation employment skills

Nature of programme
The programme focuses on the study and resolution of human-environmental problems and environmental phenomena from a spatial perspective. The thesis research can be done full-time or part-time. The research topic is developed and approved by the Department.

Assessment and formal provisions
The thesis may be presented in Afrikaans or English and is examined according to the University's provisions set out in Part 1 of the Calendar.

Enquiries
Prof JH van der Merwe

Tel: 021 808 3218/3103

E-mail: jhvdm@sun.ac.za

Department's web site: http://www.sun.ac.za/geography

873	**180**	**Thesis Geography and Environmental Studies**		

A thesis of 30 000 to 40 000 words, in which the ability to conduct research independently on a geographical problem is demonstrated.

49913 GEOGRAPHY AND ENVIRONMENTAL STUDY B

978	**360**	**PhD in Geography and Environmental Studies**		

Admission requirements
An MSc degree in Geography and Environmental Studies or a related discipline or a master's degree approved by Senate.

Programme structure and contents
Advanced knowledge and deep insight into the complexity of a selected geographical research problem

A dissertation which places the research in a disciplinary context and contributes to the creation of new knowledge

Ability to independently design and effectively manage complex systems and to communicate to and defend results among peers

Nature of programme
The programme focuses on the study and resolution of environmental problems and phenomena from a spatial perspective. The dissertation research can be done full-time or part-time. The research topic is developed and approved by the Faculty.

Dissertation
A dissertation of approximately 90 000 words, in which the candidate shows the ability to create new knowledge or to reinterpret existing knowledge about a geographical environmental problem.

Assessment and formal provisions
The dissertation may be presented in Afrikaans or English and is examined according to

the University's prescriptions in Part 1 of the Calendar.

Enquiries
Prof JH van der Merwe

Tel: 021 808 3218/3103

E-mail: jhvdm@sun.ac.za

Department's web site: http://www.sun.ac.za/geography

Department of Information Science

58173 SOCIO-INFORMATICS				
224	**16**	**Introduction to Computer Programming**	2L, 2P	**T**
Principles of computer programming. Skills development in object-oriented program languages. *Continuous assessment*				
254	**16**	**Internet Technology and Design**	2L, 2P	**T**
The internet and the world wide web. Architecture of hypertext systems. The design of web sites and portals. *Continuous assessment*				
262	**8**	**Electronic Business and Government**	1.5L	**T**
The management of private and public organisations in contexts rich in information and knowledge technology. *Continuous assessment*				
314	**18**	**Database Systems**	3L, 2P	**T**
Database concepts, models, design and management. *Continuous assessment*				
334	**18**	**Architecture of Information Systems and Enterprises**	2L, 3P	**T**
Theory of software and hardware systems and their design and analysis. Cybernetics. Introduction to modelling and modelling languages such as UML				
354	**18**	**Information Systems**	2L, 3P	**T**
Advanced software applications, such as simulation and modelling. Integration of preceding modules through the design and presentation of an elementary, experimental system. *Continuous assessment*				
364	**18**	**Knowledge Dynamics and Knowledge Management**	3L, 1P	**T**
Knowledge technology, knowledge-based systems, artificial intelligence and knowledge dynamics in complex organisations. *Continuous assessment*				

Department of Music

50652 MUSIC TECHNOLOGY				
122	**12**	**Music Technology**	2L	**T**
Standards, units and specifications. A study of sound waves, sound perception, acoustics, the sound studio, sound synthesis and sound- orientated programming.				
152	**12**	**Music Technology**	2L	**T**
Standards, units and specifications. A study of sound waves, sound perception, acoustics, the sound studio, sound synthesis and sound- orientated programming.				
222	**8**	**Music Technology**	1L, 1P	**T**
An advanced study of sound waves, sound perception, acoustics, the sound studio, sound synthesis, MIDI, sound signal processing and sound orientated programming.				
252	**8**	**Music Technology**	1L, 1P	**T**
An advanced study of sound waves, sound perception, acoustics, the sound studio, sound synthesis, MIDI, sound signal processing and sound orientated programming.				
379	**48**	**Music Technology**	2L, 2T	**T**
Projects regarding sound recordings and sound orientated programming.				

Department of Philosophy

59277 BUSINESS ETHICS				
214	**8**	**Business Ethics**	2L	**T**
Introduction to applied ethics; moral decision-making; value and value conflicts in diverse societies; philosophical approaches to ethics; macro-ethical issues in business ethics, e.g. profit, competition, wealth and poverty, justice, the environment; contemporary approaches to business ethics, e.g. stakeholder theory, corporate social responsibility, the King Report, international developments; management and organisational ethics; international and local case studies, e.g. Enron, Leisurenet, Parmalat, Fidentia; writing skills, research and case study analysis in applied ethics.				

Department of Psychology

18414 PSYCHOLOGY				
114	**12**	**Psychology as a Science**	2L, 1T	**T**
This module is an introduction to psychology both as a science and a profession, with specific emphasis on psychological issues that are relevant in the South African context. Psychology is positioned at the convergence of a number of traditions of research and practice, including biological, philosophical and pragmatic traditions. This introductory module gives students a basis from which to approach further study of the discipline.				
144	**12**	**Psychology in Context**	2L, 1T	**T**
In this module the basic principles in psychology are applied in order to understand the person in context, with particular reference to core social issues and challenges facing South African society.				

212	**8**	**Approaches to Psychological Theories of the Person**	1.5L	**T**
This module addresses psychological theories and understandings of the person with reference to major contemporary approaches. Theories to be considered may include systemic, psychodynamic, behavioural, cognitive and existential components, with consideration of the applicability of psychological theories to African contexts. *PP Psychology 114, 144*				
222	**8**	**Social Psychology**	1.5L	**T**
In this module theoretical and methodological developments in contemporary social psychology are presented. Social relationships and identity are investigated with reference to social categories like sex, race, ethnicity and sexual orientation, with emphasis on the South African context. *PP Psychology 114, 144*				
242	**8**	**Human Development in Context**	1.5L	**T**
In this module human development is studied, with specific reference to the South African context. *PP Psychology 114, 144*				
252	**8**	**Psychopathology**	1.5L	**T**
This module is an introduction to concepts of normal and abnormal behaviour from different perspectives and classification systems, with specific reference to the mental health context in South Africa. *PP Psychology 114, 144*				
318	**24**	**Research Methods and Data Analysis in Psychology**	4L	**T**
This module provides students with the knowledge and skills to plan and do research in psychology, to present, describe and analyse data, and to interpret and report research results critically. *PP three modules of Psychology 212, 222, 242, 252*				
348	**24**	**Psychological Interventions**	4L	**T**
Psychologists operate in a range of contexts, from individual psychotherapies to community interventions. This module critically discusses the principles behind the contributions psychologists make to human health, development and individual and collective well-being, with specific reference to the health and mental health context in contemporary South Africa. *PP three modules of Psychology 212, 222, 242, 252*				

Psychology as major for the BSc degree

The following modules are required: Psychology 114(12), 144(12), 212(8), 222(8), 242(8), 252(8), 318(24) and 348(24).

18414 PSYCHOLOGY				
778	**120**	**Psychology (BScHons/BAHons)**		
Admission and selection requirements For admission into the Honours programme in Psychology a Bachelor's degree with a major in Psychology with an average of at least 60% is required. A higher performance cut-off for Psychology 3 may be set in a given year, depending on the number and the achievement level of applicants. Admission to the programme is dependent upon				

selection based on academic achievement, and takes place in November of the preceding year. The annual closing date for applications is 31 October. (Information on selection is available at www.sun.ac.za/psychology.)

Programme structure and content
Nature of the programme
The Honours programme in Psychology is a one-year full-time programme. The programme is presented in English. The programme focuses on advanced knowledge of human behaviour, intrapsychic as well as interpersonal, normal as well as abnormal, individually as well as in group contexts. It also encompasses the application of such knowledge in the multi-cultural South African society, particularly with regard to the understanding of specific psychosocial problems and the development of intervention and preventative strategies. In addition, the programme also focuses on the development of critical-analytical and problem-solving thinking skills, as well as social-scientific research knowledge and skills.
Please note that the Psychology Honours programme at Stellenbosch University is an academic programme. It is not designed to meet the requirements for the Professional Board for Psychology for registration as a psychological Counsellor or as a Psychometrist, and does not serve as an entrance qualification for internships in these areas. Professional training in Psychology is offered only at Master's level.

Module description
Based on the credit values of modules (indicated in brackets after each module) a selection of modules is made to a minimum of 120 credits for the programme. The module in Research Methodology as well as the Research Assignment are compulsory for all students, while the modules in Psychotherapy, Psychopathology and Psychometry are also compulsory for students who wish to be considered for the professional Master's programme.

Compulsory modules
10042 Research Methodology 771(25) (E)
10206 Research Assignment 772(30) (E)
Elective modules
10207 Psychotherapy 711(13) (E)
10208 Psychopathology 742(13) (E)
10209 Psychometry 741(13) (E)
10210 Vocational Psychology 712(13) (E)
10211 Family Psychology 715(13) (E)
10212 Community Psychology 714(13) (E)
10213 Child Psychology 716(13) (E)
10214 Cognitive Psychology 743(13) (E)
10216 Psychological Development of Women 744(13) (E)
11558 Interpersonal Relationships 717(13) (E)
18996 Social Psychology 745(13) (E)
10218 Alcohol Abuse in South Africa 746(13) (E)
42935 Sport Psychology 711(13) (E)
11854 Contemporary Issues in Psychology 711(13) (E)
11853 Applied Community Psychology 754(13) (E)
11855 Psychology, Health and Disability 741(13) (E)
12191 Brain and Behaviour 711(13) (E)

Please note: Depending on staff availability, certain of the modules may not be offered every year. For certain modules a restriction may be placed on the number of students. If the demand for a specific module is too small in any given year, that module may not be

offered in that year.
Assessment
Modules are assessed by means of practical and written assignments, tests and written examinations in June and November. A minimum of 50% is required as pass mark for every module.
Enquiries
Programme Coordinator: Prof AP Greeff
Tel: 021 808 3464 E-mail: apg@sun.ac.za
Web address: www.sun.ac.za/psychology

18414 PSYCHOLOGY

879	**180**	**MSc in Psychology**		

Specific Admission Requirements
For admission to the programme an Honours degree in Psychology or an equivalent qualification acceptable to the University is required. Applications must be accompanied by a brief, preliminary research proposal.

Programme Structure
Nature of programme
This programme, which requires a minimum of one year of study, focuses on the acquisition and broadening of knowledge in a specific area of Psychology. It also aims at the development of research skills, particularly with respect to the planning and execution of research and the reporting of research results. On completion of the thesis, in consultation with the supervisor, students are expected to prepare a paper for publication which is based on their research.

Compulsory module
12881 Thesis (Psychology) 871(180)
Assessment and Examination
The thesis is examined according to the University's regulations for the examination of master's theses as stipulated in the section on higher degrees in Part 1 of the Calendar.

Enquiries
Programme Co-ordinator: Prof SA Kagee
Tel: 021 808 3458 E-mail: skagee@sun.ac.za
Web address: www.sun.ac.za/psychology

18414 PSYCHOLOGY

978	**360**	**PhD**		

Admission requirements
For admission to the doctoral programme in Psychology a Master's degree in Psychology or an equivalent qualification acceptable to the University is required.
Programme structure
Nature of the programme
The doctoral programme in psychology, which requires a minimum of two years of study, focuses on the broadening of knowledge in a specific area of Psychology.
Module description

Compulsory module
18414 Psychology 978(360) (A & E)
Assessment
The dissertation is examined according to the University's regulations for the examination of doctoral dissertations as stipulated in the section on higher degrees in Part 1 of the Calendar.

Enquiries
Programme Co-ordinator: Prof AV Naidoo
Tel: 021 808 3461
E-mail: avnaidoo@sun.ac.za
Web address: http://www.sun.ac.za/psychology

59773 CLINICAL PSYCHOLOGY AND COMMUNITY COUNSELLING				
899	**180**	**MSc in Clinical Psychology and Community Counselling**		

Admission Requirements
For admission to the MSc programme in Clinical Psychology and Community Counselling an Honours degree in Psychology or equivalent qualification, which was obtained with a final mark of at least 65%, is required. Admission to the programme is subject to selection, which takes place in August of the preceding year. The closing date for applications is 30 June. Application forms and information on the selection process are available on the Department of Psychology's web site at www.sun.ac.za/psychology.

Programme Structure
Nature of the programme
The programme is presented full-time for the duration of one year. It focuses on the identification and treatment of psychopathology in children and adults, as well as on the development, implementation and assessment of preventative and remedial counselling programmes. Its theoretical component is presented in English and consists of different modules which cover the broad terrain of Clinical and Counselling Psychology. The practical component of the programme requires students to be involved in the diagnostic assessment and psychotherapeutic treatment of adult patients, children and families, and to undertake individual community projects. It entails about 15 to 20 hours per week throughout the year and takes place in the Unit for Psychology of the Centre for Community Psychological Services, community clinics and within departmental community projects. An assignment, based on independent research under supervision, must also be completed.

This programme satisfies the conditions and requirements of the Professional Board for Psychology for the professional training of clinical and counselling psychologists and is accredited as such with the Professional Board. In order to register as a clinical or counselling psychologist the Professional Board for Psychology requires a full-time internship of 12 months at an institution accredited by the board for the internship training of clinical or counselling psychologists, after completion of the programme. Registration with the Board as either a clinical or counselling psychologist is determined by whether a clinical or counselling accredited internship has been completed.

Compulsory modules
11559 Concepts and Practice 875(40)
11560 Assessment and Care 875(50)
11561 Professional Development 875(30)
10224 Assignment (Clinical & Community) 875(60)
Assessment and Examination
A minimum pass mark of 50% is required for each module. The pass mark for the programme is based on the relative weights of the different modules as indicated by their respective credit values. In addition, the Professional Board for Psychology requires that, upon completion of the programme, students' knowledge and skills be externally examined and marks be moderated. This is done by means of an oral examination following the written examinations in November. Practical work is assessed

continuously, and all practical work must be successfully completed as a prerequisite for obtaining the degree.
Enquiries
Programme Co-ordinator: Prof L Kruger
Tel: 021 808 3460 E-mail: lkrug@sun.ac.za
Web address: www.sun.ac.za/psychology

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

Department of Accounting

26883 FINANCIAL ACCOUNTING

188	**24**	**Financial Accounting**	4L	**A & E**

Theoretical principles of International Financial Reporting Standards; accounting systems; preparation and presentation of financial statements for different enterprises and introduction to group statements.
Note
Students who did not pass Accounting in their matric year must attend five lectures in Financial Accounting 188 per week in the first semester.

288	**32**	**Financial Accounting**	4L	**A & E**

Continuation of generally accepted accounting practice.
Preparation and presentation of financial statements for different enterprises.

PP Financial Accounting 178 or 188

389	**48**	**Financial Accounting**	4L	**A**

Advanced aspects of International Financial Reporting Standards; continuation of group statements and consolidated cash flow statements.

PP Financial Accounting 278 or 288

Department of Business Management

48550 BUSINESS MANAGEMENT

113	**12**	**Business Management**	3L, 1P	**A & E**

Procedures for the establishment of a new business, the business environment, business ethics, competition, idea generation and entrepreneurship, choice of form of business, determining break-even levels, resources and people involved in the business, management and managerial resources.

51047 FINANCIAL MANAGEMENT

214	**16**	**Introduction to Financial Management**	3L, 1P	**A & E**

Compiling of the statement of financial position, the statement of comprehensive income and the statement of cash flow; the measurement and evaluation of financial performance with reference to profitability, liquidity and solvency analysis; case studies about financial analysis; introduction to the investment decision; the financing decision; sources of finance; the dividend decision; financial planning and the management of working capital with specific reference to cash, trade receivables and inventory control; financial failures; international financial management.

Continuous assessment
C Business Management 142 or
Mathematics 114 or
Mathematics (Bio) 124

Department of Economics

12084 ECONOMICS				
114	**12**	**Economics**	3L, 1T	**A & E**
The economic problem: scarcity, priorities and opportunity cost. Introductory microeconomics: demand and supply and the determination of equilibrium in goods markets, production and cost theory, market structures and the theory of the firm, market failures and the role of the government.				
144	**12**	**Economics**	3L, 1T	**A & E**
Introductory macroeconomics: income and production theory, the foreign sector and monetary economics. National Accounting and macroeconomic data. The South African economy: history and features. *C Economics 114*				
214	**16**	**Economics**	3L, 1T	**A & E**
Macroeconomics: the IS-LM-model, total demand and supply, inflation, monetary transmission mechanism, stabilisation policy. Microeconomics: goods and factor markets, demand theory, production and cost theory, market structures and the theory of the firm, welfare theory. *PP Economics 114, 144*				
244	**16**	**Economics**	3L, 1T	**A & E**
South African monetary policy. International trade and finance: the theory of international trade, barriers to free trade, the World Trade Organisation and regional economic integration, the balance of payments, international financial markets, adjustment mechanisms, policy options, exchange rate determination, the international monetary system and South African exchange rate policy. *PP Economics 114, 144* *C Economics 214*				
318	**24**	**Economics**	4L, 1S	**A**
Macroeconomics: economic growth, business cycle, monetary and fiscal policy. Quantitative economics: general data analysis, mathematical and econometric techniques, input/output analysis. Microeconomics: industrial structures, market structures, the theory of the firm, introduction to game theory. *PP Economics 214* *P Economics 244*				
388	**24**	**Economics**	2L, 2T	**A**
Introductory applied econometrics: statistical concepts, the classical linear model of regression, multicollinearity, autocorrelation, heteroscedasticity, dummy variables, estimation of regression models. Labour economics and labour econometrics: labour market, demand and supply, demographic tendencies, trade unions, the South African labour market. Management economics: mathematical techniques, analysis of demand, cost and production, price determination, introduction to linear programming. South African economic issues. *Continuous assessment* *PP Economics 214* *P Economics 244* *C Economics 318*				

Department of Logistics

50407 LOGISTICS MANAGEMENT				
214	**16**	**Logistics Management**	3L, 1P	**A & E**
Introduction to Logistics Management: the role of logistics in the firm, the elements of logistics, integrated logistics management, channels of distribution, client/customer service, strategic aspects of logistics management, organisation for effective logistics, international logistics, new trends. *P Business Management 113*				

55336 OPERATIONS RESEARCH				
214	**16**	**Network Optimisation**	3L, 3P	**A**
Introduction to network modelling. Time and space complexities of algorithms by means of order notation, heuristics *vs.* exact methods, connectedness of directed and undirected networks, shortest paths (algorithms of Dijkstra and Floyd), longest paths (project scheduling), shortest spanning trees (algorithms of Kruskal and Prim), location problems (generalized centres and medians), maximum flow problems. Applications using suitable software. *PP Mathematics 114, 144 (Quantitative Management modules can not be registered in combination with Operational Research)*				
244	**16**	**Linear Programming**	3L, 3P	**A**
Modelling by means of linear programming. Geometry of LP's, properties of solutions, fundamental theorem of LP, simplex algorithm, big M and two-phase-methods, sensitivity analysis, duality and complementary slackness, special cases of the simplex algorithm (transport, transhipment, assignment and minimum cost flow). Dynamic programming. Applications using suitable software. *PP Mathematics 114, 144 (Quantitative Management modules can not be registered in combination with Operational Research)*				
314	**16**	**Combinatorial Optimisation**	3L, 3P	**A**
Algorithmic complexity (recursion, P & NP complexity classes, NP-completeness), binary and integer programming (branch-and-bound methods), heuristics (*n*-Opt procedures). Applications with respect to assignment problems, colouring problems, covering problems and domination problems, Hamiltonian graphs (the travelling salesman problem). Applications using suitable software. *P Operations Research 214, 244 (Quantitative Management modules can not be registered in combination with Operational Research)*				
324	**16**	**Multi-criteria Decision Analysis**	3L, 3P	**A**
Problem structuring and modelling, preference modelling (measurement theory, utility theory, aspiration levels, ranking, relative importance of criteria), value function methods (values of alternatives with respect to different criteria, pair-wise comparisons of alternatives, determining weights for criteria, sensitivity and robustness of solutions, the AHP), goal programming (minimising the deviation from goals under different norms), ranking techniques (the ELECTRE suite, the PROMETHEE method), aspects of practical implementation. Applications using suitable software. *P Operations Research 244 (Quantitative Management modules can not be registered in combination with Operational Research)*				
344	**16**	**Nonlinear Optimisation**	3L, 3P	**A**
Introduction to optimisation and functions in R*n*, unconstrained optimisation (search methods and gradient methods), constrained optimisation (Lagrange multipliers, neces-				

sary and sufficient conditions), duality, special cases (quadratic programming, separable optimisation), geometric optimisation. Applications by means of suitable software.

Continuous assessment

P Operations Research 244 (Quantitative Management modules can not be registered in combination with Operational Research)

354	**16**	**Stochastic Methods of Operations Research**	3L, 3P	**A**

Queuing theory (modelling of arrival and service processes, birth-death processes, single and multiple server queues, finite population, constant service time, open queue networks, priorities, chi-squared test), Markov-analysis, simulation (random numbers, continuous random variables, Monte Carlo simulation, discrete random event simulation, analysis of output). Introduction to forecasting. Introduction to inventory theory. Applications using suitable software.

PP Probability Theory and Statistics 114 or 144 (Quantitative Management modules can not be registered in combination with Operational Research)

55336 OPERATIONS RESEARCH

779	**120**	**BScHons (Operations Research)**		

Admission Requirements

To be admitted to the BScHons (Operations Research) programme a student must be in possession of a bachelor's degree and have passed Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics, with an average of at least 60% on third year level, or be in possession of a qualification considered by the Department of Logistics to be of equal standing.

Programme Content

A student who enrols for Operations Research 779 must earn at least 120 credits as set out below.

Compulsory Modules

11167 – 718(12) Applied Stochastic Simulation (Dept. of Statistics and Actuarial Science) (Semester 2)
10921 – 774(30) Research Assignment (Both Semesters)

Electives (at least 63 or 78 credits)

10761 – 795(15) Mathematical Programming (only available to (and compulsory for) students who have not taken Operations Research on third-year level) (Dept. of Logistics) (Semester 1)
10906 – 712(15) Advanced Linear Programming (Dept. of Logistics) (Semester 1)
12318 – 713(15) Metaheuristics (Dept. of Logistics) (Semester 1)
10925 – 742(15) Location of Facilities (Dept. of Logistics) (Semester 2)
10932 – 742(15) Inventory Control (Dept. of Logistics) (Semester 2)
46744 – 812(15) Decision Making (Dept. of Logistics) (Semester 1)
10905 – 813(15) Financial Investment Planning (Dept. of Logistics) (Semester 1)
10926 – 814(15) Scheduling (Dept. of Logistics) (Semester 2)
10931 – 843(15) Game Theory (Dept. of Logistics) (Semester 1)
10933 – 853(15) Forecasting (Dept. of Logistics) (Semester 2)
11907 – 886(15) Methods of Operations Research (Dept. of Logistics) (Semester 2)
10542 – 782(16) Graph Theory (Dept. of Mathematical Sciences) (Semester 1)
10751 – 747(12) Time Series Analysis B (Dept. of Statistics and Actuarial Science) (Semester 2)
10750 – 722(12) Applied Time Series Analysis A (Dept. of Statistics and Actuarial Science) (Semester 1)

10749 – 752(12) Applied Time Series Analysis B (Dept. of Statistics and Actuarial Science) (Semester 2)
10600 – 721(12) Multivariate Statistical Analysis A (Dept. of Statistics and Actuarial Science) (Semester 1)
10601 – 751(12) Multivariate Statistical Analysis B (Dept. of Statistics and Actuarial Science) (Semester 2)
10598 – 714(12) Multivariate Categorical Data Analysis A (Dept. of Statistics and Actuarial Science) (Semester 1)
10599 – 744 (12) Multivariate Categorical Data Analysis B (Dept. of Statistics and Actuarial Science) (Semester 2)
58777 – 741(12) Data Mining (Dept. of Statistics and Actuarial Science) (Semester 2)
10440 – 713(12) Experimental Design (Dept. of Statistics and Actuarial Science) (Semester 1)
65250 – 718(12) Stochastic Simulation (Dept. of Statistics and Actuarial Science) (Semester 2)
10859 – 873(8) Simulation and Modelling (Dept. of Industrial Engineering) (Semester 2)
31496 – 871(8) Industrial Engineering (Dept. of Industrial Engineering) (Semester 2)
64009 – 714(15) Capita Selecta (Operations Research) (Dept. of Logistics) (Semester 1)
64009 – 744(15) Capita Selecta (Operations Research) (Dept. of Logistics) (Semester 2)

55336 OPERATIONS RESEARCH				
879	**180**	**MComm or MSc Operations Research – Full Thesis option**		

Admission Requirements
To be admitted to the MComm or MSc (Operations Research) programme (Full Thesis option) a student must be in possession of a BCommHons or BScHons degree in Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics and must be knowledgeable across the broad spectrum of Operations Research, or must be in possession of a qualification considered by the Department of Logistics to be of equal standing.
Programme Content
A student, who enrols for Operation Research 879, must submit a thesis that is the result of independent research.

55336 OPERATIONS RESEARCH				
889	**180**	**MComm or MSc (Operations Research) – Coursework and Assignment option**		

Admission Requirements
To be admitted to the MComm or MSc (Operations Research) programme (Coursework and Assignment option) a student must be in possession of an BCommHons or BScHons degree in Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics, or be in possession of a qualification considered by the Department of Logistics to be of equal standing.
For information on 55336 Operations Research 889 MComm in Operations Research (Coursework and Assignment option) please consult Part 10 (Faculty of Economic and Management Sciences) of the calendar.
Programme Content
A student who enrols for Operations Research 889 must earn at least 180 credits set out as follows:

Compulsory Modules
11907 – 886(15) Methods of Operations Research (Semester 2)
11225 – 872(75) Assignment: Operations Research (Both Semesters)

Electives (at least 90 credits)
10906 – 712(15) Advanced Linear Programming (Dept. of Logistics) (Semester 1)
12318 – 713(15) Metaheuristics (Dept. of Logistics) (Semester 1)
10925 – 742(15) Location of Facilities (Dept. of Logistics) (Semester 2)
10932 – 742(15) Inventory Control (Dept. of Logistics) (Semester 2)
46744 – 812(15) Decision Making (Dept. of Logistics) (Semester 1)
10905 – 813(15) Financial Investment Planning (Dept. of Logistics) (Semester 1)
10926 – 814(15) Scheduling (Dept. of Logistics) (Semester 2)
10931 – 843(15) Game Theory (Dept. of Logistics) (Semester 1)
10933 – 853(15) Forecasting (Dept. of Logistics) (Semester 2)
10694 – 811(12) Bootstrap Methods A (Dept. of Statistics and Actuarial Science) (Semester 1)
10695 – 841(12) Bootstrap Methods B (Dept. of Statistics and Actuarial Science) (Semester 2)
10542 – 822(16) Graph Theory (Dept. of Mathematical Sciences) (Semester 2)
64009 – 714(15) Capita Selecta (Operations Research) (Dept. of Logistics) (Semester 1)
64009 – 744(15) Capita Selecta (Operations Research) (Dept. of Logistics) (Semester 2)

55336 OPERATIONS RESEARCH

899	**180**	**MComm or MSc (Operations Research) – Coursework and Thesis option**		

Admission Requirements
To be admitted to the MComm or MSc (Operations Research) programme (Coursework and Thesis option) a student must be in possession of an BCommHons or BScHons degree in Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics, or be in possession of a qualification considered by the Department of Logistics to be of equal standing.
For information on 55336 Operations Research 899 MComm in Operations Research (Coursework and Thesis option) please consult Part 10 (Faculty of Economic and Management Sciences) of the calendar.
Programme Content
A student who enrols for Operations Research 899 must earn at least 180 credits as set out below:

Compulsory Modules
11907 – 886(15) Methods of Operations Research (Semester 2)
11243 – 882(150) Thesis: Operations Research (Both Semesters)

Electives (at least 15 credits)
10906 – 712(15) Advanced Linear Programming (Dept. of Logistics) (Semester 1)
12318 – 713(15) Metaheuristics (Dept. of Logistics) (Semester 1)
10925 – 742(15) Location of Facilities (Dept. of Logistics) (Semester 2)
10932 – 742(15) Inventory Control (Dept. of Logistics) (Semester 2)
46744 – 812(15) Decision Making (Dept. of Logistics) (Semester 1)
10905 – 813(15) Financial Investment Planning (Dept. of Logistics) (Semester 1)
10926 – 814(15) Scheduling (Dept. of Logistics) (Semester 2)
10931 – 843(15) Game Theory (Dept. of Logistics) (Semester 1)
10933 – 853(15) Forecasting (Dept. of Logistics) (Semester 2)

10694 – 811(12) Bootstrap Methods A (Dept. Of Statistics and Actuarial Science) (Semester 1)
10695 – 841(12) Bootstrap Methods B (Dept. Of Statistics and Actuarial Science) (Semester 2)
64009 – 714(15) Capita Selecta (Operations Research) (Dept. of Logistics) (Semester 1)
64009 – 744(15) Capita Selecta (Operations Research) (Dept. of Logistics) (Semester 2)

55336 OPERATIONS RESEARCH				
979	**360**	**PhD (Operations Research)**		
A dissertation containing the results of independent research is required. (See further "Higher Degrees" in Part 1 (General) of the University Calendar.)				

Department of Statistics and Actuarial Science

Actuarial Science: General information:

Please note:
Proficiency in English is an academic requirement for all Actuarial Science modules

43214 ACTUARIAL SCIENCE				
112	**8**	**Theory of Interest**	2L, 1T	**E**
Simple and compound interest. Force of interest. Future value, present value and discount. Accumulation and discounting of amounts of money. Various types of annuities and applications. *Notes* 1. This module is more intensive than Theory of Interest 152(6). 2. Students are required to complete at least 80% of all assigned class work/tutorials in order to gain access to the final examination. In a situation where this requirement is not met a student will be awarded a class mark not exceeding 35%. 3. For admission to the module students must have passed Grade 12 Mathematics with a mark of at least 70% (symbol 6 (or Higher Grade B)).				
274	**24**	**Financial Mathematics**	3L, 3P	**A**
*First semester: 4L; Second semester: 2L Basic concepts, compound interest functions, discounted cash flow, pricing of loans and other securities, annuities, stochastic interest rates and simple premium calculations. *Note* Students are required to complete at least 80% of all assigned class work/tutorials in order to gain access to the final examination. In a situation where this requirement is not met, a student will be awarded a class mark not exceeding 35%. *PP Actuarial Science 112* *PP Mathematics 114, 144 (with an average final mark of at least 60%) or Mathematics 214, 244* *PP Probability Theory and Statistics 144 (with a final mark of at least 65%) or Mathematical Statistics 214, 244* *C Mathematics 214, 244* *C Mathematical Statistics 214, 244*				

54690 FINANCIAL RISK MANAGEMENT				
212	**8**	**Institutional Investment Management**	3L, 2P	**A**

Evaluating of the investment properties and the study of the mathematical methodology underlying the following financial asset classes: Government bonds, corporate debt, equity, properties, index linked government bonds, Foreign investments. South African financial market. Liabilities and risk profile of the following Institutional Investors: Banks, life insurers, pension funds, short-term insurers, medical aid schemes, unit trusts, investment trusts.
Corporate finance: Financial instruments to raise finance and manage financial risk.

PP Mathematics 114, 144
PP Probability Theory and Statistics 144
PP Theory of Interest 152 or
PP Actuarial Science 112
C Actuarial Science 274
C Mathematical Statistics 214, 244

242	**8**	**Derivatives**	2L, 1P	**A**

Introduction to derivatives with emphasis on mathematical methodology; Mechanics of futures and option markets; Pricing of Futures and Forwards; Hedging strategies using derivatives; Interest Rate Markets; Swaps; Properties of stock options; Trading strategies involving options.

PP Mathematics 114, 144
PP Probability Theory and Statistics 144
PP Theory of Interest 152 or
PP Actuarial Science 112
P Financial Risk Management 212
C Actuarial Science 274
C Mathematical Statistics 214, 244

56820 PROBABILITY THEORY AND STATISTICS				
114	**16**	**Probability Theory and Statistics**	3L, 3T	**T**

(For BSc students)
Combinatorial analysis; the basic counting principles; permutations and combinations. Random phenomena; sample spaces and events; the probability axioms; the probability of an event; random selection; probability rules; conditional probability; the rule of Bayes; stochastic independence. Discrete and continuous stochastic variables; expected value and variance of stochastic variables; important discrete distributions: binomial, Poisson, geometric, hyper-geometric, negative binomial; important continuous distributions; uniform, exponential, normal.

Please note:
This module is identical to Probability Theory and Statistics 144(16), which is offered in the second semester by the Department of Statistics and Actuarial Science for BComm students.

144	**16**	**Probability Theory and Statistics**	3L, 3T	**A & E**

Combinatorial analysis; the basic counting principles; permutations and combinations. Random phenomena; sample spaces and events; the probability axioms; the probability of an event; random selection; probability rules; conditional probability; the rule of Bayes;

stochastic independence. Discrete and continuous stochastic variables; expected value and variance of a stochastic variable; important discrete distributions: binomial, Poisson, geometric, hyper-geometric, negative binomial; important continuous distributions, uniform, exponential, normal

Mathematical Statistics : General information:
Students, who wish to take programmes in Mathematical Statistics, are required to take and pass Probability Theory and Statistics 114 or 144, as well as Mathematics 114, 144 in their first year of study. This grants admission to Mathematical Statistics 214. Please note that the module Probability Theory and Statistics 114 is offered to BSc students in the first semester by the Department of Mathematical Sciences (Division: Applied Mathematics), and that exactly the same module is offered to BComm students as Probability Theory and Statistics 144 in the second semester by the Department of Statistics and Actuarial Science. For Mathematical Statistics as major for a BSc degree, the modules Probability Theory and Statistics 114 or 144, Mathematical Statistics 214(16), 244(16), 318(32), 344(16) and 364(16) are required.

22853 MATHEMATICAL STATISTICS

214	**16**	**Univariate Distribution Theory and Statistical Inference**	4L, 2P	**A**

Further continuous distributions: gamma- and beta distributions. Moments and moment-generating functions for discrete and continuous distributions. Determine distributions of functions of variables with moment-generating functions. The central limit theorem (without proof). Samples and sampling distributions: the standard parametric cases. Principles of point estimation: the Cramer-Rao theorem and its application, efficiency, minimum variance unbiased estimators, consistency. Method-of-moments estimators. Maximum likelihood estimators. Interval estimation and hypothesis testing: applying these principles in various standard cases of parametric inference. The Neyman-Pearson lemma: proof and applications. Likelihood ratio tests. Data representation and description, calculating and interpreting sample measures.

PP Mathematics 114, 144
PP Probability Theory and Statistics 114 or 144

244	**16**	**Bivariate Distribution Theory and Sampling Theory**	4L, 2P	**A**

Bivariate probability distributions. Marginal and conditional distributions. The multinomial distribution and the bivariate normal distribution. Bivariate transformations. Sampling theory: sampling techniques in finite and infinite populations, surveys and sequential analysis. Introduction to nonparametric statistical analysis.
The relationship between two random variables: the correlation coefficient and the regression function. The method of least squares. Inference in the simple linear regression model. Introduction to multiple regression analysis: underlying assumptions, influential points and robust regression techniques. One- and two way analysis of variance and introduction to categorical data analysis. Introduction to R software for matrix operations, regression- and variance analysis.

PP Mathematical Statistics 214

318	**32**	**Probability, Inference and Linear Models**	6L, 2P	**A**

Advanced distribution theory, sequences of random variables, limit theory for sequences, generating functions, sampling distributions. Different approaches to inference. Parametric estimation theory and hypothesis testing, goodness-of-fit tests, non-parametric inference. Bayes inference. Decision theory.

Stochastic vectors and the multivariate normal distribution. The general linear model: estimation and error spaces, sums of squares and quadratic forms, Cochran's theorem. Projections. Model identification, estimable functions, best estimators, Gauss-Markov theorem. Testability of hypotheses, hypothesis testing, confidence regions and simultaneous confidence intervals. Analysis of covariance. The use R software for covariance analysis and application of the general linear model in practice.

PP Mathematical Statistics 214, 244
P Mathematics 214, 244

344	**16**	**Stochastic Processes**	3L, 1P	**A**

Introduction to stochastic processes. Markov chains, Markov processes and their applications. Markov jump processes. Elementary martingale theorem and applications. Brownian movements. Renewal theory.

P Mathematical Statistics 318

354	**16**	**Linear Models, Variance Components Models and Generalised Linear Models**	3L, 1P	**A**

Analysis of covariance: Tests of equality of factor effects with parallel and non-parallel regression lines. Components of variance model: Estimation of the various components of variance, hypothesis testing. One-way and two-way (with and without interaction) models.
Exponential family of distributions: Canonical form, expected value and variance function, likelihood function.
Generalised linear models: Linear predictors, link functions, maximum likelihood estimators, Fisher scoring, information matrix, iterative weighted least squares, sampling distributions of score statistics, m.l. estimators and deviance, Taylor series expansions, hypothesis testing.
Applied generalised linear models: Logistic regression, Poisson regression, survival analysis.
The programming language R for implementing covariance analysis, components of variance models and generalised linear models in practice.

P Mathematical Statistics 318

364	**16**	**Time Series**	3L, 1P	**A**

Stationarity, filters for time series, autoregressive, moving average, autoregressive moving average and autoregressive integrated moving average time series, shift operators for time series, model identification and estimation and diagnostic testing of time series, multivariate time series, non-stationarity and non-linearity of time series. Applications of time series, with emphasis on econometrics and investments.

P Mathematical Statistics 318

22853 MATHEMATICAL STATISTICS				
778	**120**	**Honours programme in Mathematical Statistics**		

Admission requirements
A bachelor's degree with an average mark of at least 60% for Mathematical Statistics 3.
Duration
12 months.
Credits
A minimum of 120 credits.
Assessment
Examinations are written at the end of the first semester in June and at the end of the second semester in November. Examination results are supplemented by the assessment of various practical projects.
Availability of modules
Depending on circumstances in the Department, some of the modules listed below may not be offered in a specific year.
Commencement of the programme
One and a half weeks prior to the general commencement of classes.
Closing date for applications
Applications for a specific year must be received by the end of October of the previous year.
Programme content

Compulsory modules (36 credits)
10547 – 723(6) Introduction to S-plus/R. Block module
11228 – 791(30) Assignment: Mathematical Statistics

Elective modules (at least 84 credits)
10394 – 711(12) Bayesian Statistics (Semester 1)
10408 – 712(12) Biostatistics (Semester 1)
11922 – 724(12) Capita Selecta in Mathematical Statistics A (Semester 1)
11923 – 754(12) Capita Selecta in Mathematical Statistics B (Semester 2)
58777 – 741(12) Data Mining (Semester 2)
10440 – 713(12) Experimental Design (Semester 1)
10507 – 719(12) Advanced Inference A (Semester 1)
10508 – 749(12) Advanced Inference B (Semester 2)
10569 – 753(12) Consultation Practice (Semester 2)
10598 – 714(12) Multivariate Categorical Data Analysis A (Semester 1)
10599 – 744(12) Multivariate Categorical Data Analysis B (Semester 2)
10602 – 715(12) Multivariate Statistical Analysis A (Semester 1)
10603 – 745(12) Multivariate Statistical Analysis B (Semester 2)
10628 – 743(12) Non-parametric Statistics (Semester 2)
10636 – 746(12) Survival Analysis (Semester 2)
10701 – 716(12) Statistical Quality Control and Improvement (Semester 1)
10705 – 742(12) Sampling Techniques (Semester 2)
65250 – 718(12) Stochastic Simulation (Semester 1)
10750 – 717(12) Time Series Analysis A (Semester 1)
10751 – 747(12) Time Series Analysis B (Semester 2)

22853 MATHEMATICAL STATISTICS				
879	**180**	**MComm and MSc in Mathematical Statistics (coursework plus thesis option)**		

Admission requirements
An honours degree with Mathematical Statistics as the major field of study.
Duration
At least 12 months.
Credits
A thesis of 90 or 120 credits and further credits from advanced coursework to obtain a total of at least 180 credits.
Assessment
Examinations in the coursework are written at the end of the second semester in November. A student must submit a thesis resulting from independent research plus supplementary work that may be required by the Department.
Availability of modules
Depending on circumstances in the Department, some of the modules listed below may not be offered in a specific year
Commencement of the programme
One and a half weeks prior to the general commencement of classes.
Closing date for applications
Applications for a specific year must be received by the end of October of the previous year.
Programme content
One of the Thesis: Mathematical Statistics modules must be selected
11246 – 891(90) Thesis: Mathematical Statistics (Semester 1 and 2)
11246 – 892(120) Thesis: Mathematical Statistics (Semester 1 and 2)

Elective modules
Select modules to make up at least 180 credits together with the thesis.
10441 – 813(15) Extreme Value Theory A (Semester 1)
10442 – 843(15) Extreme Value Theory B (Semester 2)
10509 – 814(15) Advanced Multivariate Categorical Data Analysis A (Semester 1)
10511 – 844(15) Advanced Multivariate Categorical Data Analysis B (Semester 2)
10512 – 815(15) Advanced Multivariate Statistical Analysis A (Semester 1)
10513 – 845(15) Advanced Multivariate Statistical Analysis B (Semester 2)
10523 – 818(15) Advanced Sampling Techniques (Semester 1)
10524 – 819(15) Advanced Mathematical Statistics A (Semester 1)
11173 – 849(15) Advanced Mathematical Statistics B (Semester 2)
10530 – 816(15) Large Sample Theory A (Semester 1)
11531 – 846(15) Large Sample Theory B (Semester 2)
18130 – 822(15) Multidimensional Scaling A (Semester 1)
11910 – 852(15) Multidimensional Scaling B (Semester 2)
10694 – 811(15) Bootstrap and other Resampling Techniques A (Semester 1)
10695 – 841(15) Bootstrap and other Resampling Techniques B (Semester 2)
10703 – 812(15) Statistical Learning Theory A (Semester 1)
10704 – 842(15) Statistical Learning Theory B (Semester 2)
11174 – 817(15) Probability Theory A (Semester 1)
11175 – 847(15) Probability Theory B (Semester 2)

22853 MATHEMATICAL STATISTICS				
889	**180**	**MComm and MSc in Mathematical Statistics (course-work plus assignment option)**		

Admission requirements
An honours degree with Mathematical Statistics as the major field of study.
Duration
A minimum of 12 months.
Credits
A minimum of 180 credits.
Assessment
Examinations in the coursework are written at the end of the second semester in November. A student must submit an assignment resulting from independent research plus supplementary work that may be required by the Department.
Availability of modules
Depending on circumstances in the Department, some of the modules listed below may not be offered in a specific year
Commencement of the programme
One and a half weeks prior to the general commencement of classes.
Closing date for applications
Applications for a specific year must be received by the end of October of the previous year.
Programme content
Assignment: Mathematical Statistics module (Compulsory)
11228 – 895(60) Assignment: Mathematical Statistics (Semester 1 and 2)

Elective modules
Select modules to make up at least 180 credits together with the assignment.
10441 – 813(15) Extreme Value Theory A (Semester 1)
10442 – 843(15) Extreme Value Theory B (Semester 2)
10509 – 814(15) Advanced Multivariate Categorical Data Analysis A (Semester 1)
10511 – 844(15) Advanced Multivariate Categorical Data Analysis B (Semester 2)
10512 – 815(15) Advanced Multivariate Statistical Analysis A (Semester 1)
10513 – 845(15) Advanced Multivariate Statistical Analysis B (Semester 2)
10523 – 818(15) Advanced Sampling Techniques (Semester 1)
10524 – 819(15) Advanced Mathematical Statistics A (Semester 1)
11173 – 849(15) Advanced Mathematical Statistics B (Semester 2)
10530 – 816(15) Large Sample Theory A (Semester 1)
11531 – 846(15) Large Sample Theory B (Semester 2)
18130 – 822(15) Multidimensional Scaling A (Semester 1)
11910 – 852(15) Multidimensional Scaling B (Semester 2)
10694 – 811(15) Bootstrap and other Resampling Techniques A (Semester 1)
10695 – 841(15) Bootstrap and other Resampling Techniques B (Semester 2)
10703 – 812(15) Statistical Learning Theory A (Semester 1)
10704 – 842(15) Statistical Learning Theory B (Semester 2)
11174 – 817(15) Probability Theory A (Semester 1)
11175 – 847(15) Probability Theory B (Semester 2)

22853 MATHEMATICAL STATISTICS				
978	**360**	**PhD in Mathematical statistics**		
For a doctorate, a dissertation containing the results of independent research is required. See also General Rules for Doctorates in Part 1 of the Calendar.				

19690 STATISTICAL METHODS				
176	**18**	**Statistical Methods with Computer Implementation**	*	**A & E**

*First semester: 3L, 1½T; Second semester: 2L, 1½T

Sampling techniques: Simple random; Stratified; Systematic; Cluster; Probability proportional to size.

Descriptive Statistics: Various data types; Stem-and-leaf display; Frequency distributions; Graphical representation of data (histogram, polygons, bar and pie charts); Descriptive measures of location and spread (mean, median, mode, variance, standard deviation, percentiles); Approximate measures for grouped data; Box plots; Measure of association (coefficient of correlation).

Probability theory: Basic probability concepts (sample spaces, events, addition and multiplication rules, conditional probabilities, probability trees, contingency tables); Bayes' theorem; Counting rules.

Discrete random variables and probability distributions: Expected value, variance, and standard deviation of a discrete random variable; Covariance between discrete random variables; Expected value and variance of a portfolio; Binomial and Poisson distributions.

Continuous random variables and probability distributions: Normal and exponential distributions.

Sampling distributions: The central limit theorem; Sampling distribution of the mean and a proportion.

Inferential Statistics: Interval estimation and hypothesis testing for the mean and a proportion; Interval estimation and hypothesis testing for the difference between two means; Sample size calculation based on interval estimation.

Analysis of variance: One-way and two-way designs.

Regression analysis: The simple linear regression model; Inference about model parameters and the coefficient of correlation; Multiple linear regression.

Time series analysis: The components of a time series; Smoothing; Least squares trend fitting and forecasting.

Notes

1. Microsoft® Excel will be used throughout the module for the application of the different statistical techniques.
2. Students who passed Statistical Methods 176(18) will be allowed to continue with Statistics 214(16), provided that they obtained a final mark of at least 60%.

Differences between Statistics 186 and Statistical Methods 176:

In Statistics 186 and Statistical Methods 176 similar statistical techniques are covered. However, in Statistics 186 basic mathematical techniques are revised and expanded, which are not covered in Statistical Methods 176. The Statistics 186 module is a normal exam written module with three tests that are written during the year and a final examination written at the end of the year. The Statistical Methods 176 module is a more practical module that focuses on applications in Excel and computer assignments. These assignments form an important component, 40% of the module, of this continuously assessed module.

Continuous assessment

FACULTY OF EDUCATION
Department of Curriculum Studies

57150 TEACHING PRACTICE				
175	**26**	**Teaching Practice**	4L	**T**

An overview of practice-based knowledge as a process of enabling for professional education training.
Institute practical (Lesson Analysis)
A microteaching programme including the following: lesson design, media design, lesson implementation, lesson assessment and lesson observation.
School visits
Lesson planning and lesson presentation.
Experience of the current school-life world of the child.
Observation of and participation in instructional activities, school activities and general classroom and school administration.
Participation in extracurricular activities of the school.

Continuous assessment

61530 DIVERSITY AND INCLUSIVITY [PGCE]				
174	**12**	**Diversity and inclusivity**	2L	**T**

This module aims to prepare student teachers to provide effective education to a diverse, complex and interdependent world. The module focuses on the constituting processes of schools in South Africa. The main focus is the interaction between systemic, institutional and individual dimensions involved in creating and maintaining diverse yet inclusive schools. The module aims to support student teachers in the development of a conceptual foundation through which they can understand the complex and multiple dynamics of the interaction between race, class, culture, language, gender and other patterns of diversity in schools and mediate these meaningfully. An important dimension is to lay a conceptual foundation through which diversity and inclusivity can be addressed and mediated in educational contexts, based on the ethical principles of consultative co-existence and social justice. A critical awareness of sexuality and the manifestation of HIV and Aids in education and the broader community is a key component of this module.
Main themes*:*
Diversity and inclusivity in schools from a 'Sociology of Education' perspective
The school as institutional perspective
Exploration of the relationship between education and society

61565 INTRODUCTION TO EDUCATIONAL RESEARCH [PGCE]				
172	**8**	**Introduction**	1L, 1T	**T**

Introduction and overview of research, approaches to research, research methods, the teacher as researcher.

Continuous assessment

Department of Educational Policy Studies

57142 PHILOSOPHY OF EDUCATION [PGCE]				
174	**12**	**Themes in the Philosophy of Education**	2L	**T**
Critical thinking and philosophical research methodology, practical reasonableness, fairness and classroom practice, democratic education: rights and responsibilities, sensitivity to any form of discrimination, the democratic classroom, the complexity of inculcating values in schools in a democratic South Africa, the relationship between education and society, globalisation and education; market forces, consumer desires and identity, post-structuralism and colonialism, education and identity.				

61875 EDUCATION GOVERNANCE, LEADERSHIP AND MANAGEMENT [PGCE]				
174	**12**	**Perspectives on the Education System**	2L	**T**
Classrooms in local, national and global contexts. School governance and management in a democratic context. Dealing with contemporary management challenges for teachers (e.g. discipline, change, community relations, accountability, diversity, quality assurance). Taking the initiative and responsibility for your own class. The educator and the law: the legal system (constitution, human rights and education legislation); duty of care and crimes against children; selected legal topics, e.g. defamation, labour law.				

Department of Educational Psychology

61832 LEARNING AND LEARNING SUPPORT [PGCE]				
174	**12**	**Learning and Learning Support**	2L	**T**
Adolescence and developmental phases. The learning process (taking into account different leaning theories, learning and thinking styles and cognitive strategies). Different barriers to learning and development. Learning support in the inclusive classroom, learners with behavioural problems in the South African context. The development of skills to manage learners with critical incidents in the classroom. *Continuous assessment*				

Department of Sport Science

54607 SPORT SCIENCE				
222	**8**	**Motor Learning**	2L	**A**
Perceptual-motor development and behaviour; perceptual-motor learning taking the learning environment into consideration; the role of perception and decision-making in sport performance.				
232	**8**	**Exercise Physiology**	2L	**A**
Aerobic and anaerobic metabolism during exercise; acute cardiovascular, respiratory and muscle responses to endurance and resistance training; effect of strength and endurance training on physiological systems and the physiological mechanisms of training. For the programme BA (Sport Science): *P Physiology 114, 144*				

252	**8**	**Sport Physiology**	2L	**A**
Physiological factors that influence sport performance; physiological training principles and adaptations; training for special populations; nutrition and sport performance; training at altitude; legal and illegal ergogenic aids in sport. For the programme BA (Sport Science): *P Physiology 114, 144*				
262	**8**	**Applied Biomechanics**	2L, 1P	**A**
Kinematic and kinetic concepts for the analysis of human movement; the biomechanics of human upper and lower body limbs and spinal column; linear and angular kinematics and kinetics of human movement; equilibrium and human movement; human movement in a fluid medium; applications of biomechanical principles in qualitative analysis of sport skills and exercise. *P Kinesiology 112 or 162*				
382	**6**	**Professional Applications**	2L, 2P	**A**
Application of education and programme design; skills training and fitness development; alternative approaches to learning in physical activities; educational and career opportunities. *Continuous assessment*				

44229 MOVEMENT EDUCATION, SPORT AND RECREATION				
212	**8**	**Teaching and Programme Development**	2L, 4P	**A**
Teaching expertise, management skills and motivational strategies, design of physical activity programmes, planning and presenting teaching.				
222	**8**	**Adapted movement programmes**	2L	**A**
The importance of correct body alignments for successful motor performance; analysis of causes of posture deviations; introductory knowledge of various disabilities.				
242	**8**	**Sport and Recreation Management**	2L	**A**
Principles of planning, organising, leading and control in sport and recreation; marketing management: market differentiation, identification of target groups, needs assessment, formulation of objectives, marketing strategies, the marketing recipe and strategic planning.				
282	**8**	**Structure of Physical Activities**	2L, 5P	**A**
Performance enhancement in various sport types and movement forms; team co-operation; social behaviour within the physical environment; teaching tips and incentives; learning of motor skills and development of fitness; knowledge of the role of a coach, official and referee. *Continuous assessment* *PP Sport Science 184 or* *PP Kinesiology 182*				

19305 KINESIOLOGY				
162	**8**	**Anatomy**	2L, 1P	**A**
Anatomical and movement terminology; structure and function of tissue types of the human body; knowledge of the human body as a unit of mobility (skeletal and muscular) structure and function; knowledge of selected supporting systems to the mobility unit.				

182	**8**	**The Sport Experience**	2L, 2P	**A**
Sport performance as a personal experience; demonstration, strategies, insight, enhancement of selected team and individual sport types played by different cultural groups in Southern Africa. *Continuous assessment*				
312	**8**	**Sport Injuries**	2L	**A**
General principles and classification of sport injuries. Biomechanics of sport injuries. Overuse syndrome. Sport injuries of upper and lower limbs. Injuries in sport for persons with disabilities.				
332	**8**	**Peak Performance**	2L	**A**
Programme design through principles of classification and the application thereof on elite sport performance. Periodisation of training. Recovery strategies. Applied nutritional aspects of sport.				
342	**8**	**Sociological and Psychological Aspects of Sport Performance**	2L	**A**
Relationship between sport and social institutions; specific considerations for the coaching of children; the sport credo; sport and the media; use of specific psychological skills for enhancement of sport performance; psychometrics.				
352	**8**	**Tests and Measurement**	2L	**A**
Principles of valid and reliable assessment of fitness and sporting performance by means of statistical techniques and general assessment strategies.				
372	**8**	**Values and Ethics in Professional Applications**	2L, 2P	**A**
Education expertise; characteristics of development; curriculum models; management and communication skills and motivational strategies; design of physical activity programmes; teaching planning and presentation. Philosophical context of physical activities; social and cultural tendencies with regards to physical activities in SA; heterogeneous groups and physical activity; moral behaviour in physical activity, sport and recreation.				

54429 APPLIED KINESIOLOGY				
312	**12**	**Scientific Base of Sport Coaching**	2L, 2P	**A**
Apply the principles that influence fitness and skills development to the design of sport specific programmes; understand the role and responsibilities of the coach; incorporate scientific principles in the organisation of a training year. *PP Kinesiology 182 or* *PP Sport Science 184*				
314	**12**	**Scientific Base of the Fitness Industry**	2L, 2P	**A**
BA and BSc The scientific base of the health, exercise and fitness industry; national and international trends in the fitness industry; structure of the fitness industry in SA; presentation and analysis of exercise regimes; exercise programme planning; compilation and management of exercise programmes; medical considerations for the fitness industry; assessment strategies in exercise and fitness; presentation and conducting various health and fitness tests.				

324	**12**	**Principles of Adapted Movement**	2L, 2P	**A**
Value of participation of disabled persons; assessing the performance of persons with disabilities; problem as of participants with chronic illnesses; teaching adaptations regarding disabled persons; data collection and processing.				
342	**12**	**Coaching Strategies**	2L, 2P	**A**
Analysis of performance for strategic development; team cooperation; social behaviour in physical context; coaching tips and incentives; scientific principles of a training year; taking on the role of coach in the school or community; data collection and processing. *PP Kinesiology 182 or* *PP Sport Science 184*				
344	**12**	**Sport and Recreation for Persons with Disabilities**	2L, 2P	**A**
Sport classification for participation; competition opportunities for persons with disabilities; adaptation of rules and special requirements regarding sports types for persons with disabilities; support of sport development and recreations programmes in special schools and communities; conclusions of research for professional applications.				
352	**12**	**Exercise and Fitness Training**	2L, 2P	**A**
BA and BSc Presentation of selected professional fields in the fitness industry; planning, presentation and managing of fitness education for special population groups; analysis of exercise areas and exercise modalities; handling a case study personally; presentation of final case study; marketing; business management; risk management; legal considerations in the fitness industry.				

HONOURS MODULES CONTENT

For information on modules content for BScHons (Biokinetics) and BScHons (Sport Science), please consult Part 6 (Faculty of Education) of the Calendar.

43842 BIOKINETICS

778	**120**	**BScHons (Biokinetics)**		

Aims

The aims of the programme are fully in line with current developments in Outcomes-based Education. Consequently the programme outcomes are set up accordingly.

Admission

Students may be admitted to the honours programme in Biokinetics by Senate, or the Executive Committee acting on behalf of Senate, if they hold a bachelor's degree approved for this purpose by Senate, with Sport Science as one of the majors.
Application must be made in writing.
Only students with an average of at least 60% in Sport Science subjects during their undergraduate years may apply for admission.

Specific Admission Requirements

There are only a limited number of places in the Biokinetics programme. The closing date for applications is 31 August.

Notes

An internship period that meets the conditions laid down by the Health Professions Council of South Africa will be required before a candidate can apply for registration as a biokineticist.

Anchor module
43842 Biokinetics 778(120)
Compulsory submodules
60976 Biokinetics Practice 772(20)
61018 Ergonomics 775(20)
61204 Exercise Physiology 774(20)
61212 Exercise Science 771(30)
54895 Research Project 773(30)

Assessment and Examination
Continuous assessment, which includes theoretical and practical assignments, informal class tests, as well as formal tests will make up the final mark of each year module.

A class mark of 40% per semester module is required for admission to the three-hour written examination. The final mark is calculated as follows: 50% examination mark and 50% class mark per module.

Enquiries
Programme Manager: Prof E Terblanche
Department of Sport Science
Tel: 021 808 2742 E-mail: et2@sun.ac.za
Web address for more information: http://www.sun.ac.za/education

54607 SPORT SCIENCE				
778	**120/ 132**	**BScHons (Sport Science)**		

This programme has two specialisation areas, namely Performance Sport and Kinder Kinetics.
The aims of the programme are fully in line with current developments in Outcomes-based Education. Consequently the critical outcomes and developmental outcomes are taken as definitive and the programme outcomes are set up accordingly.
Admission
Students may be admitted to the Honours programme in Sport Science by Senate, or the Executive Committee acting on behalf of Senate, if they hold a bachelor's degree approved for this purpose by Senate, with Sport Science as one of the majors.
Application must be made in writing.
Only students with an average of at least 60% in Sport Science subjects during their undergraduate years may apply for admission.

BScHons (Sport Science) (Performance Sport)
Specific Admission Requirements
A limited number of candidates are admitted to the specialisation in Performance Sport. The closing date for applications is 30 September.

Apart from the compulsory modules, candidates can choose additional modules from other modules. The modules are:
Compulsory Modules
64831 Professional Practice in Sport Science 773(30)
11265 Research Project 771(30)
64815 Current Topics in Sport and Exercise Science 721(12), 751(12)
56340 Biomechanics 712(12)
61204 Exercise Physiology 743(12)
42935 Sport Psychology 712(12)
61433 Applied Exercise Physiology 714(12)

Additional Modules
61220 Exercise Psychology 713(12)
61395 History of Sport 745(12)
61077 Kinanthropometry 715(12)
61123 Motor Control 711(12)
61131 Motor Learning 741(12)
61387 Sport for Persons with Disabilities 772(12)
61409 Statistics for Sport Science and Exercise Science 772(12)

BScHons (Sport Science) (Kinder Kinetics)
Specific Admission Requirements
A limited number of candidates are admitted to this specialisation in Kinder Kinetics. The closing date for applications is 30 September.

Apart from the compulsory modules, candidates can choose additional modules from other modules. The modules are:
Compulsory Modules
64831 Professional Practice in Sport Science 773(30)
11265 Research Project 771(30)
64815 Current Topics in Sport and Exercise Science 751(12)
61123 Motor Control 711(12)
61077 Kinanthropometry 715(12)
61387 Sport for Persons with Disabilities 772(12)
11264 Kinder Kinetics Theory 772(12)
Additional Modules
61409 Statistics for Sport Science and Exercise Science 772(12)
56340 Biomechanics 712(12)
61131 Motor Learning 741(12)
61204 Exercise Physiology 743(12)
62935 Sport Psychology 712(12)
61395 History of Sport 745(12)
61433 Applied Exercise Physiology 714(12)
61220 Exercise Psychology 713(12)

Assessment and Examination
Continuous assessment, including theoretical and practical assignments, informal class tests, as well as formal tests, will count towards the final mark of every year module.

A class mark of 40% per semester module is required for admission to the three-hour examination. The final mark is calculated as follows: 50% for the examination mark and 50% for the class mark per module.

In order to pass Professional Practice in Sport Science 773, it is expected of students to do 300 hours practical work during the course of the year and to pass an oral exam at the end of the year with at least 50%.

Enquiries
Programme Manager: Dr RE Venter
Department of Sport Science
Tel: 021 808 4721
e-mail: rev@sun.ac.za
Web address for more detailed information: www.sun.ac.za/education

54607 SPORT SCIENCE				
878	**180**	**MSc (Sport Science) (full thesis)**		

MSc (Sport Science)

Programme Outcomes

The aim of the programme is to equip students with the research skills within the field of Sport Science by making research opportunities available. A secondary aim is to prepare prospective doctoral students for advanced study.

Specific Admission Requirements

On written application, students are admitted to the degree programme of MSc (Sport Science) by Senate, or by the Executive Committee acting on behalf of Senate, if they have:

- an honours degree (NQF 7) (with an average of at least 60%) which Senate has approved for this purpose; or
- a bachelor's degree (with an average of at least 60%) which Senate has approved for this purpose; or
- have attained a standard of competence in their field of study in another manner, which Senate deems satisfactory for this purpose.

In all cases, final admission to the degree programme rests with the postgraduate committee of the Department of Sport Science, subject to the available resources in the Department. If it is deemed necessary, supplementary study, as determined by the postgraduate committee of the Department, may be required.

Programme Structure

The MSc (Sport Science) consists of a full thesis (100%) on a topic which has been approved by the departmental postgraduate committee and the supervisor. The thesis is assessed externally on completion of the study.

Assessment and Examination

The thesis is examined both internally and externally. It counts 100% of the final mark. A candidate must obtain 50% in order to pass.

Enquiries

Programme Manager: Prof E Terblanche
Department of Sport Science
Tel: 021 808 2742 e-mail: et2@sun.ac.za
Web address for more detailed information: www.sun.ac.za/education

FACULTY OF MEDICINE AND HEALTH SCIENCES

Biomedical Sciences Division, Anatomy and Histology

12558 ANATOMY				
214	**16**	**Basic Anatomy of the Human Body**	3L, 3P	**T**

Dissection-based study of the human body commencing with a detailed study of the skeleton in the normal individual, as well as tracking of age-related changes from birth to 70+ years of age. A detailed study of physical anthropology and its relevance to forensic and other similar sciences. Dissection-based study of the muscular system including developmental and/or congenital abnormalities.

P Biology 124, 144 or 154

244	**16**	**Basic Anatomy of the Human Body**	3L, 3P	**T**
Dissection-based study of the anatomy of the cardiovascular and respiratory systems including the heart, lungs, pulmonary and systemic circulations, and arterial and venous systems of the torso, head and neck and limbs with reference to environmental and other influences on normal development and/or congenital abnormalities. *P Anatomy 214*				
314	**16**	**Advanced Anatomy of the Human Body**	3L, 3P	**T**
Dissection-based study of the anatomy of the digestive, urogenital and endocrine systems. Text book-based study of the organs of special sense, namely vision, hearing, posture and balance, taste, smell, proprioception and co-ordination. *P Anatomy 214, 244*				
344	**16**	**Advanced Anatomy of the Human Body**	3L, 3P	**T**
This module is a cadaver-based study of the brain and spinal cord and its related structures, as well as how each relates to function. A detailed study of development of the brain and nervous system from birth to 5 years of age. *P Anatomy 214, 244, 314*				

STUDENT AND ACADEMIC SUPPORT

SU Language Centre

(In consultation with Faculties of Science and Arts and Social Sciences)

64866 SCIENTIFIC COMMUNICATION SKILLS				
116	**12**	**Scientific Communication Skills**	3L, 3T	**A & E**
For BSc (Extended Degree Programme) students. This module focuses on the development of speaking, listening, and reading skills in the academic environment in general and specifically in the natural sciences. Aspects such as engaging with and understanding relevant academic and natural science texts, understanding text components, the use of fluent, correct and proper language, and the interpretation of graphic data, will be addressed. *Continuous assessment*				
146	**6**	**Scientific Communication Skills**	3L	**A & E**
For BSc (Extended Degree Programme) students. This module focuses on the development of writing skills in the academic environment in general and specifically in the natural sciences. Aspects such as engaging with and understanding relevant academic and natural science texts, understanding text components, presenting data in an edited and coherent text, the use of correct and proper language, the employment of accurate language, correct referencing technique and using graphics to clarify data will be addressed. *Continuous assessment*				
172	**8**	**Scientific Communication Skills**	2L	**T**
The development of the basic principles of scientific and academic communication, with a focus on reading, writing, listening and speaking in the academic (formal) context; engaging with and understanding relevant academic and scientific texts; understanding text components; presenting data in a coherent, edited text; using referencing methods correctly to avoid plagiarism; using graphics to clarify data.				

Continuous assessment.				
173	**8**	**Scientific Communication Skills**	2L	**A**
The focus of this module is on the development of basic speaking, listening, reading and writing skills (the latter two to a lesser extent) in Afrikaans within the context of the natural sciences. *Continuous Assessment*				
174	**8**	**Scientific Communication Skills**	2L	**E**
The focus of this module is on the development of communicative language skills (speaking, listening, reading and writing) in English within the context of the natural sciences with the purpose to master the academic discourse. *Continuous Assessment*				

Higher Degrees in Science

For specific information on the Faculty's postgraduate programmes, consult the Postgraduate Prospectus of Stellenbosch University or the departmental web sites.

BSc WITH HONOURS

1. The BSc with Honours (BScHons) may be conferred upon a student who –
   1.1 has been awarded a Bachelor's degree approved by the Senate for such purpose and who, upon written application, has been admitted to the BScHons programme by the Senate or the Executive Committee acting on the Senate's behalf; and
   1.2 has been registered as a student of the University for not less than one year (since the conferment of the primary degree of Bachelor, approved by the Senate for such purpose), has passed the prescribed written examination and has taken an oral examination.
2 The BScHons programme is taken in one of the majors of the BSc according to the provisions of the BSc programme. Students, who have taken a BSc programme that does not lead to a BScHons programme, may be accepted to a BScHons programme provided that such BScHons programme may commence only after an examination in the required subject or subjects has been successfully completed.
3 An average final mark of at least 60% in the major or prescribed modules in the final year of study is required for admission to a BScHons programme. A student who does not comply with this requirement may only be accepted to a BScHons programme if a recommendation has been made by the department concerned and is approved by the Faculty Committee of the Faculty of Science.
4 Specific provisions concerning the BScHons in specific subjects are given under the module content of such subjects.
5 A BScHons student shall not be allowed to take any third-year subject that includes practical work as additional subject in his first year. However, a student who is registered for BScHons programme that does not require practical work, may, subject to the approval of the Faculty Board, be allowed to take a third-year subject as additional subject.

MSc

1. The MSc degree may be conferred upon a student –
   1.1 who holds an honours degree approved by the Senate for such purpose and who – upon written application – has been admitted to the proposed MSc programme by the Senate or the Executive Committee acting on the Senate's behalf; and
   1.2 who has taken an approved programme of research or advanced study of at least one year (since the conferment upon him of the before-mentioned honours degree) at this University or at any other institution approved by the Senate; and
   1.3 who has submitted a satisfactory thesis, depending on the requirements of the department concerned, and has taken an oral examination

   or

   1.4 who holds a bachelor's degree approved by the Senate for such purpose, or who has attained a standard of competence in a particular field of study deemed by the Senate to be adequate, and who - upon written application - has been admitted to the proposed MSc programme by the Senate or the Executive Committee acting on the Senate's behalf; and
   1.5 who has taken an approved programme of research or advanced study of at least two years (since the conferment upon him of the before-mentioned bachelor's degree) or since attaining an approved standard of competence, which may

include a period of research or study of not more than one year at another institution approved by the Senate; and

1.6 who has passed the prescribed examination; and

1.7 who has submitted a satisfactory thesis, depending on the requirements of the department concerned, and has taken an oral examination.

(For the regulations regarding attendance, examiners, thesis/assignment requirements, duplication and binding of theses/assignments, see Higher Degrees in Part 1 (General) of the Calendar of the University.)

2. Subject to the provisions of the BSc degree, a student may be admitted to an MSc programme in a field of study that is one of the majors for the BSc degree. A student, who has taken a BSc programme that does not lead to an MSc programme, may be admitted to such programme provided that the proposed MSc programme may commence only after an examination in the required subject or subjects has been completed successfully.
3. Specific provisions concerning the MSc programme in specific subjects are given in the module content of the subjects concerned.
4. An MSc student shall not be permitted to take any additional third-year subject comprising practical work in the first year of the MSc. However, an MSc student may be permitted to register for an additional third-year subject, subject to the approval of the Faculty Board, if the proposed MSc programme does not require any practical work.

PhD

1. The PhD degree may be conferred upon a student who –
   1.1 has obtained a Master's degree approved by the Senate for such purpose, or has obtained some other standard of competence in the field of study in question that has been deemed suitable by the Senate for such purpose, and who has – upon written application – been accepted by the Senate to the PhD programme; and
   1.2 has registered for an approved programme of research and possible supplementary study, which may include a period of research at another institution approved by the Senate, for not less than two years since having obtained the above-mentioned Master's degree or since having attained the above-mentioned standard of competence; and
   1.3 has submitted a satisfactory dissertation; and
   1.4 has taken an oral examination.

(For the regulations regarding attendance, examiners, dissertation requirements, duplication and binding of dissertations, etc., see Higher Degrees in Part 1 (General) of the Calendar of the University.)

DSc

1. A candidate for the DSc degree shall –
   1.1. have performed advanced, original research or learned work, to the satisfaction of the University, in the field of the natural sciences; and
   1.2. have submitted original work of a high standard that has already been published, on a central theme, making a contribution of substance and of high quality to the enrichment of knowledge in the field of the natural sciences; and
   1.3. have taken an oral examination to the satisfaction of the University.

2. If a candidate already holds a degree of Doctor of Philosophy (PhD) from the Faculty of Science or any other qualification deemed equivalent by the Senate, he shall –
   2.1. have been registered at the University as a student for the degree of Doctor of Science for not less than one year of study and a period of not less than five

years shall have elapsed between the conferment upon him of the degree of Doctor of Philosophy or of some other degree or qualification deemed by the Senate to be of equivalent standard and the conferment of the DSc degree; and

2.2. have notified the Registrar at least one year before presenting himself as a candidate for the degree of such intention and provided the title(s) and scope of the proposed work(s). (Upon the Senate's acceptance of such application, a promoter and examiners shall be appointed.)

3. If a candidate already holds a Master's degree in Science (MSc) from the Faculty of Science or any other qualification deemed equivalent by the Senate, he shall –
   3.1. have been registered at the University as a student for the degree of Doctor of Science for not less than three years of study and a period of not less than seven years shall have elapsed between the conferment upon him of the degree of Master of Science or of some other degree or qualification deemed by the Senate to be of equivalent standard and the conferment of the DSc degree; and
   3.2. have notified the Registrar in writing not less than three years before presenting himself as a candidate for the degree of such intention and provided the title(s) of the proposed work(s). (Upon the Senate's acceptance of such application, a promoter and examiners shall be appointed.)
4. A candidate shall have submitted one copy of his work(s) to each of the examiners before 1 September (if he wishes to graduate in December), and before 1 December of the preceding year (if he wishes to graduate in April) at the University office, accompanied by a written statement that it is his original work and that the work has not been submitted to this or any other university for conferment of a degree. If a substantial part of the submitted work is published not in the name of the candidate only, the candidate shall submit satisfactory testimony to the part of the work submitted by himself, who commanded, performed, processed and committed to paper the submitted work and, if applicable, what part of the work has been submitted to any other university for the conferment of a degree.

INTERRUPTION OF MASTER'S AND DOCTORAL STUDIES

1. Acceptable reasons for interruption of studies

Where an application for consent to an interruption of master's or doctoral studies is being considered, the indications below of possible reasons shall serve as the guidelines in judging the acceptability of the reasons given in support of such application. Each such application shall be substantiated by means of appropriate supporting documents, such as a letter of appointment, text of academic assignment, medical certificate(s), financial statement(s), affidavit, etc.

1.1 Situation at work
1.2 Medical reasons
1.3 Financial reasons
1.4 Highly special personal circumstances if thoroughly and convincingly substantiated.

2. Procedure for application for consent to an interruption of studies

2.1 Any applications for consent to an interruption of studies shall reach the Faculty Secretary on or before 30 April of the year concerned. No application for consent to an interruption of studies shall be considered after 30 April of the academic year concerned.

2.2 Consent to an interruption of studies shall be considered on the recommendation of the promoter/supervisor and the chair of the department concerned.

2.3 Where any such application has been granted, it shall be entered in the next recommendatory report of the Faculty Board.
2.4 Consent to an interruption of studies shall be granted for a period of not less than one year.
2.5 Consent to an interruption of his studies for the degree of Master shall, in the normal course of events be granted to any student once only and for a period of one year only.
2.6 Consent to an interruption of his studies for the degree of Doctor shall in the normal course of events be granted to any student either twice at the most, namely for a period of one year in each instance, or once only, namely for a period of two years.

CONVERSION FROM MASTER'S TO DOCTORATE

In deserving cases, and with due regard for the best interests of the student concerned, the conversion of registration for the Master's degree (requiring a thesis) into registration for the Doctorate may be considered and recommended by the Faculty Board, provided that –

1. the student has shown exceptional progress with his research (after not less than one year's study); The application for conversion must be done within 18 months of registration for the MSc and is limited to good students who can be assessed on tangible outputs (see point 4 below);
2. in the course of the work done for the Master's study new and original insights that warrant further research at the Doctoral level have emerged. The conversion of the study requires more than simply increasing the volume of data and also more than adding techniques to address the questions that were formulated at the start of the MSc. There has to be clear evidence of a conceptual expansion (intellectual leap) from the MSc;
3. the work done for the Master's study exceeds the conventional MSc study in terms of scope and cannot reasonably be separated into a MSc component and a Doctoral component;
4. the outputs (which can be incremental) may include:
   - excellent progress as evident from the six-month evaluations and/or an annual report
   - conference participation (either oral or poster presentations)
   - peer-reviewed publications in journals of high quality (including those in review/in press)
   - some other acceptable form of peer evaluation;
5. the proposal for such a conversion be initiated by the supervisor, who shall make a request to the relevant departmental chair. If the chair supports the request, he shall direct the request to the Dean. (Where the supervisor is the departmental chair, the request is made directly to the Dean). After approval by the Dean, the department appoints a committee of three or four members whose subject expertise equips them to judge the request. One of the members shall preferably not be a member of staff of Stellenbosch University. After consultation with the supervisor, the student shall (i) compile a report of the progress made with the Master's study and (ii) be required to submit a written Doctorate research proposal that justifies the expansion of the philosophical/conceptual component of the study. As with new PhD studies, the candidate will be required to give a defence of the proposal. The committee shall consider the student's presentation, progress report and the submitted PhD proposal and make a recommendation for consideration by the Faculty Board;
6. before the Doctorate be awarded to the student concerned, he must have been registered for the degrees of Master and Doctor jointly for a total of not less than three years, in the case of Master's after Honours, and not less than four years in the case of Master's after Bachelor's, including not less than one year for the Doctorate;

7. in cases where written examinations are required for the Master's study in question, all such examinations shall have been taken and passed by the student before the Doctorate be awarded to him; and
8. the student's tuition fees shall not be retrospectively adjusted after the conversion.

Research and Service Bodies

BUREAU FOR INDUSTRIAL MATHEMATICS AT STELLENBOSCH UNIVERSITY

The Bureau for Industrial Mathematics at Stellenbosch University (BIMUS) was established in 1990 and functions as part of the Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science). Its objective is to encourage cooperation between the Applied Mathematics Division and industry. The Bureau facilitates consultation and research projects between lecturers and industry and supports students who do an industrial research project as part of their studies.
Fields currently supported or in which expertise are available, are: Numerical methods, numerical flow simulation, porous media, ballistics, computer simulation, image processing, pattern recognition, and computer vision.

For more information, visit dip.sun.ac.za/bimus or contact Dr Milton Maritz at 021 808 4228 or mfmaritz@sun.ac.za.

CENTRE FOR EXPERIMENTAL MATHEMATICS

The Centre for Experimental Mathematics (CEM) in the Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science) focuses on fundamental and experimental mathematical research and supports three research areas, namely the analysis of algorithms and theoretical computer science, computational algebra and numbers theory, and computational analysis research.
CEM brings together researchers and students from the fields of mathematics, engineering and computer science.
It has strong ties with leading institutions abroad, such as the Technical University Graz and the Centre of Experimental Mathematics in Essen. There is an active exchange of ideas and collaboration on research projects between members of the Centre and academics at universities in Paris, Brussels, Vienna and Johannesburg. The international links also provide the opportunity to expose students to other mathematical schools.
Activities such as seminars, workshops, research projects for young upcoming scientists and an international exchange programme for postdoctoral fellows develop mathematicians on a postgraduate level.
Graduate students are also introduced to CEM's interdisciplinary mathematical activities through suitable courses, computer assisted projects and local inter-university activities such as thematic workshops.

For more information, visit math.sun.ac.za or contact Prof Helmut Prodinger at 021 808 3273 or hproding@sun.ac.za.

CENTRE FOR HUMAN PERFORMANCE SCIENCES

The Centre for Human Performance Sciences was established in 2007 to operate as a coordinating mechanism to capitalise on the interdisciplinary potential that exists among various faculties and departments within Stellenbosch University (SU) in the areas of sport, exercise and physical activity.
It aims to develop the interface between the academic resources of the University, the Stellenbosch University Sport Performance Institute (SUSPI) and Maties Sport. Another strategic objective is the establishment of international partnerships with other universities to pursue Africa-relevant research, learning and community engagement projects in the areas of sport, exercise and physical activity.
The Centre is currently engaged in the delivery of one of the goals of the University's HOPE Project, through which SU uses its key strengths of academic excellence and cutting-edge research to address seemingly intractable problems in society. The Centre's

HOPE Project initiative explores ways in which participation in sport and exercise can be adapted to meet the physical, psychological and social development needs of youth, women and persons with disabilities. An emphasis is placed on combining resources through partnerships with other universities to create innovative and sustainable programmes.

For more information, visit www.sun.ac.za/humanperformance or contact Prof Liz Bressan at 021 808 4862 or esb@sun.ac.za.

CENTRE FOR STUDIES IN COMPLEXITY

The Centre for Studies in Complexity was launched in 2010 and aims to harness the insights from the field of complexity theory in the search for comprehensive solutions to the challenges of human development in South Africa and the rest of Africa.

Complexity theory engages in groundbreaking ways with major problems in the human and natural sciences by looking at the general picture instead of focusing on the detail. Topics studied include the behaviour of ecosystems, social and economic systems, the cellular organisation that constitutes a living organism, how meaning arise in language, the causes of political intolerance, and the functioning of health systems.

The Centre is the only one of its kind in Africa and is an initiative of the Stellenbosch University HOPE Project, through which the University uses its key strengths of academic excellence and cutting-edge research to address seemingly intractable problems in society.

The Centre's aims of knowledge generation and dissemination is achieved through collaborative research involving academics worldwide, and through teaching and supervising postgraduate students from various disciplines.

For more information, visit www.thehopeproject.co.za or contact Prof Jan-Hendrik Hofmeyr at 021 808 2704 or jhsh@sun.ac.za.

DST-NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

The DST-NRF Centre of Excellence for Invasion Biology (CIB) was launched in 2004 in partnership with a number of academic institutes and research bodies throughout South Africa.

The aim of the CIB is to improve our ability, through scientific knowledge, to understand, control and manage invasive species to improve the quality of life of all South Africans. People move species around, often unintentionally. These movements have consequences, many of which are unexpected.

Research done by the CIB focuses on the implications of biological invasions for the biodiversity, ecosystems, the functioning and ecosystem services of all South African biomes, including Marion Island, as well as systems elsewhere in Africa. It covers all aspects of invasion biology, including biodiversity and ecosystem functioning, the effect of climate change, community ecology, GPS-based assessment of ecosystem services and conservation planning, impacts of invasive species on biodiversity, macroecology and landscape ecology, marine biology, pollination, risk assessment, spatial modelling and seed bank research. In addition, the CIB contributes to policy formulation and decision-making on invasive species and their impacts.

The CIB remains at the forefront of these fields by pursuing excellence in interdisciplinary research, encouraging interaction between partners on local, regional and international level, and staying relevant to the needs of the community. The CIB focuses on South Africa in the context of trends shaping Africa and the global community.

Study and research opportunities are available at the BSc (final-year only), BScHons, MSc, and PhD levels, as well as opportunities for postdoctoral research fellowships.

For further information on the CIB, visit our web site at www.sun.ac.za/cib or contact Prof Dave Richardson at 021 808 3711 or cib@sun.ac.za.

INSTITUTE FOR APPLIED COMPUTER SCIENCE

Founded in 1981, the Institute for Applied Computer Science (IACS) functions as part of the Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science) and aims to build a centre of expertise in Computer Science at Stellenbosch University.
Since its inception, the Institute has worked closely with the private sector and trains postgraduate students capable of developing reliable systems software.

For more information, visit www.cs.sun.ac.za/iacs or contact Prof Willem Visser at 021 808 4232 or visserw@sun.ac.za.

INSTITUTE OF THEORETICAL PHYSICS

The Institute of Theoretical Physics functions in collaboration with the division of theoretical physics in the Department of Physics. Its primary aims are the pursuit of research projects in the field of theoretical physics and assistance with the education of postgraduate students. The Institute was founded in 1984, with support from the Nuclear Development Corporation of South Africa. It serves as a centre for the development of theoretical physics and encourages co-operation in physics activities in the Department and elsewhere. It enjoys close ties with the National Institute for Theoretical Physics (NITHeP).

For more information, visit www.physics.sun.ac.za/theory or contact Prof Kristian Müller-Nedebock at 021 808 3386 or kkmn@sun.ac.za.

LASER RESEARCH INSTITUTE

The Laser Research Institute (LRI), which resides in the Physics Department, strives to be a centre of excellence in laser-related research and development in South Africa. The Institute boasts excellent laser facilities and is involved in world-class research projects. There is also a vibrant research atmosphere: Students, teachers and other staff members take part in the Institute's activities and this combination contributes to a unique and highly successful research environment.
The LRI offers the only outcomes-based university programme in laser physics in Southern Africa. This four-year programme entails a three-year BSc programme and a one-year BScHons programme. The first three years are non-specific and consist of various modules in physics, chemistry, mathematics, applied mathematics and computer science. The BScHons year is devoted to a number of courses in the field of laser physics, such as modern optics, laser technology, quantum optics and advanced electromagnetism, as well as a practical laser project.
The LRI's excellence is due to its postgraduate research, in which local and international MSc and PhD students partake. Good research outputs are delivered thanks to the excellent facilities and project supervision. Projects range from basic research funded by National Research Foundation (NRF) and National Laser Centre (NLC) grants, to applied research and development funded by THRIP grants or contract research with private sector companies. Generous bursaries are available for MSc and PhD students in the fields of laser spectroscopy, femtosecond laser applications, CO2 laser research, pulsed power supply development, solid-state and fibre laser development and non-linear optics.
Bursaries are also available for BScHons students, while a limited number of bursaries are available to selected students in the first three years of their studies (BSc).

For more information, visit www.laser-research.co.za or contact Prof Heinrich Schwoerer at 021 808 3375 or heso@sun.ac.za.

NATIONAL INSTITUTE FOR THEORETICAL PHYSICS

The National Institute for Theoretical Physics (NITheP) is a national facility that leads research programmes and educational opportunities in the field of theoretical physics in South Africa and Africa. It provides South Africa with the opportunity to become an international player in a truly fundamental field of science.

NITheP is a geographically distributed institute that includes all theoretical physicists in South Africa. Its headquarters is the Stellenbosch Institute for Advanced Study (STIAS) at Stellenbosch University, with regional nodes at the University of the Witwatersrand and the University of KwaZulu-Natal. The three nodes develop and support theoretical physics in their local regions, as well as nationally.

For more information, visit www.nithep.ac.za or contact Prof Frikkie Scholtz at 021 808 3871 or fgs@sun.ac.za.

SOUTH AFRICAN CENTRE FOR EPIDEMIOLOGICAL MODELLING AND ANALYSIS

The South African Centre for Epidemiological Modelling and Analysis (SACEMA) is a national research centre established under the Centres of Excellence programme of the Department of Science and Technology and the National Research Foundation in South Africa. It is associated with the Stellenbosch Institute for Advanced Study (STIAS) and brings together researchers from mathematics, statistics, biology and medical research.

It aims to develop world-class capacity in the quantitative handling of the emergence, spread and combat of major diseases such as HIV/Aids, tuberculoses and malaria, and to provide a more scientific basis for advice to governments and other related organisations on key questions about these diseases.

SACEMA brings together researchers from Stellenbosch, Witwatersrand, KwaZulu-Natal, Zimbabwe and Botswana universities, partnered with experts from Berkeley, London, the World Health Organisation and UNAIDS (Geneva) among others.

For more information, visit www.sacema.com or contact Dr Alex Welte at 021 808 2589 or alexwelte@sun.ac.za.

STELLENBOSCH UNIVERSITY WATER INSTITUTE

The Stellenbosch University Water Institute unites established water research groups in seven Stellenbosch University faculties under one umbrella, to actively contribute towards solving South Africa and the continent's water related challenges. It is rooted in the Faculty of Science, and was established in 2010.

The positive attitude in which researchers involved with the Institute tackle water-related challenges, captures the spirit of the HOPE Project, through which Stellenbosch University uses its key strengths of academic excellence and cutting-edge research to address seemingly intractable problems in society.

Current research projects already being done by its affiliates, in collaboration with government and industry, focus on health, agriculture and food, a sustainable environment, nanotechnology and filtration, effluent treatment and social aspects surrounding water.

Microbiologists, polymer scientists, soil scientists, geologists, invasion biologists, engineers, zoologists, food scientists, biochemists, agricultural economists and a philosopher count among the affiliated researchers who work on topics such as the ethics of freshwater management, ownership of water, the safety of agricultural produce, biofouling and biocorrosion control, community health, financial-economic planning of water use, endocrine disruptors, hydrodynamics, water engineering, catchment and resource management, invasion biology, the geochemical evolution of water and waste waters, and water governance and management.

For more information, visit www.sun.ac.za/water or contact Prof Eugene Cloete at 021 808 3072 or eugenecloete@sun.ac.za.

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