Stellenbosch
UNIVERSITY
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UNIVERSITEIT

2024

Science

Academic programmes and faculty information

Yearbook, Part 5

forward together · sonke siya phambili · saam vorentoe

Please note that the University officially changed the English name "Calendar" to "Yearbook" in August 2023. The new name immediately came into effect in documents and communication of the University and will also be used in all Yearbook parts from the 2024 Yearbook onwards.

Accuracy, liability and changes

- Stellenbosch University has taken reasonable care to ensure that the information provided in the Yearbook parts is as accurate and complete as possible.
- Take note, however, that the University's Council and Senate accept no liability for any incorrect information in the Yearbook parts.
- The University reserves the right to change the Yearbook parts at any time when necessary.

The division of the Yearbook

- The Yearbook is divided into 13 parts.
- Part 1, 2 and 3 of the Yearbook contain general information applicable to all students. Make sure that you understand all provisions in Part 1 (General Rules) of the Yearbook that are applicable to you.
- Part 4 to 13 of the Yearbook are the Faculty Yearbook parts.

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

Availability of the Yearbook parts

- The electronic versions of the Yearbook parts are available at www.sun.ac.za/Yearbook.
- Parts 1 to 12 are available in both English and Afrikaans. Military Science (Part 13) is only available in English.

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How to use this Yearbook Part

This section gives you guidelines for finding particular information in the different chapters in this Yearbook part. Consult the table of contents for the page numbers of the chapters referred to below.

1. Where to find information

1.1 Prospective undergraduate students

- General Information chapter contains information about:
  - Communication with the Faculty and the University, which includes an explanation of the concepts "application number" and "student number" as well as relevant contact details where you can refer important enquiries to;
  - The University's Language Policy and Plan; and
  - The degree programmes that you can enrol for and the qualifications that you can obtain as well as important assessment provisions that are applicable to programmes and modules.
- Undergraduate Programmes chapter contains information about:
  - The minimum admission requirements for the various study programmes;
  - The Faculty's undergraduate study programmes; and
  - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Subjects, Modules and Module Contents chapter contains:
  - An explanation of subjects as opposed to modules;
  - An explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter; and
  - Definitions of prerequisite pass modules, prerequisite modules and corequisite modules.
- Alphabetical list of undergraduate subjects and postgraduate programmes is available in the back of this Yearbook part.

1.2 Prospective postgraduate students

- General Information chapter contains information about:
  - Communication with the Faculty and the University, which includes an explanation of the concepts "application number" and "student number" as well as relevant contact details where you can refer important enquiries to; and
  - The University's Language Policy and Plan.
- Postgraduate Programmes chapter contains information about:
  - The Faculty's postgraduate study programmes;
  - The minimum admission requirements for the various study programmes;
  - Specific closing dates for applications, and other relevant information, for example selection for admission; and
  - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Alphabetical list of undergraduate subjects and postgraduate programmes is available in the back of this Yearbook part.

1.3 Registered undergraduate students

- General Information chapter contains information about:
  - Communication with the Faculty and the University with relevant contact details where you can refer important enquiries to;
  - The University's Language Policy and Plan; and
  - The granting of dean's concession assessments to final-year students.
- Undergraduate Programmes chapter contains information about:
  - The Faculty's undergraduate study programmes; and
  - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Subjects, Modules and Module Contents chapter contains:
  - An explanation of subjects as opposed to modules;

  - An explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter;
  - The abbreviations and definitions used for the teaching loads of individual modules;
  - An indication at each module of what its teaching load is;
  - Definitions of prerequisite pass modules, prerequisite modules and corequisite modules, as well as an indication at each module which of the requisites apply to it, if any; and
- Alphabetical list of undergraduate subjects and postgraduate programmes is available in the back of this Yearbook part.

1.4 Registered postgraduate students

- Postgraduate Programmes chapter contains information about:
  - The Faculty's postgraduate study programmes;
  - The interruption of master's or doctoral studies; and
  - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Alphabetical list of undergraduate subjects and postgraduate programmes is available in the back of this Yearbook part.

General information

1. History and functions of the Faculty of Science

The Faculty of Science dates back to the first days of Stellenbosch University. Over the past decades it became a national and international role player in basic and applied research. Many of our teaching staff excel on an international level or have been awarded national accolades. They also play leading roles within their professional communities, either in a management capacity in professional societies or by being involved in editorial work for various leading journals.

1.1 History, structure and mission

History

The Faculty of Science is the second oldest faculty at Stellenbosch University. Courses in Mathematics and Physical Science were already part of the training offered at the former Stellenbosch Gymnasium in 1866.

With the independence of Stellenbosch University in 1918 the Faculty of Mathematics and Physical Science was established as a separate faculty where students have been able to enrol for a BSc degree. In 1957 the Faculty's name was changed to the Faculty of Science.

Structure

The Faculty consists of the following eight departments:

- Biochemistry;
- Botany and Zoology;
- Chemistry and Polymer Science;
- Earth Sciences;
- Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science)
- Microbiology;
- Physics; and
- Physiological Sciences.

Since 2000 we compile the Faculty's study programmes in line with the Higher Education Criteria and Guidelines and we structure them in such a way that a student may obtain one or more of the following degrees:

- A BSc degree;
- An honours degree (BScHons);
- A master's degree (MSc); or
- A doctoral degree (PhD or DSc).

In addition to the study fields offered by the abovementioned eight departments, students can also obtain a BSc degree with majors such as Genetics, Operations Research, Psychology, Sport Science and Mathematical Statistics. These majors are offered by the Faculties of Medicine and Health Sciences, AgriSciences, Arts and Social Sciences, and Economic and Management Sciences. In addition, the Faculty offers service modules in Science to students in the Faculties of AgriSciences, Economic and Management Sciences, Engineering, Medicine and Health Sciences, and Arts and Social Sciences.

Mission

In line with Stellenbosch University's Vision 2030 and the National Development Plan, the Faculty of Science is committed to positioning the University as a research-focused academic institution of excellence and a respected knowledge partner. By means of quality research outputs the Faculty contributes towards building the scientific, technological and intellectual capacity of Africa, and is playing an active role in South Africa's development. The Faculty endeavours to make a substantial contribution to the National Development Plan's vision to increase the number of PhD graduates from the current 28 to 100 per million per year by 2030.

1.2 Teaching, research and social impact

Teaching

The Faculty's teaching focuses on giving all students the opportunity to develop their full potential by using the most suitable methods of teaching and by encouraging students to think like scientists. The ideal is to produce graduates who are competitive and much sought after in the work environment and who can also function as independent thinkers. To ensure the undergraduate success rate, we established initiatives such as differentiated tutor support (to cater for both outstanding students and those who need additional

support), parallel-medium instruction and interpreting services. Other initiatives, such as the increased integration of Information and Communication Technology into teaching and learning, were facilitated by the Teaching and Learning Forum.

To ensure that our students can communicate effectively in a competitive national and international environment, the Faculty focuses increasingly on equipping students with the necessary scientific language and electronic communication skills.

Research

In the Faculty of Science, we believe that great teaching and quality research go hand in hand. Research is supported with modern equipment and highly trained and experienced staff. Advanced research equipment such as a DNA sequencing unit, an amino acid analysis unit and a high-resolution mass spectrometry unit, managed by the University's Central Analytical Facility, are used successfully by the Faculty's researchers. The Faculty's research institutions are supported financially by the science industry and other organisations. This extensive financial support empowers the research institutions to play a leading role in basic and applied sciences on an international level as well as to support the research of postgraduate South African and international students.

The Faculty's various centra, facilities and institutions support research on different levels. The Faculty strives for a healthy balance between basic and applied research in their various research fields, taking into consideration the needs of the regional community and South Africa at large. The Faculty advocates for a multidisciplinary approach on national and international levels and across subject, faculty and other boundaries. Research is strengthened by the eight research chairs in the Faculty. For a complete list of the research chairs, click here.

Social impact

In addition to the Faculty's focus on teaching and research excellence, another priority is service to the community. The Faculty serves the community by promoting science education at school level. Staff and students share their scientific knowledge on both a formal and an informal basis through community interaction programmes, while the needs of and problems experienced by the wider community are addressed by means of research on specific topics.

2. How to communicate with the Faculty

2.1 Contact details of the Faculty of Science

Direct specific enquiries related to the Faculty to the following address:

Faculty of Science
Stellenbosch University
Private Bag X1
MATIELAND
7602

2.2 Physical address and contact details of the Dean's Office

Dean's physical address

2nd floor, AI Perold Building, Stellenbosch main campus

Contact persons and details

Staff	Telephone number	Email address
Dean Prof L Warnich	021 808 3071	lw@sun.ac.za
Dean's Office Ms S Els	021 808 3072	se@sun.ac.za
Director: Faculty Management Ms M van den Worm	021 808 3760	mvdworm@sun.ac.za
Coordinator: Academic and Student Affairs Ms A Valentyn	021 808 3931	scienceadmin@sun.ac.za
E-learning Instructional Designer Dr I Rootman-le Grange	021 808 3535	ilser@sun.ac.za

Staff	Telephone number	Email address
NARGA: IT Manager Ms I de Kock	021 808 2682	idk@sun.ac.za
Media and Marketing Ms WE Fourie-Basson Ms JM Schoeman	021 808 2684 021 808 3465	wiidabasson@sun.ac.za science2@sun.ac.za
Recruitment and Marketing Ms Q Mhlauli	021 808 2681	science@sun.ac.za

For more information on the Faculty of Science, visit us at www.sun.ac.za/english/faculty/science.

Enquiries about academic administration (Admin A Building)

Staff	Telephone number	Email address
Faculty Administrator Ms S Ruiters **Faculty Officer** Ms L Onraët	021 808 4832 021 808 2904	shivvon@sun.ac.za laureno@sun.ac.za

2.3 Contact details of Departments

Department	Telephone number	Email address	Web page
Biochemistry	021 808 5862	biochair@sun.ac.za	www.sun.ac.za/biochem
Botany and Zoology	021 808 3236	botzoo@sun.ac.za	www.sun.ac.za/botzoo
Chemistry and Polymer Science	021 808 3172	ec@sun.ac.za	www.sun.ac.za/chemistry
Earth Sciences	021 808 3219	gstrydom@sun.ac.za	www.sun.ac.za/earthsci
Mathematical Sciences Mathematics Applied Mathematics Computer Science	 021 808 3282 021 808 4215 021 808 4232	 maths@sun.ac.za appliedmaths@sun.ac.za secretary@cs.sun.ac.za	http://mathsci.sun.ac.za/ http://math.sun.ac.za/ http://appliedmaths.sun.ac.za/ http://www.cs.sun.ac.za/
Microbiology	021 808 5847	wendyw@sun.ac.za	www.sun.ac.za/microbiology
Physics	021 808 3391	physqueries@sun.ac.za	www.sun.ac.za/physics
Physiological Sciences	021 808 3146	gas@sun.ac.za	http://academic.sun.ac.za/physiosciences

2.4 Contact details of the Society for Science Students

You are automatically a member of the Society for Science Students if you are registered as a student for a programme at the Faculty of Science. This Society is managed by the Natural Sciences Student Committee (NSC). For more information on the committee visit the following webpage or contact them electronically:

- http://www.sun.ac.za/english/faculty/science/for-students/sciences-student-committee
- nsk@sun.ac.za

3. How to communicate with the University

3.1 Prospective students

- The University allocates an application number (e.g. APP/1234567) to you when you apply to study at the University.
- The application number is your unique identification to simplify future communication regarding your programme applications with the University.
- Use your application number every time you communicate with the University.

3.2 Current or former Stellenbosch University students

- The University allocates a student number to you when you are admitted to a programme and register at the University.
- The student number is your unique identification to simplify future communication with the University.
- Use your student number every time you communicate with the University.

3.3 Contact details for enquiries about your studies, bursaries, loans and residence placements

- Email: info@sun.ac.za
- Tel: 021 808 9111
- Visit the University's website at http://www.sun.ac.za.

4. Language at the University

Stellenbosch University (SU) is committed to engagement with knowledge in a diverse society and through the Language Policy aims to increase equitable access to SU for all students and staff. Multilingualism is promoted as an important differentiating characteristic of SU. Afrikaans, English and isiXhosa are used in academic, administrative, professional and social contexts. Pedagogically sound teaching and learning are facilitated by means of Afrikaans and English.

More information concerning language at SU is available at www.sun.ac.za/language, and click here for the Faculty Language Implementation Plan.

5. Qualifications offered at the Faculty of Science

You can obtain the following qualifications, with the minimum years of study indicated, at the Faculty of Science:

Degree	Length of degree
BSc	3 years
BSc (ECP)	4 years
BScHons	1 year
MSc (Mathematical Sciences) (AIMS)	3 semesters
MSc	1 or 2 years
PhD	2 years
DSc	1 or 3 years

Please note: You can follow up the BSc degree with an honours degree in a specific subject discipline. After this an MSc and then a PhD, which are both more research focused, can follow. More information on this may be found in the chapter "Postgraduate programmes".

6. Assessment, promotion and Faculty provisions

6.1 Complete general provisions relating to assessments and promotions applicable to degree programmes are contained in Part 1 (General Rules) of the University Yearbook. It is important that you take note of these provisions.

6.2 Except for the provisions in Section 6.1, you must also take note of the following provisions of the Faculty of Science:

- If you are already registered for a degree programme at the Faculty of Science, you cannot register for a second degree programme in another faculty.
- All final marks between 35 and 50 will be allocated in integers of 5; the actual mark you obtained will be allocated for marks below 35 and above 50.
- You can only take modules from different years of study in the same year if the class and test timetables allow for it.
- You will not be allowed to register for modules that clash on the class and/or assessment timetable and you will not be accommodated about attending class and/or writing assessments.
- You can take a module from a specific year of study only if you are in arrears with only half of the credits of a single preceding year of the subject *or* only 16 credits from a combination of two or more preceding years of the subject. Please note this rule is subject to the applicable corequisite, prerequisite and prerequisite pass requirements and depends on the class and assessment

timetables concerned.

- At the **Faculty of Science**, **a student will not be allowed to repeat (a) module(s) already passed.** Under exceptional circumstances, the Dean may grant permission that (a) module(s) could be repeated. For the Dean to consider the request, the head of the relevant department must submit a motivation to the Dean, after consultation with the student. If permission to repeat a module is granted, the marks obtained by repeating the module will not count towards the degree but may be used by the department to determine whether there is a better academic grounding for admission to higher degree programmes.
- If you have followed the first year of your degree programme at the Faculty, you will only be readmitted to the rest of your degree programme if you have obtained at least a 0,50 HEMIS credit for this year. The HEMIS requirements for subsequent years and an explanation of HEMIS credits are available in Part 1 (General Rules) of the Yearbook under the section Admission and Registration.
- If you are following an extended curriculum programme, you cannot repeat modules from the first year. This means that poor class attendance or failing one or more modules in Year 1 will result in academic exclusion; that is, you will not be allowed to continue with this extended curriculum programme.

6.3 Students with credits in arrears

If you are in your second year of study and have credits in arrears from your first year, you may only take 16 credits per semester in addition to the normal credit load of your degree programme. This provision applies to all non-final year registrations.

7. Module requirements (prerequisite pass, prerequisite and corequisite modules)

7.1 Condition for the granting of a qualification or degree

The Faculty will only award a qualification if you have passed all the relevant prerequisite and corequisite modules of the specific degree programme.

In the following tables the prerequisite pass modules, prerequisite modules and corequisite modules are listed next to the applicable subjects and modules.

- **Prerequisite pass module (PP)**
  - A prerequisite pass module is a module that you must pass before you can take the module(s) for which it is a prerequisite pass module.
- **Prerequisite module (P)**
  - A prerequisite module is a module in which you must obtain a final mark of at least 40, before you can take the module for which it is a prerequisite module.
  - If you have once complied with a prerequisite rule, your compliance will remain valid for the period given in the applicable assessment rules, even if you repeat the prerequisite module and do not meet the minimum level when repeating the module.
  - Please note: You must pass all the modules you used as prerequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.
- **Corequisite module (C)**
  - A corequisite module is a module that you must take in the same academic year as the module for which it is a corequisite, or in an earlier academic year.
  - Please note: You must pass all the modules you used as prerequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

7.2 Subjects in the BSc degree programmes

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
43214	Actuarial Science 112	For admission to the module students must have passed Grade 12 Mathematics with a mark of at least 70%
43214	Actuarial Science 211	PP Actuarial Science 112 AND PP Probability Theory and Statistics 144 with a final mark of at least 65% AND PP Mathematics 114, 144 with an average final mark of at least 60% OR PP Mathematics 214 with a final mark of at least 55% C Mathematics 214 C Mathematical Statistics 214
12558	Anatomy 214	P Biology 124, 144 or 154
12558	Anatomy 244	P Anatomy 214
12558	Anatomy 314	P Anatomy 214, 244
12558	Anatomy 324	P Anatomy 214, 244
12558	Anatomy 344	P Anatomy 214, 244, 314
12558	Anatomy 364	P Anatomy 214, 244
52078	Applied Chemistry 315	C Applied Chemistry 324
52078	Applied Chemistry 324	P Chemistry 214, 264
52078	Applied Chemistry 334	PP Chemistry 214, 264
52078	Applied Chemistry 344	P Applied Chemistry 324
52078	Applied Chemistry 345	P Applied Chemistry 315 C Applied Chemistry 344
52078	Applied Chemistry 354	PP Chemistry 264 P Chemistry 214, 234
54429	Applied Kinesiology 313	PP Kinesiology 182
54429	Applied Kinesiology 314	None
54429	Applied Kinesiology 324	None
54429	Applied Kinesiology 344	None
54429	Applied Kinesiology 352	None
54429	Applied Kinesiology 353	PP Kinesiology 182
20710	Applied Mathematics 144	P Mathematics 114 C Mathematics 144
20710	Applied Mathematics 214	P Mathematics 144
20710	Applied Mathematics 244	P Mathematics 114, 144
20710	Applied Mathematics 314	P Applied Mathematics 214 or Mathematics 214
20710	Applied Mathematics 324	P Mathematics 114
20710	Applied Mathematics 354	P Applied Mathematics 144
20710	Applied Mathematics 364	PP Mathematics 114, 144 or Engineering Mathematics 115, 145
20710	Applied Mathematics 476	None
20710	Applied Mathematics 482	None
20710	Applied Mathematics 483	None

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
20710	Applied Mathematics 492	None
20710	Applied Mathematics 493	None
20753	Applied Mathematics B 124	None
20753	Applied Mathematics B 154	P Applied Mathematics B 124 C Engineering Mathematics 115
20753	Applied Mathematics B 224	P Applied Mathematics 144 or Applied Mathematics B 154
20753	Applied Mathematics B 242	P Engineering Mathematics 145 C Applied Mathematics B 224
20753	Applied Mathematics B 252	None
11053	Biochemistry 214	PP Chemistry 124 or 164, 144 PP Biology 124
11053	Biochemistry 244	P Biochemistry 214
11053	Biochemistry 315	PP Biochemistry 214, 244 PP Mathematics (Bio) 124 or Mathematics 114
11053	Biochemistry 323	PP Biochemistry 214, 244 PP Mathematics 114 or Mathematics (Bio) 124
11053	Biochemistry 345	P Biochemistry 315
11053	Biochemistry 365	P Biochemistry 315
53953	Biodiversity and Ecology 212	C Science in Context 178 or Computer Skills 171
53953	Biodiversity and Ecology 214	PP Biology 124 or 144 and a final mark of at least 40% in the other Biology module C Biodiversity and Ecology 212 or an equivalent statistical module
53953	Biodiversity and Ecology 224	PP Biology 144 or 154 and a final mark of at least 40% in the other Biology module
53953	Biodiversity and Ecology 244	PP Biology 124 or 144 and a final mark of at least 40% in the other Biology module
53953	Biodiversity and Ecology 254	PP Biology 144 or 154 and a final mark of at least 40% in the other Biology module
53953	Biodiversity and Ecology 264	PP Biology 144 or 154 and a final mark of at least 40% in the other Biology module
53953	Biodiversity and Ecology 311	None
53953	Biodiversity and Ecology 315	PP Biodiversity and Ecology 212 or 214 and a final mark of at least 40% in the other Biodiversity and Ecology module
53953	Biodiversity and Ecology 324	PP – any two of the following three modules: Biology 124, 144, 154
53953	Biodiversity and Ecology 341	None
53953	Biodiversity and Ecology 342	None
53953	Biodiversity and Ecology 344	PP Biodiversity and Ecology 212 or 214 and a final mark of at least 40% in the other Biodiversity and Ecology module C Biodiversity and Ecology 244
53953	Biodiversity and Ecology 354	PP – any three of the following six modules: Biodiversity and Ecology 212, 214, 224, 244, 254, 264
12555	Bioinformatics 312	None

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
12555	Bioinformatics 322	P Bioinformatics 312
25046	Biology 124	None
25046	Biology 144	C Biology 124
25046	Biology 146	None
25046	Biology 154	C Biology 124
66176	Biomathematics 374	None
11061	Biometry 212	P Mathematics (Bio) 124 or Mathematics 114
11061	Biometry 242	P Biometry 212
59404	Botany 354	PP Biology 144 or 154 and a final mark of at least 40% in the other Biology module
48550	Business Management 113	None
11479	Chemistry 124	None
11479	Chemistry 144	C Chemistry 124
11479	Chemistry 164	If you failed Chemistry 124 in a particular year, you may register for this module in the same academic year only if you achieved a final mark of at least 40% *and* a practical mark of at least 60%.
11479	Chemistry 176	None
11479	Chemistry 214	PP Chemistry 124 or 164; and 144
11479	Chemistry 234	PP Chemistry 124 or 164
11479	Chemistry 254	PP Chemistry 124 or 164 P Mathematics 114 C Mathematics 144
11479	Chemistry 264	PP Chemistry 124 or 164; and 144 P Mathematics 114 or 144 or Mathematics (Bio) 124 or Engineering Mathematics 115 or 145
11479	Chemistry 314	PP Chemistry 264
11479	Chemistry 324	P Chemistry 254 PP Mathematics 114, 144
11479	Chemistry 344	PP Chemistry 214
11479	Chemistry 364	PP Chemistry 234 P Chemistry 264
48321	Chemistry C 152	P Engineering Chemistry 123
48321	Chemistry C 224	PP Engineering Chemistry 123 PP Chemistry C 152
48321	Chemistry C 254	P Chemistry C 224
65692	Chemistry for Health Sciences 112	None
18139	Computer Science 113	C Actuarial Science 112 C Mathematics 114
18139	Computer Science 114	C Mathematics 114
18139	Computer Science 144	P Computer Science 113 or 114
18139	Computer Science 214	PP Computer Science 144 P Mathematics 114
18139	Computer Science 244	P Computer Science 214

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
18139	Computer Science 313	P Computer Science 214, 244
18139	Computer Science 314	P Computer Science 214, 244 For programmes in Engineering: P Computer Science E 214 P Computer Systems 245
18139	Computer Science 315	P Computer Science 144 or Computer Science E214 P Mathematical Statistics 245 and 246; or Systems and Signals 344 P Mathematics 214 or Applied Mathematics 214 or Engineering Mathematics 214
18139	Computer Science 343	P Computer Science 214 For programmes in Engineering: P Computer Science E 214 P Computer Systems 245
18139	Computer Science 344	P Computer Science 214
18139	Computer Science 345	P Computer Science 214
18139	Computer Science 411	P Computer Science 214, 244
18139	Computer Science 412	None
18139	Computer Science 441	None
18139	Computer Science 491	None
18139	Computer Science 495	None
59536	Computer Science E 214	PP Computer Programming 143 P Engineering Mathematics 115, 145
59536	Computer Science E414	P Computer Science 144 or Computer Science E214 P Mathematical Statistics 245 and 246; or Systems and Signals 344 P Mathematics 214 or Applied Mathematics 214 or Engineering Mathematics 214
50040	Computer Skills 171	None
50040	Computer Skills 176	None
50040	Computer Skills 272	P Computer Skills 171 or P Science in Context 178
50040	Computer Skills 372	P Computer Skills 272
36153	Computer Systems 214	P Computer Programming 143; or P Computer Science 114 and 144
36153	Computer Systems 245	C Computer Systems 214
55638	Conservation Ecology 314	None
14019	Data Engineering 245	P Computer Programming 143 or P Computer Science 144
14019	Data Engineering 314	P Engineering Mathematics 214 P Systems and Signals 344 or Mathematical Statistics 214
14026	Data Science 141	None

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
14026	Data Science 241	PP Data Science 141 PP Mathematical Statistics 214 OR PP Probability Theory and Statistics 114 or 144 with at least 60% AND P Mathematical Statistics 214
14026	Data Science 348	PP Data Science 241 C Mathematical Statistics 312
14026	Data Science 316	P Data Science 348 P Mathematical Statistics 312
14736	Data Science Research in Applied Mathematics 472	PP Applied Mathematics 314, 354, 364 PP Mathematical Statistics 312 PP Data Science 344
14738	Data Science Research in Computer Science 471	PP Computer Science 343, 344 PP Mathematical Statistics 312 PP Data Science 344
14739	Data Science Research in Statistical Physics 473	PP Physics 314, 334, 344 PP Mathematical Statistics 312 PP Data Science 344
46833	Design (E)	C Computer Systems 245
12239	Earth Science Field Skills 172	C Geo-environmental Science 124, 154
12239	Earth Science Field Skills 272	PP Earth Science Field Skills 172 PP Geo-environmental Science 154 P Geo-environmental Science 124 C Geology 224, 244, 254 C Environmental Geochemistry 214
12239	Earth Science Field Skills 374	PP Earth Science Field Skills 272 PP Geology 224, 244, 254 C Geology 314, 324, 344, 354
12084	Economics 114	None
12084	Economics 144	C Economics 114
12084	Economics 214	PP Economics 114, 144
12084	Economics 244	PP Economics 114, 144 C Economics 214
12084	Economics 318	PP Economics 214 P Economics 244
12084	Economics 348	PP Economics 214 P Economics 244 C Economics 318
12599	Electrotechnique 143	None
38571	Engineering Mathematics 115	None
38571	Engineering Mathematics 145	P Engineering Mathematics 115
38571	Engineering Mathematics 214	PP Engineering Mathematics 115 or 145 P Engineering Mathematics 145
38571	Engineering Mathematics 242	PP Engineering Mathematics 145 or 214 P Engineering Mathematics 214
59420	Engineering Physics 113	None

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
59420	Engineering Physics 152	P Engineering Physics 113
13622	Environmental Field Skills 271	P Geo-environmental Science 124,154 P Chemistry 124 or 164, 154 C Geography 265 C Environmental Geochemistry 214 C Geology 244
13622	Environmental Field Skills 372	P Environmental Geochemistry 214 P Geography 265 P Environmental Field Skills 271 C Geography 334 C Geology 324, 364 C Environmental Geochemistry 314
63991	Environmental Geochemistry 214	PP Geo-environmental Science 154 P Geo-environmental Science 124 P Chemistry 124 or 164, 144
63991	Environmental Geochemistry 314	PP Environmental Geochemistry 214 PP Chemistry 264 PP Mathematics 114 or Mathematics (Bio) 124 C Chemistry 234
56842	Financial Mathematics 378	PP Mathematics 214, 244 P Mathematical Statistics 214, 245, 246
54690	Financial Risk Management 212	PP Mathematics 114, 144 PP Probability Theory and Statistics 144 PP Theory of Interest 152 or Actuarial Science 112 C Actuarial Science 211 C Mathematical Statistics 214
54690	Financial Risk Management 242	PP Mathematics 114, 144 PP Probability Theory and Statistics 144 PP Theory of Interest 152 or Actuarial Science 112 P Financial Risk Management 212 C Actuarial Science 211 C Mathematical Statistics 214, 245, 246
54690	Financial Risk Management 252	PP Actuarial Science 112 PP Mathematics 114, 144 PP Probability Theory and Statistics 144 C Actuarial Science 211 C Mathematics 214, 244 C Mathematical Statistics 214, 245, 246 C Financial Risk Management 212, 242
10294	General Linguistics 178	None
10294	General Linguistics 278	PP General Linguistics 178
10294	General Linguistics 318	PP General Linguistics 278
10294	General Linguistics 348	PP General Linguistics 278

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
13285	Genetics 214	PP Biology 124 P Mathematics (Bio) 124 or Mathematics 114 or 144 P Animal Science 144 or Biology 144 or 154 or Crop Protection 152 or Probability Theory and Statistics 114
13285	Genetics 215	None
13285	Genetics 244	P Genetics 214
13285	Genetics 245	None
13285	Genetics 314	PP Genetics 244
13285	Genetics 315	P Genetics 245
13285	Genetics 324	PP Genetics 214 C Genetics 244
13285	Genetics 344	PP Genetics 244
13285	Genetics 345	None
13285	Genetics 354	P Genetics 324 P Biometry 212 and 242 or P Psychology 243 and 253 or P Mathematical Statistics 214 or P Biodiversity and Ecology 212
64165	Geo-environmental Science 124	None
64165	Geo-environmental Science 154	None
12923	Geographical Information Technology 141	None
12923	Geographical Information Technology 211	C Mathematics 114 or Mathematics (Bio) 124
12923	Geographical Information Technology 214	P Mathematics 114 or Mathematics (Bio) 124
12923	Geographical Information Technology 241	P Geographical Information Technology 141 or 214
12923	Geographical Information Technology 242	P Geographical Information Technology 211 P Mathematics 114 or Mathematics (Bio) 124
12923	Geographical Information Technology 311	P Geographical Information Technology 241
12923	Geographical Information Technology 312	P Geographical Information Technology 214 or 241
12923	Geographical Information Technology 341	P Geographical Information Technology 312
12923	Geographical Information Technology 342	P Geographical Information Technology 211
56502	Geography and Environmental Studies 265	P Geo-environmental Science 124
56502	Geography and Environmental Studies 334	P Geography and Environmental Studies 265 or P Geographical Information Technology 214
56502	Geography and Environmental Studies 358	P Geography and Environmental Studies 265 or P Geographical Information Technology 214
13374	Geology 224	P Geo-environmental Science 124 P Chemistry 124 or 164 PP Geo-environmental Science 154

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
13374	Geology 244	PP Geo-environmental Science 124, 154 PP Geology 224 C Earth Science Field Skills 272 or Environmental Field Skills 271
13374	Geology 254	PP Geo-environmental Science 124, 154 PP Geology 224 PP Chemistry 124 or 164
13374	Geology 314	P Chemistry 144 PP Geology 224,244,254 PP Chemistry 124 or 164 C Earth Science Field Skills 374
13374	Geology 324	P Chemistry 144 PP Geology 224, 244 PP Chemistry 124 or 164 C Earth Science Field Skills 374 or Environmental Field Skills 372
13374	Geology 344	P Chemistry 144 PP Geology 224, 244 PP Chemistry 124 or 164
13374	Geology 354	P Chemistry 144 PP Geology 224, 244, 254 PP Chemistry 124 or 164
13374	Geology 364	PP Environmental Geochemistry 214 PP Geology 244 C Environmental Field Skills 372 or Earth Science Field Skills 374
14441	Intellectual Property Law for Science, Engineering and Technology 314	None
19305	Kinesiology 162	None
19305	Kinesiology 182	None
19305	Kinesiology 312	None
19305	Kinesiology 332	None
19305	Kinesiology 342	None
19305	Kinesiology 352	None
19305	Kinesiology 372	None
22853	Mathematical Statistics 214	PP Probability Theory and Statistics 114 or 144 PP Mathematics 114, 144 with an average final mark of at least 60% OR PP Mathematics 214 with a final mark of at least 55%
22853	Mathematical Statistics 245	PP Mathematical Statistics 214
22853	Mathematical Statistics 246	PP Mathematical Statistics 214
22853	Mathematical Statistics 312	PP Mathematical Statistics 245 P Mathematical Statistics 246 with a final mark of at least 40% P Mathematics 214

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
22853	Mathematical Statistics 316	PP Mathematical Statistics 246 P Mathematical Statistics 245 with a final mark of at least 40% P Mathematics 214, 244
22853	Mathematical Statistics 344	P Mathematical Statistics 312, 316
22853	Mathematical Statistics 364	P Mathematical Statistics 312, 316
21547	Mathematics (Bio) 124	None
21547	Mathematics (Bio) 176	None
21539	Mathematics 114	None
21539	Mathematics 144	P Mathematics 114
21539	Mathematics 154	None
21539	Mathematics 186	None
21539	Mathematics 214	PP Mathematics 114, 144
21539	Mathematics 244	P Mathematics 214
21539	Mathematics 278	None
21539	Mathematics 314	PP Mathematics 214, 244
21539	Mathematics 324	PP Mathematics 214, 244
21539	Mathematics 344	PP Mathematics 214, 244 or equivalent modules
21539	Mathematics 345	PP Mathematics 114, 144 or equivalent modules
21539	Mathematics 365	PP Mathematics 214, 244
21539	Mathematics 378	None
16284	Microbiology 214	PP Biology 124 or 144 PP Chemistry 124 or 164, 144
16284	Microbiology 244	PP Biology 124 or 144 PP Chemistry 124 or 164, 144
16284	Microbiology 314	PP Microbiology 214 P Microbiology 244 P Biochemistry 214, 244
16284	Microbiology 324	PP Microbiology 214 P Microbiology 244 P Biochemistry 214, 244
16284	Microbiology 354	PP Microbiology 214 P Microbiology 244
16284	Microbiology 364	PP Microbiology 214 P Microbiology 244
44229	Movement Education, Sport and Recreation 212	None
44229	Movement Education, Sport and Recreation 222	None
44229	Movement Education, Sport and Recreation 242	None
44229	Movement Education, Sport and Recreation 282	PP Kinesiology 182
50652	Music Technology 112	None

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
50652	Music Technology 142	None
50652	Music Technology 222	None
50652	Music Technology 252	None
50652	Music Technology 379	None
36323	Numerical Methods 262	P Engineering Mathematics 214
55336	Operations Research 214	P Mathematics 114, 144
55336	Operations Research 244	PP Mathematics 144 P Mathematics 114
55336	Operations Research 314	P Operations Research 244 OR PP Business Analytics 214 and 244 with an average final mark of at least 80%, and a pass mark in a departmental cross-over assessment
55336	Operations Research 322	PP Probability Theory and Statistics 114 or 144 OR PP Business Analytics 214 and 244 with an average final mark of at least 80%, and a pass mark in a departmental cross-over assessment
55336	Operations Research 344	C Operations Research 244 OR PP Business Analytics 214 and 244 with an average final mark of at least 80%, and a pass mark in a departmental cross-over assessment
55336	Operations Research 352	PP Probability Theory and Statistics 114 or 144 OR PP Business Analytics 214 and 244 with an average finale mark of at least 80%, and a pass mark in a departmental cross-over assessment
14689	Organisational Informatics 214	None
14689	Organisational Informatics 244	This module may not be taken simultaneously with or following Computer Science 114.
14689	Organisational Informatics 318	P Organisational Informatics 214 and P Organisational Informatics 244 or P Computer Science 114
14689	Organisational Informatics 348	P Organisational Informatics 318 and PP Organisational Informatics 244 or PP Computer Science 114
13005	Physics (Bio) 134	C Mathematics (Bio) 124 or Mathematics 114
13005	Physics (Bio) 154	P Physics (Bio) 134
12998	Physics 114	C Mathematics 114
12998	Physics 144	P Physics 114 P Mathematics 114 C Mathematics 144
12998	Physics 176	None
12998	Physics 224	PP Physics 114, 144 P Mathematics 114, 144

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
12998	Physics 254	P Mathematics 114, 144 P Physics 224
12998	Physics 314	P Physics 254 P Mathematics 214, 244 or Applied Mathematics 214, 244
12998	Physics 334	PP Physics 224 P Mathematics 214, 244 or Applied Mathematics 214, 244 P Physics 254
12998	Physics 342	P Physics 224, 254 P Mathematics 214, 244 or Applied Mathematics 214, 244
12998	Physics 344	P Mathematics 214 or Applied Mathematics 214 or Physics 224
12998	Physics 352	P Physics 254, 334
12998	Physics 372	None
12998	Physics 384	C Physics 342, 352 or 372
12998	Physics 412	None
12998	Physics 421	None
12998	Physics 457	None
12998	Physics 458	None
13080	Physiology 114	None
13080	Physiology 144	P Physiology 114
13080	Physiology 214	For the Human Life Sciences programme, and the interdisciplinary focal area Applied Medicinal Chemistry: P Biology 124, 154 C Biochemistry 214 For the interdisciplinary focal area Biomedical Mathematical Sciences: P Biology 124 C Biochemistry 214
13080	Physiology 244	P Physiology 214 C Biochemistry 244
13080	Physiology 314	PP Physiology 214, 244 P Biochemistry 214, 244
13080	Physiology 334	PP Physiology 214, 244 P Biochemistry 214, 244
13080	Physiology 344	P Biochemistry 214, 244 P Physiology 314
13080	Physiology 364	PP Physiology 214, 244 P Biochemistry 214, 244
56820	Probability Theory and Statistics 114	None
56820	Probability Theory and Statistics 144	None
18414	Psychology 114	None
18414	Psychology 144	None
18414	Psychology 213	PP Psychology 114, 144

Subject number	Module name	Prerequisite pass (PP), prerequisite (P) or corequisite (C) modules
18414	Psychology 223	PP Psychology 114, 144
18414	Psychology 243	PP Psychology 114, 144
18414	Psychology 314	PP – any three of the following four modules: Psychology 213, 223, 243, 253
18414	Psychology 324	PP – any three of the following four modules: Psychology 213, 223, 243, 253
18414	Psychology 348	PP – any three of the following four modules: Psychology 213, 223, 243, 253
13623	Science in Context 178	None
64866	Scientific Communication Skills 116	None
64866	Scientific Communication Skills 146	None
12263	Scientific Computing 272	None
12263	Scientific Computing 372	P Scientific Computing 272
58173	Socio-informatics 214	None
58173	Socio-informatics 244	None
58173	Socio-informatics 348	None
14176	Soil Science 214	P Chemistry 144
19267	Special Physics 111	None
54607	Sport Science 222	None
54607	Sport Science 232	None
54607	Sport Science 252	None
54607	Sport Science 262	PP Kinesiology 162
54607	Sport Science 382	None
19658	Statistics 318	PP Statistics 214, 224, 244 or PP Mathematical Statistics 214, 245, 246
19658	Statistics 348	P Statistics 318
14223	Statistics and Data Science 188	None
46779	Systems and Signals 214	C Electrotechnique 143
46779	Systems and Signals 244	C Electrotechnique 143 C Engineering Mathematics 214, 242
50563	Textile Science 254	P Chemistry 124 or 164; and 144
64007	University Practice in the Natural Sciences 176	None

8. Rules for dean's concession assessments

8.1 An undergraduate final-year student who, when all the assessments have been taken and 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 the degree, or such credit value in arrears for the degree as the individual faculties permit in highly exceptional cases (in other words, the student has taken the assessments in the modules concerned and failed), may – subject to the provisions of Paragraphs 8.2, 8.3 and 8.4 below – be admitted to a dean's concession assessment (DCA) as a concession by the Dean, in consultation with the department(s) concerned. Please note that you must have been registered for the module(s) concerned in the specific year and that you must have obtained a final mark of at least 35% in the(se) module(s).

8.2 Such students shall be identified by the faculty administrator, 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 administrator in good time (not later than 15 January) about their admission to the DCA.

8.3 If the student fails the module in the DCA, no further DCA shall be granted, and the student **has to** register for the module again.

8.4 The DCA shall be scheduled by the relevant department for January or February. Students who have been granted a DCA shall ascertain timeously from the department concerned when and where the DCA in question is to be taken. They shall ensure that they present themselves at such time and place.

8.5 DCAs shall be granted only with the approval of the Dean. **No student shall be granted a DCA by any department under any circumstances**. No lecturer can give an undertaking to a student in this matter.

8.6 Admission to a DCA in a module is subject to the rules of the faculty offering the module. For the rules governing DCAs in modules not offered by the Faculty of Science, consult the relevant faculty's Yearbook part or the faculty administrator.

Undergraduate programmes

1. Admission requirements

1.1 School-leaving qualifications

For admission to the University you need:

- A National Senior Certificate or school-leaving certificate from the Independent Examination Board as certified by Umalusi with admission to bachelor's* degree studies; or
- A university exemption certificate issued by the South African Matriculation Board to students with other school qualifications.

*Admission to bachelor's degree studies requires that you obtain a mark of at least 4 (50-59%) in each of four designated university admission subjects.

1.2 Minimum admission requirements for BSc degree programmes

To be considered for selection for the BSc degree programmes at the Faculty, you must meet the following minimum admission requirements:

1.2.1 National Senior Certificate (NSC) or Independent Examination Board (IEB) school-leaving certificate

- An average final mark of 65% in the National Senior Certificate or the school-leaving certificate from the Independent Examination Board (excluding Life Orientation);
- For degree programmes in the Physical and Mathematical Sciences, a final mark of 70% (6) for Mathematics; OR
- For degree programmes in the Biological Sciences when you take Mathematics (Bio) 124 and Physics (Bio) 134, 154, a final mark of 60% (5) for Mathematics; OR if you are planning to take Mathematics 114, 144 and Physics 114, 144, a final mark of 70% (6) for Mathematics;
- For degree programmes in the Biological Sciences and Physical Sciences, a final mark of 50% (4) for Physical Sciences;
- For degree programmes in the Mathematical Sciences when you choose Chemistry and/or Physics, a final mark of 50% (4) for Physical Sciences;
- A final mark of 50% (4) for Afrikaans or English (Home Language or First Additional Language); and
- A final mark of 50% (4) for one other designated university admission subject.

1.2.2 School qualifications other than the National Senior Certificate or the Independent Examination Board school-leaving certificate

- If you have a school qualification other than the National Senior Certificate or the Independent Examination Board school-leaving certificate, you must ensure that you can obtain a university exemption certificate from the South African Matriculation Board.
- You must have taken both Physics and Chemistry as school subjects if Physical Sciences are set as admission requirement.

*See the programme specific requirements as set for other school systems in the back of this Yearbook part.

1.2.3 Physical Sciences as school subject

- If you want to register for a programme in the Biological or Physical Sciences, you must have taken Physical Sciences or both Chemistry and Physics as school subject(s).
- If you want to register for any module in Chemistry or Physics, you must have taken Physical Sciences or both Chemistry and Physics as school subject(s).

1.2.4 Life Sciences as school subject

If you want to register for a programme in the Biological Sciences, it is recommended that you must have taken Life Sciences as a school subject, although this is not an admission requirement.

1.3 Selection requirements

1.3.1 Your admission to the Faculty of Science is dependent on the availability of places per programme and the Faculty follows a selection process in order to obtain enrolment targets.

1.3.2 Meeting the minimum admission requirements of the programme you are applying for does not guarantee selection for your chosen programme. See the tables in Section 1.7 below.

1.3.3 You must **also** meet the specific selection requirements for a specific year. The Faculty's selection

policy and procedures are available at www.maties.com.

1.3.4 If you want to register for a programme in the Biological Sciences, please note that you may be required to work with animal- and/or human-biological material. In the case of animals, it may also include primary sample collection.

1.4 How to apply

Apply online at SUNStudent (https://student.sun.ac.za) and follow the prompts to submit your completed application before **30 June** of the year preceding your intended studies.

1.5 Prospective students who are already in possession of a school-leaving certificate, as certified by Umalusi, when applying

- If you apply to the University after obtaining a school leaving certificate, your application will be considered if you meet the selection requirements that are applicable in the year that you apply.
- All applications will be considered according to the selection process. If you do not meet the admission requirements, but are busy improving your final school marks during the time that you are applying, your application will be placed on a waiting list until the improved final marks are available.

1.6 Admission requirements for the BSc (extended curriculum programmes)

These programmes offer an alternative route to the programmes in the Biological, Physical and Mathematical Sciences.

If you meet all but one of the minimum admission requirements for BSc degree programmes, you can apply for admission to an extended curriculum programme. To be considered for this, the requirements are as follows:

- A final mark of at least 50% (4) for Afrikaans or English (Home Language or First Additional Language); and
- Physical Sciences as school subject; and
- Either an average final mark of at least 60% in the National Senior Certificate, excluding Life Orientation; OR
- At least 45% for Physical Sciences; OR
- For programmes in the Physical and Mathematical Sciences, a final mark of either at least 65% for Mathematics; OR
- For programmes in the Biological Sciences, a final mark of at least 55% for Mathematics.

*See the table with programme specific minimum requirements for admission to the BSc (extended curriculum programmes) in Appendix 2 of this Yearbook part.

The Faculty of Science selects a limited number of students for the BSc extended curriculum programmes and preference is given to socio-economically disadvantaged South African learners. The selection policy and procedures are available at www.maties.com.

The duration of an extended curriculum programme is at most one year longer than the mainstream degree programme. Please note the following:

- During the first year of the programme your knowledge base is strengthened and your skills are developed to prepare you to enter the mainstream modules from your second year of study.
- Class attendance is compulsory and you must pass all modules in Year 1 to proceed to the next year of study.
- You cannot repeat modules from the first year. This means that poor class attendance or failing one or more modules in Year 1 will result in you not being readmitted to the extended curriculum programme.
- If you complete this degree programme successfully, you will receive a degree certificate from the University that is exactly the same as those received by mainstream students.

1.7 Admission to the BSc degree programme with prior tertiary learning

If you have already completed applicable modules before enrolling for a BSc programme at the Faculty of Science, you may apply for the recognition and exemption of modules that you have already completed.

Your application for recognition of prior learning (RPL/CAT) will be considered by the Academic Committee, and you will receive written feedback. Refer to the document "Recognition of Prior Learning and Credit Accumulation and Transfer (RPL/CAT) Procedures for the Faculty of Science" for details. Contact **scienceadmin@sun.ac.za** for access to the document.

- **Please note:** Only credits completed in the preceding **five years** are normally considered to be transferable.
- Recognition will be granted per module (in other words, recognition is not granted for parts of modules) and is subjected to the curriculum, outcomes and credits of the completed module which

must largely meet or exceed the requirements of the corresponding module within the programme you want to follow.

To obtain a BSc degree at the Faculty of Science with recognition for modules from other programmes or institutions, you must meet the following requirements:

- You must have obtained a school-leaving certificate with admission to bachelor's degree studies before starting with the subjects that will possibly be acknowledged for the BSc degree;
- You must register for the specific degree programme for at least two academic years at the Faculty of Science, Stellenbosch University; and
- You must obtain at least half of the total number of credits, including all final-year credits prescribed for the proposed degree, at the Faculty of Science, Stellenbosch University.
- The content and outcomes of the modules (module framework or syllabus guide) that you are asking recognition for, must be included in the application.

1.7.1 Applicants from other programmes; or with a qualification obtained at Stellenbosch University

1.7.1.1 This section applies to you if you began your studies in another programme at Stellenbosch University and want to **change to a BSc programme** at the Faculty of Science.

Admission requirements

To change in the middle of an academic year

- You must meet the minimum admission requirements, as well as the selection requirements as applied in that specific year (also applicable to applicants without any prior tertiary learning). (See Section 1.2 and 1.3 above.)
- You must be in a position to comply with the Faculty of Science specific minimum HEMIS credit requirements at the end of the year of the planned change. These credits must be obtained by following modules that are prescribed in the curriculum of the programme to which you plan to change.
- Your study record is important in the consideration of your application.
- Transferring module credits already obtained in another programme will be evaluated on an individual basis.

Admission requirements

To change at the beginning of an academic year

- You must meet the minimum admission requirements as well as the selection requirements that also apply to applicants without any prior tertiary learning. (See Section 1.2 and 1.3 above.)
- You must be in a position to comply with the Faculty of Science specific minimum HEMIS credit requirements.
- Your study record is important in the consideration of your application.
- Transferring module credits already obtained in another programme will be evaluated on an individual basis.

Application procedure

Contact the Coordinator: Academic and Student Affairs for more information on the application procedure. The application will serve at the Faculty's Academic Committee, chaired by the Vice-dean: Teaching and Learning.

1.7.1.2 This section applies to you if you **obtained a qualification at Stellenbosch University** and want to enrol for a BSc programme in the Faculty of Science

Admission requirements

- You must meet the admission requirements, as well as the selection requirements that also apply to applicants without any prior tertiary learning. (See Section 1.2 and 1.3 above.)
- See Section 1.7 above and refer to the document "RPL/CAT Procedures for the Faculty of Science" for more details relating to RPL/CAT. Contact **scienceadmin@sun.ac.za** to request access to this document.
- Transferring module credits already obtained in another programme will be evaluated on an individual basis.
- Less than 50% of the credits already obtained will be recognised as credits for the new degree programme.
- Your study record is important in the consideration of your application.

Application procedure

Apply online at SUNStudent (https://student.sun.ac.za) and follow the prompts to submit your completed application before **30 June** of the year preceding your intended studies.

1.7.2 Applicants from programmes of, or with qualifications from, other universities in South Africa

1.7.2.1 This section applies to you if you began your studies at another university, but want to **continue your studies in a BSc programme in the Faculty of Science at SU.** A minimum of two years' registration at SU is required to obtain a degree from SU.

Admission requirements

To be admitted to a BSc degree programme in the Faculty of Science on the basis of your prior studies at another university, you must meet the following requirements:

- You must meet the minimum admission requirements as well as the selection requirements that also apply to applicants without any prior tertiary learning (see Section 1.2 and 1.3 above); or
- If you do not meet the admission requirements, you may apply for admission based on prior learning. See Section 1.7 above and refer to the document "RPL/CAT Procedures for the Faculty of Science" for more details. Contact scienceadmin@sun.ac.za to request access to this document.
- You must meet the requirements to continue with your studies at the university where you studied before or where you are studying at the time of your application.
- Your study record is important in the consideration of your application.
- Transferring modules already obtained in another programme will be evaluated on an individual basis.

Application procedure

Apply online at SUNStudent (https://student.sun.ac.za) and follow the prompts to submit your completed application before **30 June** of the year preceding your intended studies.

1.7.2.2 This section applies to you if you **have obtained a qualification at another university in South Africa** and want to enrol for a BSc programme in the Faculty of Science, SU. A minimum of two years' registration at SU is required to obtain a degree from SU.

Admission requirements

To be admitted to a BSc degree programme in the Faculty of Science on the basis of your prior studies at another university, you must meet the following requirements:

- You must meet the admission requirements as well as the selection requirements that also apply to applicants without any prior tertiary learning (see Section 1.2 and 1.3 above); or
- If you do not meet the admission requirements you may apply for admission based on prior learning. See Section 6.1 above and refer to the document "RPL/CAT Procedures for the Faculty of Science" for more details. Contact scienceadmin@sun.ac.za to request access to this document.
- Your study record is important in the consideration of your application.
- Transferring modules already obtained in another programme will be evaluated on an individual basis.

Application procedure

Apply online at SUNStudent (https://student.sun.ac.za) and follow the prompts to submit your completed application before **30 June** of the year preceding your intended studies.

1.7.3 Applicants from universities outside South Africa

Admission requirements

To be admitted to a BSc degree programme in the Faculty of Science on the basis of your prior studies at another university outside South Africa, you must meet the following requirements:

- You must meet the minimum admission requirements as well as the selection requirements that also apply to applicants without any prior tertiary learning (see Section 1.2 and 1.3 above).
- See Section 1.7 above and refer to the document "RPL/CAT Procedures for the Faculty of Science" for more details relating to recognition of prior learning/credit accumulation and transfer. Contact scienceadmin@sun.ac.za to request access to this document.
- In the event of an incomplete qualification, you must meet the requirements to continue with your studies at the university where you studied before or where you are studying at the time of your application.
- Your study record is important in the consideration of your application.
- Transferring modules already obtained in another programme will be evaluated on an individual

basis.

Application procedure

Apply online at SUNStudent (https://student.sun.ac.za) and follow the prompts to submit your completed application before **30 June** of the year preceding your intended studies.

The Stellenbosch University International Services Centre (SUI) will assist with the assessment of foreign qualifications and prior learning.

1.7.4 Recognition of prior learning not covered in the sections above

If you want to apply for admission based on the recognition of modules completed elsewhere, but your situation is not covered in Sections 1.7.1; 1.7.2 or 1.7.3 above, contact scienceadmin.ac.za for procedures for recognition of prior learning. The following details of prior learning must be included with your application:

- the name of the programme,
- a description (contents, scope and outcomes),
- the assessment criteria,
- the type of assessments,
- the accreditation of the institution, and
- when the learning was obtained.

Please note: If you leave out any of this information, your application cannot be processed. Experience in itself is **not** recognised; it must be **learning** that has been assessed in a recognised manner.

The Academic Committee of the Faculty will consider your application by comparing your education with relevant module contents, outcomes and credits. The committee can:

- refuse your application with relevant reasons;
- recognise certain module(s);
- recommend that you complete mainstream assessments for certain modules; and/or
- request a personal interview (which will be considered as an oral assessment). At least two academic staff members must be present during this interview.

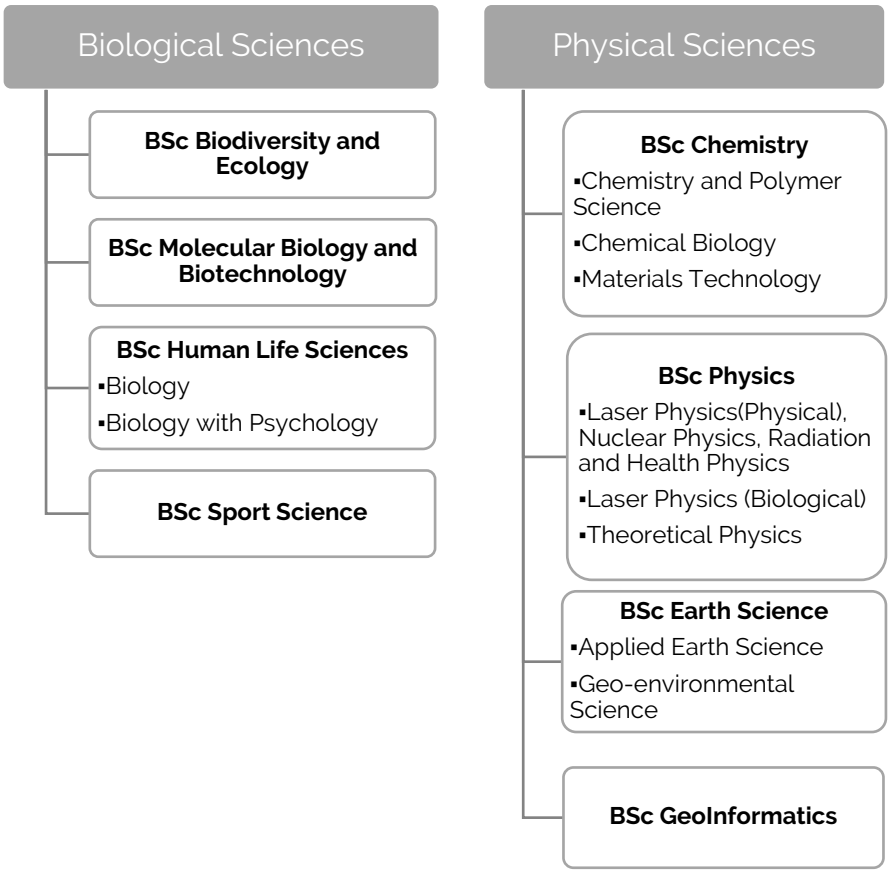
The Faculty Administrator will give you written feedback

1.8 Summary of undergraduate programmes and admission requirements per programme

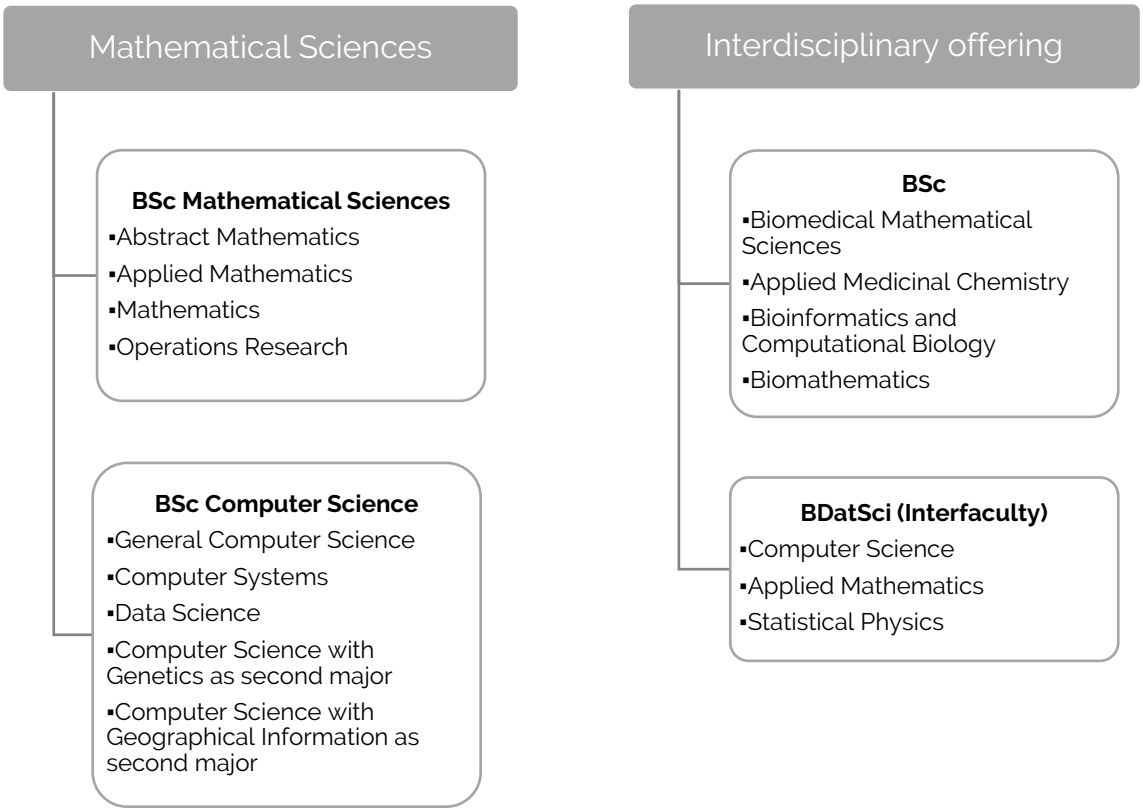
The curricula or combination of subjects that you can take for a BSc degree are represented in terms of programmes. A programme can consist of a number of prescribed curricula, where each specific curriculum is known as a focal area.

The two diagrams below offer a representation of the programmes and focal areas for a BSc degree. We offer eleven degree programmes, grouped together in four main fields, namely the Biological, Physical and Mathematical Sciences, and an interdisciplinary field. We also offer three of the focal areas in the BDatSci programme. The various programmes and their additional focal areas, where applicable, are set out in the categories for Biological, Physical and Mathematical Sciences and the interdisciplinary offering.

The Faculty's programmes and focal areas



The Faculty's programmes and focal areas



The four tables below give a breakdown of the first-year curricula that must be taken for specific programmes, focal areas within programmes, as well as the combination of subject-specific admission requirements applicable to a specific programme or focal area. Consult Section 3 of this chapter for all first-year curricula and the applicable subjects and modules for each.

Biological Sciences

Programmes, focal areas in programmes and *first-year curriculum*	**Admission requirements**
Biodiversity and Ecology *(Curriculum 1)*	An average final mark of 65%, excluding Life Orientation Afrikaans or English (Home Language or First Additional Language) 4 Physical Sciences 4 Mathematics 6 (If you will be taking Mathematics 114, 144 and Physics 114, 144) **OR** Mathematics 5 (If you will be taking Mathematics (Bio) 124 and Physics (Bio) 134, 154)
Molecular Biology and Biotechnology *(Curriculum 1, or adapted curriculum 3)*	
Human Life Sciences 1. Focal area: Biology *(Curriculum 1, or adapted curriculum 3)* 2. Focal area: Biology with Psychology *(Curriculum 2)*	
Sport Science *(Curriculum specific to programme)*	

Physical Sciences

Programmes, focal areas in programmes and *first-year curriculum*	**Admission requirements**
Chemistry 1. Focal area: Chemistry and Polymer Science *(Curriculum 3, or 4, or 5, or 6)* 2. Focal area: Chemical Biology *(Curriculum 3)* 3. Focal area: Materials Technology *(Curriculum 3, or 5, or 6)*	An average final mark of 65%, excluding Life Orientation Afrikaans or English (Home Language or First Additional Language) 4 Physical Sciences 4 Mathematics 6
Physics 1. Focal areas: Laser Physics (Physical), Nuclear Physics, Radiation and Health Physics *(Curriculum 5, or 6, or 7)* 2. Focal area: Laser Physics (Biological) *(Curriculum 3)* 3. Focal area: Theoretical Physics *(Curriculum 7)*	
Earth Science *(Curriculum specific to focal areas* 1. Focal area: Applied Earth Science 2. Focal area: Geo-environmental Science	An average final mark of 65%, excluding Life Orientation Afrikaans or English (Home Language or First Additional Language) 4 Physical Sciences 4 Mathematics 6 (If you will be taking Mathematics 114, 144 and Physics 114, 144) **OR** Mathematics 5 (If you will be taking Mathematics (Bio) 124 and Physics (Bio) 134, 154)
GeoInformatics *(Curriculum specific to programme)*	

Mathematical Sciences

Programme, focal areas in the programme and *first-year curriculum*	Admission requirements
Mathematical Sciences 1. Focal area: Applied Mathematics *(Curriculum specific to programme)* 2. Focal area: Mathematics *(Curriculum specific to programme)* 3. Focal area: Operations Research *(Curriculum specific to programme)* 4. Focal area: Abstract Mathematics *(Curriculum specific to programme)*	An average final mark of 65%, excluding Life Orientation Afrikaans or English (Home Language or First Additional Language) 4 Mathematics 6 Any other school subject from the designated subject list for university admission 4 **OR** Physical Sciences 4 (If you will be taking Physics or Chemistry)
Computer Science 1. Focal area: General Computer Science *(Curriculum specific to programme)* 2. Focal area: Computer Systems *(Curriculum specific to programme)* 3. Focal area: Data Science *(Curriculum specific to programme)* 4. Focal area: Computer Science with Genetics as second major *(Curriculum specific to programme)* 5. Focal area: Computer Science with Geographical Information Technology as second major *(Curriculum specific to programme)*	An average final mark of 65%, excluding Life Orientation Afrikaans or English (Home Language or First Additional Language) 4 Mathematics 6 Any other school subject from the designated subject list for university admission 4 **OR** Physical Sciences 4 (If you will be taking Physics or Chemistry)

Interdisciplinary offering

Programme, focal areas in the programme and *first-year curriculum*	Admission requirements
Interdisciplinary BSc Offering 1. Focal area: Biomedical Mathematical Sciences *(Curriculum specific to programme)* 2. Focal area: Applied Medicinal Chemistry *(Curriculum specific to programme)* 3. Focal area: Bioinformatics and Computational Biology *(Curriculum specific to programme)* 4. Focal area: Biomathematics *(Curriculum specific to programme)*	An average final mark of 65%, excluding Life Orientation Afrikaans or English (Home Language or First Additional Language) 4 Physical Sciences 4 Mathematics 6
BDatSci (Interfaculty) 1. Focal area: Computer Science *(Curriculum specific to programme)* 2. Focal area: Applied Mathematics *(Curriculum specific to programme)* 3. Focal area: Statistical Physics *(Curriculum specific to programme)*	An average final mark of 80%, excluding Life Orientation Mathematics 80% *One of the following*: • Afrikaans Home Language 60% • English Home Language 60% • Afrikaans First Additional Language 75% • English First Additional Language 75%

2. Principles used to compile the BSc degree programme

The three-year BSc degree programme consists of at least 24 standard semester modules (after this named standard modules) of 16 credits each, plus the modules that include the compulsory generic skills (such as Computer Skills 171, 272 and Scientific Communication Skills 172).

You must take at least 18, but preferably more, of these standard modules from the core subjects. The Science Faculty Board will consider approving acknowledged equivalent modules.

The following rules regarding module combinations (plus the modules that include the compulsory generic skills) apply to the three-year BSc degree:

- First year: You must take at least 8 standard modules at first-year level.
- Second year: You must take at least 8 standard modules with at least 6 modules at second-year level.
- Third year: You must take at least 8 standard modules with at least 6 modules at third-year level. At least 4 of these 6 standard modules must be from the core subjects, generally leading to 2 majors making provision for at least 2 postgraduate options. The remaining 2 standard modules may be at second-year level.

All three-year BSc programmes must contain at least 1 standard module in Mathematics and at least 2 standard modules, but preferably more, in the core subjects outside your major category. The Faculty's current approved first-year curricula ensure that your programme compilation meets these requirements.

For programme compilation a major is defined as follows:

- A number of approved and 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.

Please note: You can follow up the BSc degree with a BScHons degree in a specific subject discipline. After this an MSc and then a PhD, which are both more research focused, can follow. For more information regarding the postgraduate degrees refer to the chapter "Postgraduate programmes".

3. Curricula for the BSc (extended curriculum programmes)

3.1 First-year curriculum for the four-year BSc (extended curriculum programmes)

YEAR 1 (146 CREDITS)

Compulsory Modules

Biology	146(16)
Chemistry	176(32)
Computer Skills	176(8)
Physics	176(32)
Scientific Communication Skills	116(12), 146(6)
University Practice in the Natural Science	176(8)

and

Mathematics (Bio)	176(32) **OR**
Mathematics	186(32)

YEARS 2, 3 AND 4

Once you have successfully completed your first year in the extended curriculum programme, you can choose from the curricula from Year 1, 2 and 3 as per the mainstream degree programmes in the Biological, Physical and Mathematical Sciences.

4. Curricula for all years of study in the BSc degree programmes

Each programme or focal area of a programme will list the compulsory modules and elective modules, if any of the latter, for each academic year. To obtain the BSc degree, you must follow and pass the prescribed curriculum (subjects and modules) of your chosen programme or focal area.

The various programme curricula that can be followed for the BSc degree are set out in the following sections.

4.1 Programmes in the Biological Sciences

There are four programmes in the Biological Sciences group. Consult the sections below for more information on each of the programmes as well as the various focal areas, where applicable.

4.1.1 Biodiversity and Ecology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

This programme leads to:

- An honours programme in Biodiversity and Ecology, which leads to a master's programme in Botany or Zoology.
- An honours programme in Applied Plant Physiology.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 108)

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Mathematics (Bio)	124(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 32)

Choose one of the following options.

Option 1

Geo-environmental Science	124(16)
Geographical Information Technology	141(16)

or

Option 2

Physics (Bio)	134(16), 154(16)

2ND YEAR (CREDITS = MINIMUM 128, MAXIMUM 144)

Compulsory Modules

(credits = 96)

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

plus

Elective Modules

(credits = minimum 32, maximum 48)

Choose one of the following two subjects. You must take both modules of your chosen subject.

Geographical Information Technology	214(16), 241(16)
Genetics	214(16), 244(16)

plus

Additional Elective Module

Geography and Environmental Studies	265(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

(credits = 112)

Biodiversity and Ecology	311(16), 315(16), 324(16), 341(16), 342(16), 344(16), 354(16)

plus

Elective Module

(credits = 16)

Choose one of the following modules.

Geographical Information Technology	312(16)
Genetics	314(16)

4.1.2 Molecular Biology and Biotechnology

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Physical Sciences – 4
- Mathematics – 6 (If you will be taking Mathematics 114, 144 and Physics 114, 144)

OR

- Mathematics – 5 (If you will be taking Mathematics (Bio) 124 and Physics (Bio) 134, 154)

Continued Study Possibilities

Third-year major study possibilities lead to:

- Major subject 1 leads to an honours programme in Biochemistry.
- Major subject 2, option 1 is required for admission to the honours programme in Genetics.
- Major subject 2, option 2 is recommended for admission to the honours programme in Plant Biotechnology.
- Major subject 3 leads to an honours programme in Microbiology.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 76)

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Science in Context	178(12)

plus

Option 1

(credits = 64)

Biology	144(16)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

or

Option 2

(credits = 64)

Mathematics	114(16), 144(16)
Physics	114(16), 144(16)

2ND YEAR (144 CREDITS)

Compulsory Modules

(credits = 128)

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Genetics	214(16), 244(16), 245(16) Genetics 245 is recommended for admission to the honours programme in Plant Biotechnology.
Microbiology	214(16), 244(16)

plus

Elective Modules

(credits = 16)

Choose one of the following two modules.

Chemistry	214(16)
Genetics	215(16) Genetics 215 is recommended for admission to the honours programme in Plant Biotechnology.

3RD YEAR (128 CREDITS)

Compulsory Modules

Choose two major subjects. You must take all the modules of your chosen major subjects.

Major subject 1

Biochemistry	315(16), 323(8), 345(16), 365(16) AND
Bioinformatics	312(8)

Major subject 2, option 1

Genetics	314(16), 324(16), 344(16), 354(16)

Major subject 2, option 2

Genetics	314(16), 315(16), 344(16), 345(16)

Major subject 3

Microbiology	314(16), 324(16), 354(16), 364(16)

4.1.3 Human Life Sciences

This programme consists of two focal areas, namely Biology, and Biology with Psychology.

4.1.3.1 Focal area: Biology

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Physical Sciences – 4
- Mathematics – 6 (If you will be taking Mathematics 114, 144 and Physics 114, 144)

OR

- Mathematics – 5 (If you will be taking Mathematics (Bio) 124 and Physics (Bio) 134, 154)

Continued Study Possibilities

- This focal area leads to an honours programme in Physiological Sciences.
- If you take applicable elective modules, this focal area also leads to an honours programme in Anatomy, Biochemistry or Genetics.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 76)

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Science in Context	178(12)

plus

Option 1

(credits = 64)

Biology	144(16)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

or

Option 2

(credits = 64)

Mathematics	114(16), 144(16)
Physics	114(16), 144(16)

2ND YEAR (144 CREDITS)

Compulsory Modules

(credits =112)

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Genetics	214(16), 244(16)
Physiology	214(16), 244(16)

plus

Elective Modules

(credits = 32)

Choose one of the following subjects. You must take both modules of your chosen subject.

Anatomy	214(16), 244(16) A maximum of 30 students will be selected on merit for Anatomy 214 and 244. To be considered, you must obtain an average of 60% for the first year, with 60% for Biology 124 and 154, respectively. The Faculty of Medicine and Health Sciences may however decide not to select any students in a particular year.
Microbiology	214(16), 244(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

(credits = 64)

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

plus

Elective Modules

(credits = 64)

Choose one of the following subject options: Anatomy; or Biochemistry and Bioinformatics; or Genetics. You must take all the modules of your chosen subject option.

Anatomy	314(16), 324(16), 344(16), 364(16)
Biochemistry	315(16), 323(8), 345(16), 365(16) AND
Bioinformatics	312(8)
Genetics	314(16), 324(16), 344(16), 354(16)

4.1.3.2 Focal area: Biology with Psychology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Physiological Sciences, Genetics or Psychology.

For more information on admission to the honours programme in Physiological Sciences, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part. For more information on admission to the honours programme in Psychology, please consult the Faculty of Arts and Social Sciences Yearbook, Part 4. For more information on admission to the honours programme in Genetics, please consult the Faculty of AgriSciences Yearbook, Part 7.

1ST YEAR (148 CREDITS)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Psychology	114(12), 144(12)
Science in Context	178(12)

2ND YEAR (136 CREDITS)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Genetics	214(16), 244(16)
Physiology	214(16), 244(16)
Psychology	213(8), 223(8), 243(8)

3RD YEAR (144 CREDITS)

Compulsory Modules

Choose one of the following two options.

Option 1

Genetics	314(16), 344(16)
Physiology	314(16), 334(16), 344(16), 364(16)
Psychology	314(12), 324(12), 348(24)

or

Option 2

Genetics	314(16), 324(16), 344(16), 354(16)
Physiology	314(16), 364(16)
Psychology	314(12), 324(12), 348(24)

4.1.4 Sport Science

Specific Minimum Admission Requirements

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

Special Provisions

- Selection for the programme is done according to clear guidelines, which are based on both academic and non-academic merits. If you are selected, you must complete a medical history form. If you are declared medically unfit, you will not be allowed to register for or continue with this programme.
- You must obey the prescribed regulations regarding clothing. You can obtain more information on these rules from the Department of Sport Science at the beginning of the academic year.

Continued Study Possibilities

This programme leads to:

- An honours programme in Biokinetics.
- An honours programme in Sport Science, Specialisation: Performance Sport.
- An honours programme in Sport Science, Specialisation: Kinderkinetics.
- An honours programme in Physiological Sciences.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Kinesiology	162(8), 182(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)
Science in Context	178(12)

2ND YEAR (128 CREDITS)

Compulsory Modules

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 (134 CREDITS)

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)

plus

Elective Modules

(credits = 24)

Choose one of the following subjects. You must take both modules of your chosen subject.

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

or

Applied Kinesiology (Sport Coaching)	313(12), 353(12)

or

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

4.2 Programmes in the Physical Sciences

There are four programmes in the Physical Sciences group. Consult the sections below for more information on each one of the programmes as well as the various focal areas where applicable.

4.2.1 Chemistry

This programme consists of three focal areas, namely Chemistry and Polymer Science; Chemical Biology; and Materials Technology.

4.2.1.1 Focal area: Chemistry and Polymer Science

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Chemistry, Microbiology or Polymer Science.
- If applicable elective modules are taken as indicated in Option 1, this focal area also leads to an honours programme in Applied Mathematics, Computer Science, Earth Sciences, Mathematics or Physics.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 108)

Chemistry	124(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 32)

Choose modules to the value of 32 credits from the following subjects.

Applied Mathematics	144(16)
Biology	124(16), 144(16) or 154(16)
Computer Science	114(16), 144(16)
Geo-environmental Science	124(16), 154(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Chemistry	214(16), 234(16), 254(16), 264(16)

plus

Computer Skills	272(5)

or

Scientific Computing	272(5)

plus

Elective Modules

(credits = 64)

Choose modules to the value of 64 credits from the following subjects.

Applied Mathematics	214(16), 244(16)
Biochemistry	214(16), 244(16)
Computer Science	214(16), 244(16)
Environmental Geochemistry	214(16)
Genetics	214(16), 244(16)
Geology	224(16), 244(16), 254(16)

Mathematics	214(16), 244(16), 278(32)
Microbiology	214(16), 244(16)
Physics	224(16), 254(16)
Textile Science	254(16)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Chemistry	314(16), 324(16), 344(16), 364(16)

plus

Computer Skills	372(5)

or

Scientific Computing	372(5)

plus

Elective Modules

(credits = 64)

Choose modules to the value of 64 credits from the following subjects.

If you want to take Applied Chemistry as a second major, you must take four of the modules.

Applied Chemistry	315(16), 324(16), 344(16), 345(16), 354(16)
Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Computer Science	313(16), 314(16), 343(16), 344(16)
Environmental Geochemistry	314(16)
Geology	324(16), 344(16), 364(16)
Mathematics	314(16), 324(16), 344(16), 365(16), 378(32)
Microbiology	314(16), 324(16), 354(16), 364(16)
Physics	314(16), 334(16), 342(8), 352(8), 344(16) OR 384(16)

4.2.1.2 Focal area: Chemical Biology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Chemistry or Biochemistry.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Science in Context	178(12)

2ND YEAR (133 CREDITS)

Compulsory Modules

Biochemistry	214(16), 244(16)
Chemistry	214(16), 234(16), 254(16), 264(16)
Microbiology	214(16), 244(16)

plus

Computer Skills	272(5)

or

Scientific Computing	272(5)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 112)

Biochemistry	315(16), 323(8), 365(16)
Bioinformatics	312(8)
Chemistry	314(16), 324(16), 344(16), 364(16)

plus

Computer Skills	372(5)

or

Scientific Computing	372(5)

plus

Elective Module

(credits = 16)

Choose one of the following modules.

Applied Chemistry	354(16)
Biochemistry	345(16)

4.2.1.3 Focal area: Materials Technology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Chemistry or Polymer Science.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 108)

Chemistry	124(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 32)

Choose modules to the value of 32 credits from the following subjects.

Applied Mathematics	144(16)
Biology	124(16), 144(16) or 154(16)
Computer Science	114(16), 144(16)
Probability Theory and Statistics	114(16)

2ND YEAR (MINIMUM 133, MAXIMUM 137 CREDITS)

Special Provision

It is expected that you gain at least two weeks' practical experience in the textile, chemicals or related industry during the holidays in your second or third year.

Compulsory Modules

(credits = 85)

Chemistry	214(16), 234(16), 254(16), 264(16)
Textile Science	254(16)

plus

Computer Skills	272(5)

or

Scientific Computing	272(5)

plus

Elective Modules

(credits = minimum 48, maximum 52)

Choose modules to a minimum value of 48 credits and a maximum value of 52 credits from the subjects below. It is important that you ensure before registration that your chosen modules do not have timetable clashes with compulsory modules.

Applied Mathematics	214(16), 244(16)
Biochemistry	214(16), 244(16)
Economics Business Management	114(12), 144(12) AND 113(12)
Microbiology	214(16), 244(16)
Physics	224(16), 254(16)

3RD YEAR (133 CREDITS)

Special Provision

It is expected that you gain at least two weeks' practical experience in the textile, chemicals or related industry during the holidays in your second or third year.

Compulsory Modules

(credits = 117)

Applied Chemistry	324(16), 344(16), 315(16), 345(16)
Chemistry	314(16), 324(16), 344(16), 364(16)

plus

Computer Skills	372(5)

or

Scientific Computing	372(5)

4.2.2 Physics

This programme consists of the focal areas of Laser Physics (Physics), Nuclear Physics, Radiation and Health Physics, Laser Physics (Biological), and Theoretical Physics.

4.2.2.1 Focal areas: Laser Physics (Physical), Nuclear Physics, Radiation and Health Physics

Specific Minimum Admission Requirements

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

Continued Study Possibilities

Third-year module study possibilities lead to the following:

- **All Options: 1, 2 and 3 modules** lead to an honours programme in Physics (including Theoretical Physics) and to an honours programme in Physical and Mathematical Analysis.
- **Option 1 modules** also lead to an honours programme in Chemistry, Applied Mathematics or Mathematics (including Abstract Mathematics).
- **Option 3 modules,** with the applicable elective modules, also lead to an honours programme in Computer Science.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 76)

Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 64)

Choose modules to the value of 64 credits from the following subjects.

Applied Mathematics	144(16)
Chemistry	124(16), 144(16)
Computer Science	114(16), 144(16)
Probability Theory and Statistics	114(16)

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

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

plus

Elective Modules

(credits = 64)

Choose modules to the value of 64 credits from the following list, depending on the first-year curriculum you followed. Also take into consideration the additional major subject modules that you will be taking in your third year.

Applied Mathematics	214(16), 244(16)
Chemistry	214(16), 234(16), 254(16), 264(16)
Computer Science	214(16), 244(16)
Mathematics	278(32)
Mathematical Statistics	214(16), 245(8), 246(8)

3RD YEAR

You can choose from the following three options:

Option 1: (133 credits)

Compulsory Modules

(credits = 69)

Physics	314(16), 334(16), 342(8), 352(8), 384(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 64)

Choose one of the following options depending on the elective modules that you took in your second year.

Chemistry	314(16), 324(16), 344(16), 364(16)

or

Applied Mathematics	324(16), 354(16), 364(16) AND
Mathematics	324(16)

or

Mathematics	324(16), 365(16), 378(32)

Option 2: (minimum 133, maximum 141 credits)

Compulsory Modules

(credits = 101)

Applied Mathematics	364(16)
Physics	314(16), 334(16), 342(8), 344(16), 352(8), 384(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = minimum 32, maximum 40)

Choose modules to a minimum value of 32 credits and a maximum value of 40 credits from the list below.

Applied Mathematics	324(16), 354(16)
Computer Science	313(16), 314(16), 343(16)
Mathematics	324(16), 378(32)
Physics	372(8)

Option 3: (minimum 133, maximum 165 credits)

Compulsory Modules

(credits = 117)

Computer Science	313(16), 314(16), 343(16)
Physics	314(16), 334(16), 342(8), 344(16), 352(8)
Scientific Computing	372(5)

plus

Elective Modules

(credits = minimum 16, maximum 48)

Choose modules to a minimum value of 16 credits and a maximum value of 48 credits from the list below.

Applied Mathematics	324(16), 364(16)
Computer Science	344(16)
Physics	384(16)

4.2.2.2 Focal area: Laser Physics (Biological)

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Physics (all elective options).
- It also leads to an honours programme in Biochemistry (elective option 4 in 3rd year).

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Science in Context	178(12)

2ND YEAR (133 CREDITS)

Compulsory Modules

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

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 85)

Biochemistry	315(16)
Physics	314(16), 334(16), 342(8), 352(8), 384(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 48)

Choose one of the following options.

Option 1

Applied Mathematics	364(16)
Biochemistry	323(8)
Bioinformatics	312(8)
Chemistry	314(16) or 344(16)

or

Option 2

Biochemistry	323(8)
Bioinformatics	312(8)
Chemistry	314(16), 344(16)

or

Option 3

Applied Mathematics	364(16)
Physiology	214(16), 244(16)

or

Option 4

If you choose option 4, you need to liaise with the Department of Physics to reschedule Physics 384 practicals in first semester to accommodate timetable clash with Biochemistry 323 and Bioinformatics 312; and to reschedule Physics 342 and 352 tutorials in the second semester to accommodate timetable clash with Biochemistry 345 tutorial.

Biochemistry	323(8), 345(16), 365(16)
Bioinformatics	312(8)

4.2.2.3 Focal area: Theoretical Physics

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Theoretical Physics.
- If applicable elective modules are taken, this focal area also leads to an honours programme in Physics or Physical and Mathematical Analysis.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Applied Mathematics	144(16)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

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

plus

Elective Modules

(credits = 64)

Choose modules to the value of 64 credits from the following list, depending on the elective modules you took in your first year.

Applied Mathematics	214(16), 244(16)
Computer Science	214(16), 244(16)
Mathematics	278(32)
Mathematical Statistics	214(16), 245(8), 246(8)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 101)

Applied Mathematics	364(16)
Mathematics	324(16)
Physics	314(16), 334(16), 342(8), 344(16), 352(8) OR 372(8)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 32)

Choose modules to the value of 32 credits from the following list depending on the elective modules you took in your second year.

Applied Mathematics	324(16), 354(16)
Computer Science	313(16), 314(16), 315(16), 343(16)
Mathematics	314(16), 344(16), 378(32)
Physics	384(16)

4.2.3 Earth Science

This programme consists of two focal areas, namely Applied Earth Science; and Geo-environmental Science.

4.2.3.1 Focal area: Applied Earth Science

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Physical Sciences – 4
- Mathematics – 6 (If you are planning to take Physics 114, 144 and/or Mathematics 114, 144)

OR

- Mathematics – 5 (If you are planning to take Mathematical (Bio) 124 and Physics (Bio) 134, 154)

Continued Study Possibilities

- This programme leads to an honours programme in Earth Sciences.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (148 CREDITS)

Compulsory Modules

(credits = 84)

Chemistry	124(16), 144(16)
Earth Science Field Skills	172(8)
Geo-environmental Science	124(16), 154(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 64)

Choose one of the following three subject combinations.

Subject Combination 1

Mathematics	114(16), 144(16)
Physics	114(16), 144(16)

or

Subject Combination 2

Biology	124(16)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

or

Subject Combination 3

Mathematics	114(16), 144(16)
Physics (Bio)	134(16), 154(16)

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 117)

Computer Skills	272(5)
Earth Science Field Skills	272(16)
Environmental Geochemistry	214(16)
Geographical Information Technology	214(16), 241(16)
Geology	224(16), 244(16), 254(16)

plus

Elective Modules

(credits = 16)

Choose a module to the value of 16 credits from the subjects below.

Chemistry	234(16), 264(16)
Geographical Information Technology	211(16)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 101)

Computer Skills	372(5)
Earth Science Field Skills	374(16)
Geographical Information Technology	312(16)
Geology	314(16), 324(16), 344(16), 354(16)

plus

Elective Modules

(credits = 32)

Choose two modules to the value of 32 credits from the subjects below.

Geographical Information Technology	311(16), 341(16)
Geology	364(16)
Soil Science	214(16)

4.2.3.2 Focal area: Geo-environmental Science

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Physical Sciences – 4
- Mathematics – 6 (If you are planning to take Physics 114, 144 and/or Mathematics 114, 144)

OR

- Mathematics – 5 (If you are planning to take Mathematical (Bio) 124 and Physics (Bio) 134, 154)

Continued Study Possibilities

- This programme leads to an honours programme in Earth Science.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (148 CREDITS)

Compulsory Modules

(credits = 84)

Chemistry	124(16), 144(16)
Earth Science Field Skills	172(8)
Geo-environmental Science	124(16), 154(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 64)

Choose one of the following three subject combinations.

Subject Combination 1

Mathematics	114(16), 144(16)
Physics	114(16), 144(16)

or

Subject Combination 2

Biology	124(16)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

or

Subject Combination 3

Mathematics	114(16), 144(16)
Physics (Bio)	134(16), 154(16)

2ND YEAR (141 CREDITS)

Compulsory Modules

Chemistry	234(16), 264(16)
Computer Skills	272(5)
Environmental Field Skills	271(8)
Environmental Geochemistry	214(16)
Geographical Information Technology	214(16), 241(16)
Geography and Environmental Studies	265(16)
Geology	224(16), 244(16)

3RD YEAR (141 CREDITS)

Compulsory Modules

Computer Skills	372(5)
Environmental Field Skills	372(8)
Environmental Geochemistry	314(16)
Geographical Information Technology	312(16), 341(16)
Geography and Environmental Studies	334(16), 358(16)
Geology	324(16), 344(16), 364(16)

4.2.4 GeoInformatics

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Physical Sciences – 4
- Mathematics – 6 (If you are planning to take Mathematics 114, 144 and Physics 114, 144)

OR

- Mathematics – 5 (If you are planning to take Mathematics (Bio) 124 and Physics (Bio) 134, 154)

Continued Study Possibilities

- This programme leads to an honours programme in GeoInformatics. If you complete this BSc and BScHons (four years in total), you will automatically be able to register as a Professional Geographical Information Science Practitioner in training.

- If applicable elective modules are taken, this programme also leads to a BScHons programme in Computer Science or a BComHons programme in Information Systems Management (Faculty of Economic and Management Sciences).

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of the relevant Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

(credits = 44)

Geo-environmental Science	124(16)
Geographical Information Technology	141(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 96)

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

or

Biology	124(16)
Chemistry	124(16), 144(16)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

2ND YEAR (135 CREDITS)

Compulsory Modules

(credits = 103)

Geographical Information Technology	211(16), 214(16), 241(16), 242(16)
Scientific Computing	272(5)
Socio-informatics	214(16)
Statistics and Data Science	188(18)

plus

Elective Modules

(credits = 32)

Choose one of the following subjects. You must take all the modules of your chosen subject.

Computer Science	214(16), 244(16)

or

Organisational Informatics	214(16), 244(16)

3RD YEAR (MINIMUM 133, MAXIMUM 141 CREDITS)

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)

Choose modules to a minimum value of 64 credits and a maximum value of 72 credits from the modules below. If you are considering an honours programme in Computer Science or Informatics, you must take all modules for the relevant field of study.

Computer Science	313(16), 314(16), 343(16), 344(16)
Organisational Informatics	318(24), 348(24)
Socio-informatics	348(24)

4.3 Programme in the Mathematical Sciences

Since 2023, this programme consists of four focal areas, namely Applied Mathematics, Mathematics, Operations Research, and Abstract Mathematics.

Please note: The following focal areas are being phased out since 2023 and will be available only to students who have registered for the programme and focal areas before 2023: Financial Mathematics, Computer Science, Mathematical Statistics, and Biomathematics (the latter still available in the Interdisciplinary BSc programme).

4.3.1 Focal area: Financial Mathematics

This focal area is being phased out, and no new enrolments will be allowed from 2023 onwards. Students who enrolled for Financial Mathematics for the first time before or in 2022 will have until 2025 to complete their focal area with the combination of modules available. If you are interested in the subject Financial Mathematics, it is still offered as an elective module in the third year of the Mathematics focal area.

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other subject from the designated list for university admission – 4

Continued Study Possibilities

- This focal area leads to an honours programme in Mathematics if you take Mathematics as a major.
- It also leads to an honours programme in Mathematical Statistics if you take Mathematical Statistics as a major.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

2ND YEAR (MINIMUM 125, MAXIMUM 141 CREDITS)

Compulsory Modules

(credits = 109)

Actuarial Science	211(18)
Financial Risk Management	212(8), 242(8), 252(6)
Mathematical Statistics	214(16), 245(8), 246(8)
Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus

Elective Modules

(credits = minimum 16, maximum 32)

Choose modules to a minimum value of 16 credits or a maximum value of 32 credits from the list below. Your choice depends on there being no timetable clashes.

Computer Science	214(16), 244(16)
Economics	214(16), 244(16)
Mathematics	278(32)
Operations Research	214(16), 244(16)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 85)

Financial Mathematics	378(32)
Mathematical Statistics	312(16), 316(16)
Mathematics	324(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 48)

Choose one of the following subjects. You must take all modules of your chosen subject.

Mathematics	314(16), 344(16), 365(16)

or

If you choose Mathematical Statistics, you must choose another elective module of your choice to the value of 16 credits.

Mathematical Statistics	344(16), 364(16)

4.3.2 Focal area: Computer Science

Please note:

A new programme, BSc in Computer Science, was introduced in 2022. This new programme replaces the Computer Science focal area (and its three options) in the BSc Mathematical Sciences programme. Students who enrolled for the first time in or before 2022 will have until 2024 to complete their focal area with the combination of modules available.

Continued Study Possibilities

- This focal area leads to an honours programme in Computer Science.
- If applicable elective modules from the stated options are taken, this focal area also leads to honours programmes in Applied Mathematics, Economics, Genetics, Geographical Information Technology, Mathematics, Mathematical Statistics or Operations Research.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

4.3.2.1 Option 1: Computer Science (excluding Genetics or Geographical Information Technology as second major)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Computer Science	313(16), 314(16), 343(16), 344(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 64)

Choose modules from the list below that follow on your second-year modules to reach the required credit total.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	374(16)
Chemistry	324(16), 364(16)
Computer Science	315(16), 345(16)

Economics	318(24), 348(24)
General Linguistics	318(24), 348(24)
Mathematical Statistics	312(16), 316(16), 344(16), 364(16)
Mathematics	314(16), 324(16), 344(16), 345(16), 365(16), 378(32)
Music Technology	379(48)
Operations Research	314(16), 322(16), 344(16), 352(16)
Physics	314(16), 334(16), 344(16), 384(16)

4.3.2.2 Option 2: Computer Science with Genetics as second major

3RD YEAR (133 CREDITS)

Compulsory Modules

Computer Science	313(16), 314(16), 343(16), 344(16)
Scientific Computing	272(5)
Genetics	314(16), 324(16), 344(16), 354(16)

4.3.2.3 Option 3: Computer Science with Geographical Information Technology as second major

3RD YEAR (133 CREDITS)

Compulsory Modules

Computer Science	313(16), 314(16), 343(16), 344(16)
Geographical Information Technology	311(16), 312(16), 341(16), 342(16)
Scientific Computing	372(5)

4.3.3 Focal area: Applied Mathematics

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated list for university admission – 4

OR

- Physical Sciences – 4 (If you are planning to take Physics or Chemistry)

Continued Study Possibilities

- This focal area leads to an honours programme in Applied Mathematics.
- If applicable elective modules are taken, this focal area also leads to honours programmes in Computer Science, Economics, Mathematics (focus in Mathematics, or focus in Biomathematics), and Operations Research.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (MINIMUM 132, MAXIMUM 140 CREDITS)

Compulsory Modules

(credits = 76)

Applied Mathematics	144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 56 to 64)

Choose at least one of the following two subjects. You must take both modules of your chosen subject, thus 32 credits.

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

plus

Choose additional modules to a minimum value of 24 credits from the list below to reach the required credit total.

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
General Linguistics	178(24)
Geo-environmental Science	124(16), 154(16)
Mathematics	154(16)
Music Technology	112(6), 142(6)

2ND YEAR (MINIMUM 125, MAXIMUM 133 CREDITS)

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)

Choose modules to a minimum value of 32 credits from the list below.

Computer Science	214(16), 244(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Operations Research	214(16), 244(16)
Physics	224(16), 254(16)

plus

Choose additional modules to a maximum value of 32 credits from the list below to reach the required credit total.

Chemistry	234(16), 254(16)
Economics	214(16), 244(16)
Geographical Information Technology	211(16), 241(16), 242(16)
Mathematics	278(32)
Music Technology	222(8), 252(8)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

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

plus

Elective Modules

(credits = 64)

Choose any of the modules below that follow your second-year modules.

Biomathematics	374(16)
Chemistry	324(16), 364(16)
Computer Science	313(16), 314(16), 315(16), 343(16), 344(16)
Economics	318(24), 348(24)
Financial Mathematics	378(32)
Geography and Environmental Studies	358(16)
Mathematics	314(16), 324(16), 344(16), 345(16), 365(16), 378(32)
Music Technology	379(48)
Operations Research	314(16), 322(16), 344(16), 352(16)
Physics	314(16), 342(8), 344(16), 352(8), 384(16)

4.3.4 Focal area: Mathematics

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated list for university admission – 4

OR

- Physical Sciences – 4 (If you are planning to take Physics or Chemistry)

Continued Study Possibilities

- This focal area leads to an honours programme in Mathematics.
- If applicable elective modules are taken, this focal area also leads to honours programmes in Applied Mathematics, Mathematics (focus in Biomathematics), Computer Science, and Mathematical Statistics.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (MINIMUM 132, MAXIMUM 140 CREDITS)

Compulsory Modules

(credits = 44)

Mathematics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 88 to 96)

Choose modules to a minimum value of 88 credits and a maximum value of 96 credits from the following subjects.

Applied Mathematics	144(16)
Biology	124(16), 144(16) OR 154(16)
Chemistry	124(16) AND 144(16)
Computer Science	114(16) AND 144(16)
Economics	114(12) AND 144(12)
General Linguistics	178(24)
Mathematics	154(16)
Physics	114(16) AND 144(16)
Probability Theory and Statistics	114(16)

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 37)

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

plus

Elective Modules

(credits = 96)

Choose modules to a minimum value of 64 credits from the list below.

Applied Mathematics	214(16), 244(16)
Computer Science	214(16), 244(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Operations Research	214(16), 244(16)
Physics	224(16), 254(16)

You can choose additional modules to a maximum value of 32 credits from the list below to reach the required credit total.

Chemistry	234(16), 254(16)
Economics	214(16), 244(16)
General Linguistics	278(32)
Mathematics	278(32)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Mathematics	314(16), 324(16), 344(16), 365(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 64)

Choose any of the modules to the value of 64 credits from the list below that follow your second-year modules.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	374(16)
Chemistry	324(16), 364(16)
Computer Science	313(16), 314(16), 315(16), 343(16), 344(16), 345(16)
Economics	348(24)
Financial Mathematics	378(32)
General Linguistics	318(24), 348(24)
Mathematical Statistics	312(16), 316(16), 344(16), 364(16)
Mathematics	345(16), 378(32)
Operations Research	322(16), 352(16)
Physics	314(16), 334(16), 342(8), 352(8)

4.3.5 Focal area: Mathematical Statistics

This focal area is being phased out, and no new enrolments have been allowed since 2023. Students who enrolled for Mathematical Sciences for the first time prior to 2023 will have until 2025 to complete their focal area with the combination of modules available. For a major in Mathematical Statistics, follow relevant modules in either the Mathematics focal area or the Abstract Mathematics focal area.

Specific Minimum Admission Requirements

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

OR

- Physical Sciences – 4 (If you are planning to take Physics or Chemistry)

Continued Study Possibilities

- This focal area leads to an honours programme in Mathematical Statistics.
- If applicable elective modules are taken, this focal area also leads to honours programmes in Computer Science, Economics, Mathematics (focus in Mathematics, or focus in Biomathematics) and Operations Research.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Mathematical Statistics	214(16), 245(8), 246(8)
Mathematics	214(16), 244(16)
Scientific Computing	272(5)

plus

Elective Modules

(credits = 64)

Choose modules to a minimum value of 32 credits from the list below.

Applied Mathematics	214(16), 244(16)
Computer Science	214(16), 244(16)
Operations Research	214(16), 244(16)
Physics	224(16), 254(16)

You can choose additional modules to a maximum value of 32 credits from the list below to reach the required credit total. Please note that most of the modules in the list below have prerequisite modules that are elective modules in your first year.

Economics	214(16), 244(16)
Geographical Information Technology	211(16), 214(16), 241(16), 242(16)
Mathematics	278(32)
Physics	224(16), 254(16)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Mathematical Statistics	312(16), 316(16), 344(16), 364(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 64)

Choose any modules to the value of 64 credits from the list below that follow on your second-year modules.

Biomathematics	374(16)
Computer Science	313(16), 314(16), 315(16), 343(16), 344(16), 345(16)
Economics	318(24), 348(24)
Financial Mathematics	378(32)
Geography and Environmental Studies	358(16)
Mathematics	314(16), 324(16), 344(16), 345(16), 365(16), 378(32)
Operations Research	314(16), 322(16), 344(16), 352(16)
Physics	314(16), 344(16), 384(16)

4.3.6 Focal area: Operations Research

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated list for university admission – 4

OR

- Physical Sciences – 4 (If you are planning to take Physics or Chemistry)

Continued Study Possibilities

- This focal area leads to an honours programme in Operations Research.
- If applicable elective modules are taken, this focal area also leads to honours programmes in Applied Mathematics, Mathematics (focus in Biomathematics), Computer Science, and Physics.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (MINIMUM 132, MAXIMUM 140 CREDITS)

Compulsory Modules

(credits = 76)

Applied Mathematics	144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 56 to 64)

Choose at least one of the following two subjects. You must take both modules of your chosen subject, thus 32 credits.

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

plus

You can choose more modules to a minimum value of 24 credits and a maximum of 32 credits from the list below to reach your required credit total.

Biology	124(16), 144(16) OR 154(16)
Chemistry	124(16), 144(16)
Geo-environmental Science	124(16), 154(16)
Mathematics	154(16)

2ND YEAR (133 CREDITS)

Compulsory Modules

(credits = 37)

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

plus

Elective Modules

(credits = 96)

Choose modules to a minimum value of 64 credits from the list below.

Applied Mathematics	214(16), 244(16)
Computer Science	214(16), 244(16)
Mathematical Statistics	214(16), 245(8), 246(8) (only an option if you enrolled for this focal area before 2023)
Mathematics	214(16), 244(16)
Physics	224(16), 254(16)

You can choose additional modules to a maximum value of 32 credits from the list below to reach your required credit total. Please note that most of the modules on the list below have prerequisite modules that are elective modules in your first year.

Economics	214(16), 244(16) (only an option if you enrolled for this focal area before 2023)
Geographical Information Technology	211(16), 214(16), 241(16), 242(16)
Mathematics	278(32)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 69)

Operations Research	314(16), 322(16), 344(16), 352(16)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 64)

Choose any of the modules from the list below.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	374(16)
Computer Science	313(16), 314(16), 343(16), 344(16)
Economics	348(24) (only an option if you enrolled before 2023)
Financial Mathematics	378(32)
Mathematical Statistics	312(16), 316(16), 344(16), 364(16) (only an option if you enrolled before 2023)
Mathematics	378(32)
Physics	314(16), 334(16), 342(8), 344(16), 352(8), 384(16)

4.3.7 Focal area: Abstract Mathematics

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the list of designated subjects for university admission – 4
- Physical Sciences – 4 (If you are planning to take Physics or Chemistry)

Continued Study Possibilities

- This focal area leads to an honours programme in Mathematics.
- If applicable elective modules are taken, this focal area also leads to honours programmes in Applied Mathematics, Biochemistry, Chemistry, Computer Science, Genetics, Mathematical Statistics and Physics.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

Please note: Mathematics is a compulsory major subject in your third year in this focal area. Your second major subject is dependent on the curriculum that you choose for your first year.

1ST YEAR (CREDITS = 140)

Compulsory Modules

(credits = 44)

Mathematics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 96)

Choose modules to the value of 96 credits from the subjects below.

Applied Mathematics	144(16)
Biology	124(16), 144(16) OR 154(16)

Chemistry	124(16), 144(16)
Computer Science	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)

2ND YEAR (MINIMUM 133, MAXIMUM 144 CREDITS)

Compulsory Modules

(credits = minimum 69, maximum 80)

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

plus

Scientific Computing	272(5)

Or, if you take Genetics as second major subject, choose one of the following subjects. You must take all the modules of your chosen subject.

Biometry	212(8), 242(8)
Mathematical Statistics	214(16)

plus

Elective Modules

(credits = 64)

Choose modules to the value of 64 credits from the list below. You must take all modules of your chosen subject(s). Your choice is determined by the second major subject you are planning to take in your third year.

Applied Mathematics	214(16), 244(16)
Chemistry	214(16), 234(16), 254(16), 264(16)
Computer Science	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Physics	224(16), 254(16)

3RD YEAR (133 CREDITS)

Compulsory Modules

(credits = 53)

Mathematics	314(16), 378(32)
Scientific Computing	372(5)

plus

Elective Modules

(credits = 80)

Choose any of the subject combinations below that follow on your second-year modules. You must take all the modules of your chosen subjects.

If you take Chemistry as second major subject

Chemistry	314(16), 324(16), 344(16), 364(16)
Mathematics	344(16)

or

If you take Physics as second major subject

Choose one of the options below.

Option 1

Mathematics	344(16) or 345(16)
Physics	314(16), 334(16), 342(8), 344(16), 352(8)

or

Option 2

Mathematics	324(16), 365(16)
Physics	314(16), 334(16), 342(8), 352(8), 384(16)

or

If you take Genetics as second major subject

Genetics	314(16), 324(16), 344(16), 354(16)
Mathematics	344(16)

or

If you take Computer Science as second major subject

Computer Science	313(16), 314(16), 343(16), 344(16)
Mathematics	345 (16)

or

If you take Applied Mathematics as second major subject

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Mathematics	324(16), 365(16)

or

If you take Mathematical Statistics as second major subject

Mathematical Statistics	312(16), 316(16), 344(16), 364(16)
Mathematics	345(16)

4.3.8 Focal area: Biomathematics

Take note: Since 2023, the focal area Biomathematics has been available in the Interdisciplinary BSc programme. Therefore, the Biomathematics focal area is no longer offered in the BSc Mathematical Sciences programme. Only students who enrolled for Biomathematics for the first time in or before 2022 will have until 2025 to complete their degree programme with this focal area with the combination of modules available.

This focal area offers two options. See the sections below for more information on the two options.

4.3.8.1 Option 1: Molecular Biology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This option of the focal area leads to an honours programme in Mathematics (focus in Biomathematics) and in Biochemistry.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

2ND YEAR (133 CREDITS)

Compulsory Modules

Biochemistry	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematics	214(16), 244(16), 278(32)
Scientific Computing	272(5)

3RD YEAR (133 CREDITS)

Compulsory Modules

Applied Mathematics	314(16), 324(16), 364(16)
Biochemistry	315(16), 323(8), 345(16), 365(16)
Bioinformatics	312(8)
Biomathematics	374(16)
Scientific Computing	372(5)

4.3.8.2 Option 2: Ecology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This option of the focal area leads to an honours programme in Mathematics (focus in Biomathematics) and Applied Mathematics.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

2ND YEAR (133 CREDITS)

Compulsory Modules

Biodiversity and Ecology	214(16), 264(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Mathematics	214(16), 244(16), 278(32)
Scientific Computing	272(5)

3RD YEAR (133 CREDITS)

Compulsory Modules

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biodiversity and Ecology	324(16), 364(16)
Biomathematics	374(16)
Mathematics	344(16)
Scientific Computing	372(5)

4.4 BSc Computer Science

This programme consists of five focal areas, namely General Computer Science, Computer Systems, Data Science, Computer Science with Genetics as second major, and Computer Science with Geographical Information Technology as second major.

4.4.1 Focal area: General Computer Science

Specific Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated subject list for university admission – 4

OR

- Physical Sciences – 4 (if you are planning to take Physics or Chemistry)

Continued Study Possibilities

- If applicable elective modules are taken, this focal area leads to honours programmes in Applied Mathematics, Computer Science, Economics, General Linguistics, Mathematical Statistics, Mathematics, Operations Research or Statistics.

For more information on admission to the honours programme you are considering, please consult the specific honours programme's details in the chapter "Postgraduate programmes" of the relevant faculty Yearbook part.

1ST YEAR (MINIMUM 124, MAXIMUM 140 CREDITS)

Compulsory Modules

(credits = 92)

Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

plus

Elective Modules

(credits = minimum 32, maximum 48)

Choose at least one of the following modules.

Applied Mathematics	144(16)
Mathematics	154(16)

plus

Choose any modules from the list below to reach your required credit total as necessary. Your choice depends on there being no timetable clashes, and you having the appropriate prerequisites for the modules.

Biology	124(16), 144(16) or 154(16)
Chemistry	124(16), 144(16)
Economics	114(12), 144(12)
General Linguistics	178(24)
Geo-Environmental Science	124(16), 154(16)
Music Technology	112(6), 142(6)
Physics	114(16), 144(16)

2ND YEAR (128 CREDITS)

Compulsory Modules

(credits = 32)

Computer Science	214(16), 244(16)

plus

Elective Modules

(credits = 96)

Choose any modules from the list below to reach your required credit total.

Applied Mathematics	214(16), 244(16)
Chemistry	214(16), 234(16), 254(16), 264(16)
Economics	214(16), 244(16)
General Linguistics	278(32)
Mathematical Statistics	214(16), 245(8), 246(8)
Mathematics	214(16), 244(16), 278(32)
Music Technology	222(8), 252(8)
Operations Research	214(16), 244(16)
Physics	224(16), 254(16)

3RD YEAR (128 CREDITS)

Compulsory Module

(credits = 64)

Computer Science	313(16), 314(16), 343(16), 344(16)

plus

Elective Modules

(credits = 64)

Choose any modules from the list below to reach your required credit total.

Applied Mathematics	314(16), 324(16), 354(16), 364(16)
Biomathematics	374(16)
Chemistry	344(16)
Computer Science	315(16), 345(16)
Economics	318(24), 348(24)
General Linguistics	318(24), 348(24)
Mathematical Statistics	312(16), 316(16), 344(16), 364(16) These modules may not be taken with Statistics 318 or 348.
Mathematics	314(16), 324(16), 344(16), 345(16), 365(16), 378(32)
Music Technology	379(48)
Operations Research	314(16), 322(16), 344(16), 352(16)
Physics	314(16), 334(16), 344(16), 384(16)
Statistics	318(24), 348(24)

4.4.2 Focal area: Computer Systems

Note: This focal area includes modules assessed during the Engineering test week. In the event of test timetable clashes, please consult the divisional head of Computer Science during the first two weeks of the semester.

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated subject list for university admission – 4

OR

- Physical Sciences – 4 (if you are planning to take Physics)

Continued Study Possibilities

- This focal area leads to an honours programme in Computer Science.

For more information on admission to the honours programme you are considering, please consult the specific honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (139 CREDITS)

Compulsory Modules

Applied Mathematics	144(16)
Computer Science	114(16), 144(16)
Electrotechnique	143(15)
Mathematics	114(16), 144(16)
Physics	114(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

2ND YEAR (130 CREDITS)

Compulsory Modules

Applied Mathematics B	224(15)
Computer Science	214(16), 244(16)
Computer Systems	214(15), 245(15)
Engineering Mathematics	214(15), 242(8)
Systems and Signals	214(15), 244(15)

3RD YEAR (127 CREDITS)

Compulsory Modules

Applied Mathematics	324(16), 364(16)
Computer Science	313(16), 314(16), 343(16), 344(16), 345(16)
Design E	314(15)

4.4.3 Focal area: Data Science

Note: This focal area includes modules assessed during the Engineering test week. In the event of test timetable clashes, please consult the divisional head of Computer Science during the first two weeks of the semester.

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated subject list for university admission – 4

OR

- Physical Sciences – 4 (if you are planning to take Physics)

Continued Study Possibilities

- **All Options: Option 1, 2 and 3 modules** lead to an honours programme in Computer Science.
- **Option 3 modules** also lead to an honours programme in Mathematical Statistics.

For more information on admission to the honours programme you are considering, please consult the specific honours programme's details in the chapter "Postgraduate programmes" of the relevant faculty's Yearbook part.

1ST YEAR (MINIMUM 124, MAXIMUM 140 CREDITS)

Compulsory Modules

credits = 108

Computer Science	114(16), 144(16)
Data Science	141(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

plus

Elective Modules

(credits = minimum 16, maximum 32)

Choose any modules from the list below to reach your required credit total.

Applied Mathematics	144(16)
Economics	114(12), 144(12)
Mathematics	154(16)
Physics	114(16), 144(16)

2ND YEAR (MINIMUM 124, MAXIMUM 128 CREDITS)

Compulsory Modules

(credits = 112)

Applied Mathematics	214(16)
Computer Science	214(16), 244(16)
Mathematics	214(16), 244(16)
Mathematical Statistics	214(16), 245(8), 246(8)

plus

Elective Modules

(credits = minimum 12, maximum 16)

Choose one of the modules below.

Data Engineering	245(12)
Data Science	241(16)

3RD YEAR (MINIMUM 127, MAXIMUM 128 CREDITS)

Compulsory Modules

(credits = 64)

Computer Science	314(16), 315(16), 343(16), 344(16)

plus

Elective Modules

(credits = minimum 63, maximum 64)

Choose one of the following options. Only certain options may be possible, depending on your choice of elective in your second year.

Option 1

Computer Science	345(16)
Data Science	316(16), 348(16)
Mathematical Statistics	312(16)

or

Option 2

Data Engineering	314(15)
Statistics	318(24), 348(24)

or

Option 3

Mathematical Statistics	312(16), 316(16), 344(16), 364(16)

4.4.4 Focal area: Computer Science with Genetics as second major

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated subject list for university admission – 4

Continued Study Possibilities

- This focal area leads to an honours programme in Computer Science or Genetics.

For more information on admission to the honours programme you are considering, please consult the specific honours programme's details in the chapter "Postgraduate programmes" of the relevant faculty's Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Applied Mathematics	144(16)
Biology	124(16), 144(16) or 154(16)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

2ND YEAR (128 CREDITS)

Compulsory Modules

(credits = 96)

Computer Science	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematics	214(16), 244(16)

plus

Elective Modules

(credits = 32)

Choose one of the following subjects. You must take all modules of your chosen subject.

Biometry	212(8), 242(8)
Mathematical Statistics	214(16)

plus

Choose modules to the value of 16 credits from the list below.

Mathematical Statistics	245(8), 246(8)
Operations Research	214(16), 244(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

Computer Science	313(16), 314(16), 343(16), 344(16)
Genetics	314(16), 324(16), 344(16), 354(16)

4.4.5 Focal area: Computer Science with Geographical Information Technology as second major

Specific Minimum Admission Requirements

- Afrikaans or English (Home Language or First Additional Language) – 4
- Mathematics – 6
- Any other school subject from the designated subject list for university admission – 4

OR

- Physical Sciences – 4 (if you are planning to take Physics or Chemistry)

Continued Study Possibilities

- This focal area leads to an honours programme in Computer Science or GeoInformatics.

For more information on admission to the honours programme you are considering, please consult the specific honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Applied Mathematics	144(16)
Computer Science	114(16), 144(16)
Geo-environmental Science	124(16)
Geographical Information Technology	141(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Science in Context	178(12)

2ND YEAR (128 CREDITS)

Compulsory Modules

Computer Science	214(16), 244(16)
Geographical Information Technology	211(16), 214(16), 241(16), 242(16)
Mathematics	214(16), 244(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

Computer Science	313(16), 314(16), 343(16), 344(16)
Geographical Information Technology	311(16), 312(16), 341(16), 342(16)

4.5 Interdisciplinary BSc programme

4.5.1 Focal area: Biomedical Mathematical Sciences

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Mathematics or Physiological Sciences.
- This focal area also leads to a master's programme (MEngSci) and a PhD (Biomedical Engineering) at the Faculty of Engineering.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of the relevant faculty's Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Applied Mathematics	144(16)
Biology	124(16)
Chemistry	124(16, 144(16)
Mathematics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = 32)

Choose modules to the value of 32 credits from the subjects below.

Biology	154(16)
Computer Science	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)

2ND YEAR (MINIMUM 128, MAXIMUM 144 CREDITS)

Compulsory Modules

(credits = 112)

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Physiology	214(16), 244(16)
Mathematics	214(16), 244(16)

plus

Elective Modules

(credits = minimum 16, maximum 32)

Choose modules to a minimum value of 16 credits and a maximum value of 32 credits from the list below.

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

3RD YEAR (128 CREDITS)

Compulsory Modules

(credits = 80)

Physiology	314(16), 334(16), 344(16), 364(16)
Biomathematics	374(16)

plus

Elective Modules

(credits = 48)

Choose modules to the value of 48 credits from the list below.

Applied Mathematics	324(16), 354(16)
Mathematics	314(16), 324(16), 344(16), 365(16), 378(32)

4.5.2 Focal area: Biomathematics

The focal area of Biomathematics has been offered as part of this programme since 2023.

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Mathematics (with a focus in Biomathematics), Biochemistry, or Botany and Zoology.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of the relevant faculty's Yearbook part.

1ST YEAR (MINIMUM 124, MAXIMUM 140 CREDITS)

Compulsory Modules

(credits = 108)

Applied Mathematics	144(16)
Biology	124(16)
Chemistry	124(16), 144(16)
Mathematics	114(16), 144(16)
Science in Context	178(12)

plus

Elective Modules

(credits = minimum 16, maximum 32)

Choose modules to the minimum value of 16 and a maximum value of 32 credits from the subjects below.

Biology	144(16), 154(16)
Computer Science	114(16), 144(16)
Physics	114(16), 144(16)
Probability Theory and Statistics	114(16)

2ND YEAR (128 CREDITS)

Compulsory Modules

(credits = 32)

Mathematics	214(16), 244(16)

plus

Elective Modules

(credits = minimum 96)

Choose modules to a minimum value of 96 credits from the subjects below. You must take all the modules of your chosen subjects.

Biochemistry	214(16), 244(16)
Biodiversity and Ecology	212(16), 214(16), 244(16)
Computer Science	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematics	278(32)

3RD YEAR (128 CREDITS)

Compulsory Modules

(credits = 48)

Applied Mathematics	314(16), 324(16)
Biomathematics	374(16)

plus

Elective Modules

(credits = 80)

Choose one of the options below.

Option 1

Applied Mathematics	354(16)
Biochemistry	315(16), 323(8), 345(16), 365(16)
Bioinformatics	312(8)

or

Option 2

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

4.5.3 Focal area: Applied Medicinal Chemistry

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Physiological Sciences or Chemistry.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Mathematics	114(16), 144(16)
Physics	114(16), 144(16)
Science in Context	178(12)

2ND YEAR (144 CREDITS)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Chemistry	214(16), 234(16), 254(16), 264(16)
Physiology	214(16), 244(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

(credits = 112)

Applied Chemistry	354(16)
Chemistry	314(16), 324(16), 344(16), 364(16)
Physiology	314(16), 364(16)

plus

Elective Modules

(credits = 16)

Choose one of the following modules.

Biodiversity and Ecology	324(16)
Intellectual Property law for Science, Engineering and Technology	314(16)

4.5.4 Focal area: Bioinformatics and Computational Biology

Specific Minimum Admission Requirements

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

Continued Study Possibilities

- This focal area leads to an honours programme in Bioinformatics and Computational Biology.

For more information on admission to the honours programme you are considering, please consult the relevant honours programme's details in the chapter "Postgraduate programmes" of this Yearbook part.

1ST YEAR (140 CREDITS)

Compulsory Modules

Biology	124(16)
Chemistry	124(16), 144(16)
Computer Science	114(16), 144(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	144(16)
Science in Context	178(12)

2ND YEAR (128 CREDITS)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Computer Science	214(16), 244(16)
Genetics	214(16), 244(16)
Mathematics	214(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

Biochemistry	315(16), 345(16)
Bioinformatics	312(8), 322(8)
Computer Science	314(16), 343(16), 344(16)
Genetics	314(16), 344(16)

4.6 Interdisciplinary BDatSci programme

BDatSci: General

Interdepartmental and Interfaculty Collaboration

This programme is presented in four faculties, namely Economic and Management Sciences, Science, AgriSciences and Arts and Social Sciences. The faculty where you are registered, awards the degree.

Specific Minimum Admission Requirements

- Overall NSC average of at least 80%, excluding Life Orientation
- Mathematics 80%
- One of the following:
  - Afrikaans Home Language 60%
  - English Home Language 60%
  - Afrikaans First Additional Language 75%
  - English First Additional Language 75%

Duration of Programme

Four years

Changing focal areas within BDatSci

You can change focal areas at the end of the 1st and 2nd years of the BDatSci programme, provided that you have met the prerequisite pass, prerequisite and corequisite requirements for the compulsory modules in the subsequent years of study in the new focal area.

The 3rd and 4th years of the programme include a research component, and foundational concepts and knowledge are acquired during those years. Therefore, if you change focal areas during your 3rd or 4th year, your programme will be extended by further years of study because you will need to complete additional modules.

Programme Structure

The BDatSci programme consists of a set of core compulsory modules on all year levels. The core modules lay the foundation for studies in the field of data science. For the rest, you have a relatively free choice of modules to enable you to focus on a very specific field within the data science environment. In choosing your modules, please take note of the stipulations regarding timetable clashes in the general section at the beginning of this chapter.

It is also possible within this programme to focus on a specific area of study, called a focal area. You will register for the BDatSci in the faculty that offers the focal area.

Focal areas

The objective of focal areas is to help you choose a specific career focus within the BDatSci programme. The focal area is not a programme, and the module combinations are only recommendations for you to make more focussed module choices. Nevertheless, there are several compulsory modules that must be taken within each focal area. The module choices in the tables describing each focal area fit in with the lecture and assessment timetables.

There are eight focal areas in the BDatSci programme, and three of these focal areas are offered in the Faculty of Science. Only these three focal areas are described further down under "Focal areas within the BDatSci programme". For the sake of completeness, however, all eight focal areas of BDatSci are listed below. An indication of the faculty where the programme is offered is given in brackets, and you will find the description of the focal area in that faculty's Yearbook part.

- Applied Mathematics (Science);
- Computer Science (Science);
- Statistical Physics (Science);
- Statistical Learning (Economic and Management Sciences);
- Analytics and Optimisation (Economic and Management Sciences);
- Behavioural Economics (Economic and Management Sciences);
- Geoinformatics (Arts and Social Sciences); and
- Statistical Genetics (AgriSciences)

Enquiries

For further information about the BDatSci programme, visit www.sun.ac.za/datascience or use the contact details below.

For general enquiries about the programme:

Prof Paul Mostert

Department of Statistics and Actuarial Science

Tel: 021 808 3536

Email: pjmos@sun.ac.za

For enquiries about specific focal areas in the Faculty of Science:

Applied Mathematics focal area

Prof Willie Brink

Applied Mathematics Division

Tel: 021 808 4218

Email: wbrink@sun.ac.za

Computer Science focal area

Prof Steve Kroon

Computer Science Division

Tel: 021 808 9375

Email: kroon@sun.ac.za

Statistical Physics focal area

Prof Kristian Müller-Nedebock

Department of Physics

Tel: 021 808 3386

Email: kkmn@sun.ac.za

Focal areas within the BDatSci programme

4.6.1 Focal area: Computer Science (credits = 508)

(Faculty of Science, Home Department: Mathematical Sciences, Computer Science Division)

Description of focal area

Computer Science studies the principles and practice of computation and data processing. It considers problem-solving techniques and data manipulation for everything from routing data over the internet and powering your social media feeds, to controlling GPS satellites, manufacturing robots and even your computer.

1ST YEAR (120 CREDITS)

Compulsory Modules

Actuarial Science	112(8)
Computer Science	113(16), 144(16)
Data Science	141(16)
Mathematics	114(16), 144(16), 154(16)
Probability Theory and Statistics	114(16)

2ND YEAR (128 CREDITS)

Compulsory Modules

Computer Science	214(16), 244(16)
Data Science	241(16)
Mathematics	214(16), 244(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Operations Research	214(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

Computer Science	314(16), 315(16), 343(16), 344(16), 345(16)
Data Science	316(16), 346(16)
Mathematical Statistics	312(16)

4TH YEAR (132 CREDITS)

Compulsory Modules

Advanced Algorithms	412(16)
Computer Science	411(16)
Data Science Research in Computer Science	471(40)
Functional Programming	495(16)
Introduction to Statistical Learning	441(12)
Machine Learning	441(16)
Space Science Algorithms	491(16)

4.6.2 Focal area: Applied Mathematics (credits = minimum 508, maximum 516)

(Faculty of Science, Home Department: Mathematical Sciences, Applied Mathematics Division)

Description of focal area

Applied mathematics looks at real-world applications of mathematical methods in fields such as science, engineering, business, computer science and industry. It is therefore a combination of mathematics, science and domain knowledge.

1ST YEAR (MINIMUM 120 CREDITS, MAXIMUM 128 CREDITS)

Compulsory Modules

(credits = 112)

Applied Mathematics	144(16)
Computer Science	113(16) or 114(16), 144(16)
Data Science	141(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)

plus

Elective Module

(credits = minimum 8, maximum 16)

Actuarial Science	112(8)

or

Physics	114(16)

2ND YEAR (128 CREDITS)

Compulsory Modules

Applied Mathematics	214(16), 244(16)
Computer Science	214(16), 244(16)
Data Science	241(16)
Mathematics	214(16)
Mathematical Statistics	214(16), 245(8), 246(8)

3RD YEAR (128 CREDITS)

Compulsory Modules

Applied Mathematics	314(16), 354(16), 364(16)
Computer Science	315(16), 343(16)
Data Science	316(16), 346(16)
Mathematical Statistics	312(16)

4TH YEAR (132 CREDITS)

Compulsory Modules

Computer Vision	492(16)
Data Science Research in Applied Mathematics	472(40)
Digital Image Processing	493(16)
Graph Theory	482(16)
Introduction to Statistical Learning	441(12)

Machine Learning	441(16)
Numerical Methods	476(16)

4.6.3 Focal area: Statistical Physics (credits = 516)

(Faculty of Science, Home Department: Physics)

Description of focal area

Statistical physics uses sophisticated mathematics and simulations to explore and understand the physics underlying everything from quantum mechanics to phase transitions to factory nuts and bolts.

1st year (128 credits)

1ST YEAR (128 CREDITS)

Compulsory Modules

Computer Science	114(16), 144(16)
Data Science	141(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)
Physics	114(16), 144(16)

2ND YEAR (128 CREDITS)

Compulsory Modules

Computer Science	214(16), 244(16)
Data Science	241(16)
Mathematics	214(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Physics	224(16), 254(16)

3RD YEAR (128 CREDITS)

Compulsory Modules

Computer Science	315(16), 343(16)
Data Science	316(16), 346(16)
Mathematical Statistics	312(16)
Physics	314(16), 334(16), 344(16)

4TH YEAR (132 CREDITS)

Compulsory Modules

(credits = 124)

Applied Markov Processes	483(16)
Data Science Research in Statistical Physics	473(40)
Introduction to Statistical Learning	441(12)
Lagrange and Hamilton Mechanisms	412(16)
Statistical Physics B	421(16)
Stochastic Simulation	441(12)
Time Series Analysis	441(12)

plus

Elective Module

(credits = 8)

Bayesian Physics	457(8)

or

Dynamic Systems and Complexity	458(8)

Postgraduate programmes

For more information on the Faculty's postgraduate programmes, consult the University's Postgraduate Prospectus or the departmental websites.

1. Summary of postgraduate programmes

The undergraduate programmes offered at the Faculty of Science lead to the following postgraduate programmes at the Faculty of Science and at other faculties.

For more information regarding postgraduate programmes offered at other Faculties (i.e. not listed below), please consult the relevant Faculty Yearbook part.

Postgraduate Programme	Offered by Faculty of Science	Offered by other Faculties
BScHons (Biological Sciences)	Biochemistry; Biodiversity and Ecology; Microbiology; Physiological Sciences	*Faculty of AgriSciences:* Genetics; Plant Biotechnology *Faculty of Medicine and Health Sciences*: Biokinetics; Sport Science (Performance Sport); Sport Science (Kinderkinetics)
BScHons (Physical Sciences)	Chemistry; Earth Sciences; Physics; Polymer Science; Theoretical Physics	*Faculty of Arts and Social Sciences:* GeoInformatics
BScHons (Mathematical Sciences)	Applied Mathematics; Computer Science; Mathematics	*Faculty of Economic and Management Sciences:* Operations Research
BScHons (Interdisciplinary)	Bioinformatics and Computational Biology	
MSc (Biological Sciences)	Biochemistry; Botany; Exercise Science; Microbiology; Physiological Sciences; Zoology	*Faculty of AgriSciences:* Genetics; Plant Biotechnology *Faculty of Medicine and Health Sciences*: Sport Science
MSc (Physical Sciences)	Chemistry; Earth Sciences; Polymer Science; Physics; Physical and Mathematical Analysis	*Faculty of Arts and Social Sciences:* Geography and Environmental Studies; GeoInformatics
MSc (Mathematical Sciences) Structured MSc	Applied Mathematics; Computer Science; Mathematics MSc in Machine Learning and Artificial Intelligence	*Faculty of Economic and Management Sciences:* Operations Research
MSc (Interdisciplinary)	Bioinformatics and Computational Biology	*Faculty of Engineering:* Engineering Science
PhD	Applied Mathematics; Biochemistry; Bioinformatics and Computational Biology; Botany; Chemistry; Computer Science; Earth Sciences; Mathematics; Microbiology; Physical and Mathematical Analysis; Physics; Physiological Sciences; Polymer Science; Zoology	*Faculty of AgriSciences:* Genetics; Plant Biotechnology *Faculty of Arts and Social Sciences:* Geography and Environmental Studies; GeoInformatics *Faculty of Economic and Management Sciences:* Operations Research *Faculty of Engineering:* Biomedical Engineering

Postgraduate Programme	Offered by Faculty of Science	Offered by other Faculties
DSc	Applied Mathematics; Biochemistry; Botany; Chemistry; Computer Science; Geology; Mathematics; Microbiology; Physics; Physiological Sciences; Polymer Science; Zoology	*Faculty of AgriSciences:* Genetics

2. General information on the postgraduate programmes

2.1 BScHons degree

2.1.1 The degree BScHons can be awarded to you if you –

2.1.1.1 have obtained a bachelor's degree approved by Senate for this purpose and upon written application, were admitted to the BScHons programme; and

2.1.1.2 have been registered as a student at the University for at least one year (after obtaining the bachelor's degree), have passed the prescribed written examination and successfully completed an oral examination.

2.1.2 The BScHons programme is taken in one of the majors of the BSc according to the provisions of the BSc programme. Students, who followed a BSc programme that does not lead to a BScHons programme, may be accepted to a BScHons programme provided that the BScHons programme can only begin after an examination in the required subject or subjects was successfully completed.

2.1.3 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 in the major in question. If you do not comply with this requirement, you may only be accepted to a BScHons programme if a recommendation has been made by the department concerned and with the special approval of the Faculty Committee of the Faculty of Science.

2.1.4 Specific provisions concerning BScHons programmes in specific subjects are given under the module content of the applicable subjects.

2.1.5 BScHons students are not allowed to take any additional third-year subject that includes practical work in the first year of the BScHons. However, if the BScHons programme concerned does not require practical work, you can, depending on the approval of the Faculty Board, be allowed to take an additional third-year subject.

2.2 MSc degree

2.2.1 The MSc degree can be awarded to you if you –

2.2.1.1 have obtained an honours degree approved by Senate for this purpose and upon written application, have been admitted to the proposed MSc programme; and

2.2.1.2 have followed an approved programme of research or advanced study of at least one year after obtaining the BScHons degree) at this University or at any other place approved by Senate; and

2.2.1.3 have submitted a satisfactory thesis or assignment, depending on the requirements of the department concerned, and have completed an oral examination.

2.2.2 Specific provisions concerning MSc programmes in specific subjects are given in the module content of the subjects concerned.

2.2.3 MSc students are not allowed to take any additional third-year subject that includes practical work in the first year of the MSc. However, if the MSc programme concerned does not require practical work, you can, depending on the approval of the Faculty Board, be allowed to take an additional third-year subject.

2.2.4 After three years of full-time MSc studies, you must reapply for continuation of studies.

Please note: For the regulations regarding attendance, examiners, thesis requirements, submission and binding of theses, etcetera, consult the Section "Postgraduate Qualifications" in Part 1 (General Rules) of the University's Yearbook.

2.3 PhD degree

2.3.1 The PhD degree can be awarded to you if you –

2.3.1.1 have obtained a Master's degree approved by Senate for this purpose, or have achieved a level of competence in a particular field of study that Senate considers suitable for the purpose, and upon written application been accepted by Senate to the PhD programme; and

2.3.1.2 have followed an approved programme of research and possible supplementary study, which may include a period of research at another place approved by Senate, for at least two years

after obtaining the above-mentioned Master's degree or after gaining the above-mentioned level of competence; and

2.3.1.3 have submitted a satisfactory dissertation; and

2.3.1.4 have completed an oral examination.

2.3.2 After four years of full-time PhD studies, you must reapply for continuation of studies.

Please note: For the regulations regarding attendance, examiners, dissertation requirements, submission and binding of dissertations, etcetera, consult the Section "Postgraduate Qualifications" in Part 1 (General Rules) of the University's Yearbook.

2.4 DSc degree

2.4.1 As a candidate for the DSc degree you must –

2.4.1.1 have conducted advanced, original research or creative work, to the satisfaction of the University, in the field of the natural sciences;

2.4.1.2 have submitted original work(s) of a high standard that has already been published, on a central theme, making a substantial contribution of high quality, in the view of Senate, to the enrichment of knowledge in the field of the natural sciences; and

2.4.1.3 have completed an oral examination to the satisfaction of the University.

2.4.2 If you already hold a PhD degree from the Faculty of Science or any other qualification that Senate considers an equivalent, you must –

2.4.2.1 have been registered at this University for the DSc degree for at least one academic year before the degree can be awarded to you and at least five years must have passed after obtaining the PhD degree, or another degree or qualification that is considered to be equally acceptable, before being awarded the DSc degree; and

2.4.2.2 have notified the Registrar in writing of the intention to be a candidate for the degree at least one year before presenting yourself for the degree and provided the title(s) and scope of the proposed work(s). Once Senate accepts the application, a supervisor and examiners will be appointed.

2.4.3 If you hold an MSc degree from the Faculty of Science or any other qualification that the Senate considers an equivalent, you must –

2.4.3.1 have been registered at this University for the DSc degree for at least three academic years before the degree can be awarded to you and at least seven years must have passed after obtaining the MSc degree, or another degree that is considered an equivalent, before being awarded the DSc degree; and

2.4.3.2 have notified the Registrar in writing of the intention to be a candidate for the degree at least three years before presenting yourself as a candidate and provided the title(s) and scope of the proposed work(s). Once Senate accepts the application, a supervisor and examiners will be appointed.

2.4.4 You must submit one copy of the work(s) that you want to present per examiner before 1 September (if you want to graduate in December), or before 1 December of the previous year (if you want to graduate in March) at the University office. The copies must be accompanied by a written statement that it is your original work and that the work has not been submitted to this or any other university for the purpose of obtaining any degree. If a substantial part of the submitted work was published under your name and that of another author, you must submit satisfactory testimony detailing which part of the work was done by you. Furthermore, you must mention who started the work, under whose supervision the work was done, who did the work, processed and submitted it to paper, and, if applicable, what part of the work was submitted to any university for the purposes of obtaining a degree.

3. Provisions regarding enrolment for, and the conversion of, programmes

3.1 Periods of enrolment for master's and doctoral studies

Table

Programme	The year of enrolment					
	1	2	3	4	5	6
MSc full-time	M	N	F	X	-	-
PhD full-time	M	M	N	F	X	-

The Faculty does not offer part-time postgraduate studies, but in exceptional cases, a student can motivate

for extension of studies based on personal circumstances. In these approved cases, the student will only be allowed to extend the studies to N+2 years (X). See table above.

Legend

M	Minimum enrolment period
N	Normal maximum enrolment period
F	Final concessional year (May register without having to apply for readmission)
X	Enrolment only if readmission has been approved by the Faculty Board or, for PhD, the Senate (Allowed in exceptional circumstances)
-	Further registration not allowed

Please note: In the case of a conversion from master's to doctoral studies, the first registration for the PhD is considered the start of the enrolment. (See Section "Conversion from Master's to Doctorate" at 5 below.)

3.2 Continued enrolment during the maximum period of enrolment

You must register as a student every year for the full duration of your studies, until you are awarded the degree, except if the Faculty Board approves an interruption of your studies (see Section "Interruption of studies" below). You must make sufficient progress in your studies each year to be permitted to register again. If your progress is insufficient, the relevant departmental chairperson may recommend to the Faculty Board that the Board prevent you from continuing your postgraduate studies.

3.3 Continued enrolment after the maximum period of enrolment

After the normal maximum enrolment period (status F), you may only re-register as a postgraduate student if a departmental panel recommends approving your application to continue (status X). Such approval will only be granted more than once in exceptional circumstances.

4. Interruption of master's or doctoral studies

4.1 Acceptable reasons for interruption of studies

All requests for the interruption of your studies must be supported by appropriate supporting documents, such as a letter of appointment, work assignment, medical certificate(s), financial statement(s), affidavit, etcetera. The following possible reasons for the interruption of master's or doctoral studies serve as acceptable guidelines when dealing with these requests:

4.1.1 Work situation;

4.1.2 Medical reasons;

4.1.3 Financial reasons; or

4.1.4 Highly special personal circumstances if thoroughly and convincingly supported.

4.2 Procedure to apply for permission to interrupt studies

4.2.1 Any applications for permission to interrupt master's or doctoral studies must reach the faculty administrator on or before 30 April of the year concerned. No applications will be considered after 30 April of the academic year concerned.

4.2.2 Permission to interrupt studies will be considered on the recommendation of the supervisor and the head of the department concerned.

4.2.3 Applications that are approved according to the internal procedure of each faculty must be entered in the next report of communication of the Faculty Board to Senate.

4.2.4 Permission to interrupt studies will be approved for a period of at least one year.

4.2.5 Approval to interrupt master's studies is normally given only once and for a period of only one year.

4.2.6 Approval to interrupt doctoral studies is normally given only twice for a period of one year each or given only once for a period of two years during the duration of the studies.

5. Conversion from master's to doctoral studies

In deserving cases, and with regard to your best interests as a student, the Faculty Board can consider and recommend that your registration for the MSc degree (which includes a thesis) be converted to registration for the PhD degree, provided that –

5.1 you have shown exceptional progress with conducted research after at least one year's study. The application for conversion must be done within 18 months of registration for the MSc and is limited to

exceptional students who can be assessed on tangible outputs. Also see point 4.4 below;

5.2 in the course of the work done for your MSc study new and original insights have emerged that deserve further research at a doctoral level. 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 must be clear evidence of a conceptual expansion or intellectual leap from the MSc;

5.3 the work done for the master's study exceeds the conventional MSc study in terms of scope and cannot reasonably be separated into an MSc component and a PhD component;

5.4 the outputs, which can be incremental, may include:

5.4.1 excellent progress as evident from the six-month evaluations and/or an annual report;

5.4.2 conference participation (either oral or poster presentations);

5.4.3 peer-reviewed publications in journals of high quality (including those in review/in press); and

5.4.4 some other acceptable form of peer evaluation;

5.5 the proposal for the conversion of MSc to PhD studies is initiated by the supervisor, who makes a request in writing to the relevant departmental chair. If the chair supports the request, the request is presented to the Dean in writing. If the supervisor is also the departmental chair, the request is made directly and in writing 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. It is preferable that one of the members is not a staff member of Stellenbosch University. After consulting with the supervisor, you must (i) compile a report of the progress you made with the master's study and (ii) submit a written PhD research proposal that justifies the expansion of the philosophical or conceptual component of the study. As with new PhD studies, you will be required to defend the research proposal in an oral presentation. The committee will consider the oral presentation, the progress report and the PhD research proposal and make a recommendation for consideration by the Faculty Board;

5.6 you must be registered for at least three years in the instance of an MSc after an honours degree before the PhD degree can be awarded. At least one of those years you must be registered for the PhD degree;

5.7 in cases where written examinations are required for the master's study in question, you must have taken and passed all examinations before the PhD degree is awarded to you; and

5.8 tuition fees will not be adjusted retrospectively after the conversion.

6. Postgraduate programmes per department

6.1 Centre for Bioinformatics and Computational Biology

6.1.1 BScHons in Bioinformatics and Computational Biology

Programme Code

14166 – 778 (120)

Specific Admission Requirements

- An applicable BSc degree in either Bioinformatics, Genetics, Biochemistry, Molecular Biology, Computer Science or Mathematics or

  any other, related BSc degree approved by the Postgraduate Committee of the Centre for Bioinformatics and Computational Biology.
- An average final mark of at least 60% for the applicable third-year modules.
- Proficiency in both written and spoken English.
- The Postgraduate Committee may prescribe supplementary studies depending on your previous training and experience.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases – dependent on places being available – applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Programme Structure

The honours programme in Bioinformatics and Computational Biology is compiled annually and consists of a compulsory research project (721(50)) supervised by a member or associate member of the Centre for Bioinformatics and Computational Biology; a seminar (715(5)); a facilitated group discussion of relevant classic and current publications in bioinformatics (713(5)); and lectures and practical sessions on Algorithms in Bioinformatics (716(5)), Machine Learning in Bioinformatics (717(5)) and a range of topics in Advanced Bioinformatics (714(40)) currently relevant to the field, including statistics, databases, genomics and functional genomics, sequence analysis of RNA/DNA and proteins, genomes and disease, evolution and phylogenetics, structural bioinformatics, networks and pathways, and microbiomes.

Depending on your training and experience, one elective module, either Scientific Computing in Bioinformatics 711(10) or Cell Biology in Bioinformatics 712(10), must be chosen. This choice has to be approved by the Postgraduate Committee of the Centre for Bioinformatics and Computational Biology.

Duration of Programme

The duration of the programme usually is one year, but under exceptional circumstances, and at the discretion of the Postgraduate Committee of the Centre for Bioinformatics and Computational Biology, it is possible to repeat a module. The programme begins one week prior to the general start of classes.

Programme Content

The following modules are used to compile the honours programme annually.

Compulsory Modules

(credits = 110)

Subject Number	Module Code	Credits	Module Name	Semester
14234	713	5	Current Topics in Bioinformatics	1
14235	714	40	Advanced Bioinformatics	1
14236	715	5	Bioinformatics Seminar	1
14237	716	5	Algorithms in Bioinformatics	1
14238	717	5	Machine Learning in Bioinformatics	1
14240	721	50	Project in Bioinformatics	2

plus

Elective Module

Choose one of the following modules.

Subject Number	Module Code	Credits	Module Name	Semester
14241	711	10	Scientific Computing in Bioinformatics	1
14242	712	10	Cell Biology in Bioinformatics	1

Assessment and Examination

The programme is assessed by means of flexible assessment. The research project is assessed by means of a research report and an oral presentation. The performance mark is calculated as a weighted mark according to the credit values of each module. To obtain this honours degree, a performance mark of at least 50% must be achieved in each module.

6.1.2 MSc in Bioinformatics and Computational Biology

Programme Code

14166 – 879 (180)

Specific Admission Requirements

- A BScHons degree in Bioinformatics and Computational Biology, Biochemistry, Genetics, or Molecular Biology or;
- An applicable BScHons degree in a biological field or;
- A BScHons degree in Computer Science, Informatics, Mathematics, Applied Mathematics or Statistics or;
- An applicable BScHons degree in a Mathematics-related field or;

- Any other academic degree qualification and appropriate experience (assessed using the regular RPL procedures) approved by the Senate
- Depending on your previous training and experience, the Postgraduate Committee of the Centre for Bioinformatics and Computational Biology may prescribe additional studies.

Programme Content

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required. The main supervisor must be a member or an associate member of the Centre for Bioinformatics and Computational Biology. This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
14165	828	180	Thesis Bioinformatics and Computational Biology	Both

Assessment and Examination

After completion of the research you must submit a thesis for examination to the satisfaction of the appointed examiners and do an oral examination. See also section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Enquiries

Programme coordinator: Prof Hugh Patterton

Centre for Bioinformatics and Computational Biology

Tel: 021 808 2774

Email: hpatterton@sun.ac.za

6.1.3 Structured MSc in Bioinformatics of Infectious Diseases and Pathogen Genomics

This is a new programme that has been submitted for approval to the Department of Higher Education and Training (DHET) and accreditation by the Council on Higher Education (CHE). The programme will be offered only after it has been registered with the South African Qualifications Authority (SAQA), probably in 2025/2026. For more information on the programme, please contact **sdyers@sun.ac.za**.

6.1.4 PhD in Bioinformatics and Computational Biology

Programme Code

14166 – 978 (360)

Programme Description

A publication-ready dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.2 Department of Biochemistry

6.2.1 BScHons in Biochemistry

Programme Code

11053 – 778 (120)

Specific Admission Requirements

- An applicable BSc degree with Biochemistry 214, 244, 315, 345, 365, Bioinformatics 312 and Biochemistry 323, or Bioinformatics 322 or equivalent third-year Biochemistry modules.
- An average final mark of at least 60% for third-year Biochemistry.
- Proficiency in both written and spoken English.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Programme Structure

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 below. This selection is compulsory for the students of the particular year.

Duration of Programme

The duration of the programme is normally one year, but under exceptional circumstances, and at the discretion of the department, it is possible to repeat a module. The programme begins one week before the general start of classes.

Programme Content

The following modules are used to compile the honours programme annually.

Subject Number	Module Code	Credits	Module Name	Semester
11412	711	10	Practical Protein Biochemistry	1
11413	712	10	Steroid Hormones	1
14046	713	10	Soft Skills and Data Analysis	1
11415	714	10	Systems Biology	1
14069	715	10	Advanced Gene Expression	1
14047	716	10	Biophysical and Bio-analytical Techniques	1
11418	717	10	Specialised Topics	1
11420	718	10	Chemical Biology Topics	1
54895	741	60	Research project (Biochemistry)	2
18325	742	10	Seminar	2

Assessment and Examination

The programme is assessed by means of flexible assessment and the final mark is calculated as a weighted mark according to the credit values of each module.

6.2.2 MSc in Biochemistry

Programme Code

11053 – 878(180)

Specific Admission Requirements

- An applicable BScHons degree or other qualification approved by the Senate.
- Lecturers may require supplementary studies from you.

Programme Content

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66206	828	180	Thesis Biochemistry	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral presentation. An oral examination may also be required.

6.2.3 PhD in Biochemistry

Programme Code

11053 – 978 (360)

Programme Description

For the PhD degree a dissertation that contains the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.2.4 DSc in Biochemistry

Programme Code

11053 – 998 (360)

Programme Description

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 from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.3 Department of Botany and Zoology

6.3.1 BScHons in Biodiversity and Ecology

Programme Code

53953 – 778 (120)

Specific 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.
- Supplementary work may be prescribed by the Department depending on your background.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

General Programme Information

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. You will also receive practical training in relevant modern experimental techniques and be exposed to theoretical training in a number of biological sub-disciplines. The programme provides an effective bridging year if you are interested in pursuing advanced postgraduate degrees in various biological fields, but also provides you with key skills applicable to different market-orientated career choices. The programme places emphasis on three aspects in the educational process:

- The development of a satisfactory knowledge base;
- The development of a wide-ranging practical and theoretical capability; and
- The development of a professional scientific-methodological and ethical approach.

The programme includes theoretical work, seminars, practical tasks, independent research work and independent consultation of the broader biological literature. An honours student, it is required from you to attend departmental seminars and to serve as an undergraduate demonstrator.

Programme Structure

The programme consists of three components:

- A research project;
- A generic scientific skills module; and
- Theoretical topics in biodiversity science.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins with the start of the academic year.

Programme Content

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
66184	715	24	Generic Scientific Skills	2
55867	717	60	Research Project	Both
12249	796	36	Theoretical Topics in Biodiversity Sciences	Both

Assessment and Examination

- Assessment includes two oral examinations, written examinations, assignments, book reviews, seminars, a research project, and the production of a popular article.
- For successful completion of the honours programme, you must complete the generic scientific skills module, modules on theoretical topics in biodiversity science and a research project.
- You must pass each of the three components with a final mark of at least of 50%.

If you fail a theory-based module in the honours programme, you may apply to repeat this module in the following year. You may obtain a subminimum of 40% for only one of the theory-based modules, but the average of the skills modules and theory-based modules still needs to be above 50%. However, the research project cannot be repeated and if you fail it, you will not graduate with an honours degree.

6.3.2 Postgraduate programmes in Botany

6.3.2.1 MSc in Botany

Programme Code

59404 – 878 (180)

Specific Admission Requirements

- A BScHons degree in Biodiversity and Ecology or an approved equivalent qualification.
- The Department may also require supplementary study such as formal classes and/or seminars on specific aspects from you.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Description

Independent research on an approved subject as determined by the supervisor(s) and leading to a thesis is required.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66303	828	180	Thesis Botany	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral examination.

6.3.2.2 PhD in Botany

Programme Code

59404 – 978 (360)

Programme Description

A publication-ready dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.3.2.3 DSc in Botany

Programme Code

59404 – 998 (360)

Programme Description

For this degree, published research articles of a high international standard that contribute to the enrichment of knowledge in Botany, are required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.3.3 Postgraduate programmes in Zoology

6.3.3.1 MSc in Zoology

Programme Code

59412 – 878 (180)

Specific Admission Requirements

- A BScHons degree in Biodiversity and Ecology or an approved equivalent qualification.
- The Department may require supplementary studies such as formal classes and/or seminars on specific aspects.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Description

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66338	828	180	Thesis Zoology	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral examination.

6.3.3.2 PhD in Zoology

Programme Code

59412 – 978 (360)

Programme Description

A publication ready dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.3.3.3 DSc in Zoology

Programme Code

59412 – 998 (360)

Programme Description

For this degree, published research articles of a high international standard that significantly contribute to the enrichment of knowledge in Zoology, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.4 Department of Chemistry and Polymer Science

6.4.1 Postgraduate Programmes in Chemistry

6.4.1.1 BScHons in Chemistry

Programme Code

11479 – 778 (120)

Specific Admission Requirements

- 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.
- The departmental committee that gives final approval for admission can impose additional requirements, for example if you performed poorly in a particular module.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins one week before the general start of classes.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
10382	711	20	Analytical techniques	1
10638	712	20	Organic chemistry	1
10462	713	20	Physical chemistry	1
10384	714	20	Inorganic chemistry	1
56030	741	10	Special topics in Chemistry	2
63258	744	30	Research project in Chemistry	2

Assessment and Examination

All modules in this honours programme, with the exception of the research project, are assessed through a combination of theory, practical work and an examination. The research project is assessed based on submission of a final research report and an oral presentation. The final mark is calculated as a weighted mark according to the credit value of each module. To obtain this honours degree you must achieve a final mark of 50% and pass each module with 50%.

If you fail a first-semester module, you may apply to repeat this module in the following year. You may repeat a maximum of two first-semester modules. Admission to the relevant module(s) in the following year is solely at the discretion of the department. However, if you fail the research module or the special topics in the second semester, you fail the BScHons in Chemistry programme, as you cannot apply to repeat these modules in the following year.

6.4.1.2 MSc in Chemistry

Programme Code

11479 – 878 (180)

Specific Admission Requirements

- An applicable BScHons degree or other qualification as approved by the Senate.

Programme Content

An independent research project on an approved topic as determined by your supervisor(s) and leading to a thesis, is required. Supplementary studies as determined by the supervisor(s) may also be required.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66214	828	180	Thesis Chemistry	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral presentation.

6.4.1.3 PhD in Chemistry

Programme Code

11479 – 978 (360)

Programme Description

A dissertation containing the results of your independent, original research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.4.1.4 DSc in Chemistry

Programme Code

11479 – 998 (360)

Programme Description

For the DSc degree a body of already published scientific work(s) of a high standard that have made a significant and outstanding contribution to the enrichment of knowledge in Chemistry, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.4.2 Postgraduate programmes in Polymer Science

6.4.2.1 BScHons in Polymer Science

Programme Code

40789 – 778 (120)

Specific Admission Requirements

- 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).
- If you have not done at most one of the third-year modules (Chemistry 314, 324, 344 or 364) due to the specific requirements of the BSc degree in question, the Department will take your final marks of the other main subject(s) of the degree programme in question into consideration.
- The departmental committee gives final approval for admission and may impose additional requirements.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins one week before the normal start of classes.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
10382	711	20	Analytical techniques	1
10490	712	20	Advanced Analytical Polymer Science	1
10658	724	20	Polymer Chemistry	1
10463	744	15	Physical Polymer Science	2
13370	754	15	Special Topics in Polymer Science	2
64440	714	30	Research Project in Polymer Science	2

Assessment and Examination

All modules in this honours programme, with the exception of the research project, are assessed through a combination of theory, practical work and an examination. The research project is assessed based on submission of a final research report and an oral presentation. The final mark is calculated as a weighted mark according to the credit value of each module. To obtain this honours degree you must achieve a final

mark of 50% and pass each module with 50%.

If you fail a theory-based module you may apply to repeat this module in the following year. You may repeat a maximum of two modules. Admission to the relevant module(s) in the following year is solely at the discretion of the department. However, if you fail the research module or the module: special topics in the second semester, you fail the BScHons in Polymer Science programme, as you cannot apply to repeat these modules in the following year.

6.4.2.2 MSc in Polymer Science

Programme Code

40789 – 878 (180)

Programme Description

An independent research project on an approved topic as determined by your supervisor(s) and leading to a thesis, is required. Supplementary studies as determined by the supervisor(s) may also be required.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66230	828	180	Thesis Polymer Science	Both

Assessment and Examination

On completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and complete an oral examination.

6.4.2.3 PhD in Polymer Science

Programme Code

40789 – 978 (360)

Programme Description

A dissertation containing the results of your independent, original research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.4.2.4 DSc in Polymer Science

Programme Code

40789 – 998 (360)

Programme Description

For the DSc degree a body of already published scientific work(s) of a high standard that have made a significant and outstanding contribution to the enrichment of knowledge in Polymer Science, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.5 Department of Earth Sciences

6.5.1 BScHons in Earth Sciences

Programme Code

12918 – 778 (120)

Specific Admission Requirements

- A BSc degree with Geology or equivalent as major. Students with other comparable subject combinations should contact the department regarding admission.
- Stellenbosch graduates with a BSc in Earth Sciences must offer the following third-year modules:
  - Focal area Applied Earth Science: Geology 314, 324, 344 and 354, and Earth Science Field Skills 374.
  - Focal area Geo-environmental Science: Geology 324, 344, 364, and Environmental Geochemistry 314 and Environmental Field Skills 372.
- An average final mark of at least 65% for the prescribed module combinations, made up of third-

year Geology, Environmental Geochemistry, Earth Science Field Skills or Environmental Field Skills modules.

- The Department of Earth Sciences will evaluate all applications individually. If you obtained an average final mark of 55–64% for third-year Geology, and if applicable, third-year Environmental Geochemistry, you could also be considered for honours.
- Please note: If you have obtained a final mark between 55 and 59% for third-year Geology, and if applicable, third-year Environmental Geochemistry, and you are recommended by the department for admission to the honours programme, the Science Faculty Board must grant final approval.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Programme Structure

The honours programme in Earth Sciences is composed of three compulsory modules, a research project and two further modules from one of two focal areas. The focal areas are:

- Applied Geology; and
- Environmental Geochemistry.

The content of each of these modules is further divided into sections at the departmental level and may vary from year to year. The Department can decide not to offer a given module or focal area depending on staff availability and student numbers. The specific content of focal areas and modules for each year is provided before the start of the honours year. You can take elements of different modules in consultation with your supervisors and the honours co-ordinator.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme normally starts on the Monday of the second last week in January.

Compulsory modules

(credits = 80)

Subject Number	Module Code	Credits	Module Name	Semester
12240	771	15	Geology of Southern Africa	Both
12241	772	15	Research Methods in Earth Sciences	Both
12242	773	15	Special Topics in Earth Science	Both
54895	795	35	Research project	Both

Choose one of the following focal areas

Focal area A – Applied Geology (credits = 40)

Subject Number	Module Code	Credits	Module Name	Semester
12243	712	20	Concepts in Crustal Evolution	1
12247	742	20	Economic Geology	2

Focal area B – Environmental Geochemistry (credits = 40)

Subject Number	Module Code	Credits	Module Name	Semester
12244	714	20	Hazardous Waste Site Assessment	1
12275	744	20	Environmental Systems	2

Assessment and Examination

All modules in this honours programme, with the exception of the research project, are assessed through a combination of theory, practical work and an examination. The research project is assessed based on submission of your final research report and an oral presentation. To obtain the honours degree you must pass all modules with a 50% sub-minimum.

6.5.2 MSc in Earth Sciences

Programme Code

12918 – 879 (180)

Specific Admission Requirements

- A BScHons degree in Geology or an approved equivalent qualification.
- Supplementary studies may be required from you before beginning research.

Programme Content

An independent research project on a specific topic that may entail field research/laboratory research, as determined by your supervisor(s) and leading to a thesis, is required.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
14314	828	180	Thesis Earth Sciences	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral examination.

6.5.3 PhD in Earth Sciences

Programme Code

12918 – 978 (360)

Programme Description

A dissertation that is the product of your personal and independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.5.4 DSc in Geology

Programme Code

13374 – 998 (360)

Programme Description

A compilation of scientific publications contributing substantially and at a high level to the body of knowledge in Geology, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.6 Department of Mathematical Sciences

6.6.1 Division: Mathematics

6.6.1.1 BScHons in Mathematics

Programme Code

21539 – 797 (128)

Programme Description

This honours programme has a focus in Mathematics or Biomathematics. The minimum credit requirement per focus area is 128.

Specific Admission Requirements

- A BSc degree with Mathematics as major or an equivalent qualification.
- A final mark of at least 60% for Mathematics 3.
- For the Biomathematics focus, you must have a BSc degree approved by the Biomathematics programme committee with an average mark of at least 60% for the relevant third-year modules.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the

verification of qualifications. Therefore, apply early.

Promotion Rules

In order to obtain this degree, you need to achieve at least 50% in every module of this programme.

If you fail a theory-based module, you may apply to repeat this module in the following year. You may apply to repeat a maximum of two modules. Admission to the relevant module(s) in the following year is solely at the discretion of the department. However, the honours project module cannot be repeated and if you fail this, you will not graduate with the BScHons in Mathematics.

Programme Structure

A programme will be developed for you as student depending on your background and preferences. You can, with the permission of the Mathematics Division, take a maximum of the equivalent of half of the programme outside the Mathematics Division. In each semester you must take honours modules to the value of at least 64 credits. In the second semester one of these modules is a research project. The modules you choose give a focus to the BScHons in Mathematics. This focus will be discussed with you to design an appropriate curriculum.

More information about the honours programme is available on the website of the Department of Mathematical Sciences at http://mathsci.sun.ac.za.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins in the first week of February.

Programme Content

The following table contains the modules for the focus in **Mathematics.**

First Semester

Subject Number	Module Code	Credits	Module Name	Semester
10378	711	16	Algebra (prerequisite pass module: Mathematics 314)	1
11202	712	16	Functional Analysis and Measure Theory (Prerequisite pass module: Mathematics 365)	1
62987	713	16	Real and Complex Analysis (Prerequisite pass module: Mathematics 324, 365)	1
62871	714	16	Set Theory and Topology (Prerequisite pass module: Mathematics 365 or 378)	1

Second Semester

Depending on the interest shown and the availability of lecturers the following modules will be presented.

Subject Number	Module Code	Credits	Module Name	Semester
11493	747	8	Algebraic Number Theory	2
11494	748	8	Computational Algebra	2
20405	749	8	Wavelet analysis	2
66389	751	8	Functional Analysis II	2
66397	752	8	Measure Theory II	2
64400	753	8	Category Theory	2
66419	754	8	Logic	2
66427	755	8	Concrete Mathematics	2
66435	756	8	Topics in Algebra	2
12250	757	8	Complex Analysis II	2

Additional capita selecta modules are offered each year, subject to the research interests of students, teachers and visiting academics. These modules will be announced in the first semester. Visit the departmental website at http://mathsci.sun.ac.za for the current offering of modules.

Subject Number	Module Code	Credits	Module Name	Semester
62928	741	8	Capita selecta I	2
62979	742	8	Capita selecta II	2
62936	743	8	Capita selecta III	2
11204	744	8	Capita selecta IV	Both
63002	745	8	Capita selecta V	2
11203	760	8	Advanced Analysis	2
12550	761	8	Advanced Abstract Algebra	2
12551	762	8	Number theory	2
14048	767	8	Advanced Combinatorics	2
14049	768	8	Algebraic Curves	2
14050	769	8	Algebraic Geometry	2
14051	771	8	Asymptotic Methods	2
14053	772	8	Categorical Algebra	2
14054	773	8	Differential Geometry	2
14055	774	8	Functional Analysis III	2
14056	775	8	Hilbert Spaces and C*-algebras	2
14057	776	8	Knot Theory	2
14058	780	8	Lie Groups and Lie Algebras	2
14059	784	8	Model Theory	2
14061	785	8	Operator Theory	2
14062	781	8	Universal Algebra	2
14063	782	8	Representation Theory	2
14064	783	8	Analytic Number Theory	2

An honours project that introduces you to a research theme is completed in the second semester.

Subject Number	Module Code	Credits	Module Name	Semester
62944	746	32	Mathematics: Honours project	2

The following table contains the modules for the focus in **Biomathematics.**

First Semester

Specific modules are offered in collaboration with the African Institute for Mathematical Sciences (AIMS) at its campus in Muizenberg.

Subject Number	Module Code	Credits	Module Name	Semester
11779	721	16	Computational and discrete methods in Biomathematics	Both
11780	722	16	Non-linear Dynamical Systems in Biomathematics	Both
11781	723	8	Advanced Topics in Biomathematics I	Both
11782	724	8	Advanced Topics in Biomathematics II	Both
11785	725	8	Selected topics from biological sciences	Both
11786	726	8	Selected topics from biomedical sciences	Both

Second Semester

You complete an 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.

Subject Number	Module Code	Credits	Module Name	Semester
11787	747	32	Biomathematics: Honours project	Both
12553	748	16	Advanced Topics in Biomathematics III	2
12554	749	8	Advanced Topics in Biomathematics IV	2

plus

Elective Modules

(credits = 8)

You can take any honours module in consultation with the Biomathematics programme committee and if it complies with specific prerequisites.

6.6.1.2 MSc in Mathematics

Programme Code

21539 – 878 (180)

Specific Admission Requirements

- A BScHons degree in Mathematics or an approved equivalent qualification.
- The Department can require supplementary studies in consultation with you and your supervisor.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Description

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
11201	828	180	Thesis Mathematics	Both

Assessment and Examination

After completion of the research, you must submit a thesis to the satisfaction of the examiners and do an oral examination.

Enquiries

Contact the chair of the Department of Mathematical Sciences for more information on the MSc degree in Mathematics.

6.6.1.3 PhD in Mathematics

Programme Code

21539 – 978 (360)

Programme Description

A dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.6.1.4 DSc in Mathematics

Programme Code

21539 – 998 (360)

Programme Description

For this degree published scientific work(s) of a high standard, which have made a substantial and outstanding contribution to the knowledge of Mathematics, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.6.2 Division: Applied Mathematics

6.6.2.1 BScHons in Applied Mathematics

Programme Code

20710 – 797 (128)

Specific 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.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Promotion Rules

In order to obtain this degree, you need to achieve at least 50% in every module in your programme.

If you fail a theory-based module, you may apply to repeat this module in the following year. You may apply to repeat a maximum of two modules. Admission to the relevant module(s) in the following year is solely at the discretion of the department. However, the research module cannot be repeated and if you fail it, you will not graduate with the BScHons in Applied Mathematics.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins with the start of the academic year.

Programme Content

The minimum credits required are 128. You can take some modules at other departments with the permission of the Division Applied Mathematics. The following modules are offered:

Subject Number	Module Code	Credits	Module Name	Semester
10381	781	16	Analytical Methods of Applied Mathematics	1 or 2
36323	776	16	Numerical Methods	1
10643	774	16	Partial Differential Equations (Students who have taken Applied Mathematics 364 are not allowed to take Partial Differential Equations 774 as well).	1
10542	782	16	Graph Theory	1 or 2
62782	784	16	Coding Theory	1 or 2
10728	794	16	Tensor Analysis	1 or 2
62820	775	16	Numerical Simulation of Fluids	1 or 2
62839	791	16	Porous Media	1 or 2
62812	773	16	Numerical Modelling	1 or 2
64572	793	16	Digital Image Processing	1 or 2
62847	792	16	Computer Vision	1 or 2
62855	796	16	Statistical Pattern Recognition	1 or 2
11380	711	10	X-ray Tomography	1 or 2
12253	761	8	Capita selecta I	1 or 2
12255	762	8	Capita selecta II	1 or 2
12256	763	16	Capita selecta III	1 or 2
12257	764	16	Capita selecta IV	1 or 2

Subject Number	Module Code	Credits	Module Name	Semester
10557	772	32	Research Project in Applied Mathematics	Annual
13946	771	16	Finite Difference and Finite Element Methods	1 or 2
14233	783	16	Applied Markov Processes	1 or 2

The Research Project in Applied Mathematics is compulsory. Not all other modules will necessarily be offered every year and the Division can decide to make certain modules compulsory.

Assessment and Examination

All modules are assessed continuously. To obtain this honours degree, you must achieve a final mark of at least 50% in each module, including the project.

6.6.2.2 MSc in Applied Mathematics

Programme Code

20710 – 878 (180)

Specific Admission Requirements

- A BScHons degree in Applied Mathematics or an approved equivalent qualification.
- The Department can require supplementary studies from you which may be considered when calculating your final mark.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Description

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66354	828	180	Thesis Applied Mathematics	Both

Assessment and Examination

After completion of the research, you must submit a thesis to the satisfaction of the examiners and do an oral examination.

6.6.2.3 MSc in Machine Learning and Artificial Intelligence

Programme Code

14371 – 887 (180)

Programme Description

This one-year structured postgraduate programme is aimed at students with a strong mathematical and computational background. It will equip you with a foundation of machine learning and artificial intelligence fundamentals, as well as a suite of sophisticated techniques and concepts at the research forefront of these fields.

Specific Admission Requirements

In order to register for the programme, one of the following qualifications is required:

- An honours degree in Applied Mathematics, Computer Science, Mathematics, or Mathematical Statistics;
- A four-year bachelor's degree in Electrical Engineering;
- A qualification deemed equivalent to the above, in a field closely linked to machine learning.

You will also be expected to have existing and demonstrable proficiency in Python or an equivalent programming language, be comfortable with numerical linear algebra and multivariable calculus, and possess basic knowledge of probability theory and statistics.

Final approval for admission rests with the departmental academic committee in collaboration with the programme coordinator, who also take into account the infrastructure and capacity of the Department.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year.

Duration of Programme

The programme extends over one academic year full-time, or two academic years part-time, beginning in January and ending in December.

Programme Structure

The programme consists of three separate blocks: compulsory core modules, elective modules and a research project. Every block bears 60 credits, bringing the programme total to 180 credits. The modules in a particular block may not all run in parallel over the entire block; scheduling will depend on intermodular content development and the availability of lecturers.

Programme Content

The programme will equip you with specialist knowledge and skills to the level where you will be able to critically evaluate the suitability of existing theories and techniques for a specific application. The modules (with their associated assignments) and the research project will also develop your abilities to design, select and apply technically advanced methods, techniques and theories to complex practical and theoretical machine-learning and artificial intelligence problems.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
14398	814	15	Applied Machine Learning at Scale	1 or 2
14396	813	15	Foundations of Deep Learning	1 or 2
14394	811	15	Mathematics for Machine Learning	1 or 2
14395	812	15	Probabilistic Modelling and Reasoning	1 or 2
14399	885	60	Research Project (Machine Learning)	1 or 2

plus

Elective Modules

Choose 6 modules to the value of 60 credits. Not all of these modules will necessarily be offered every year.

Subject Number	Module Code	Credits	Module Name	Semester
14404	820	10	Advanced Probabilistic Modelling	1 or 2
14409	825	10	Advanced Topics in Artificial Intelligence	1 or 2
14408	824	10	Advanced Topics in Machine Learning	1 or 2
14407	823	10	Artificial Intelligence and the Brain	1 or 2
62847	842	10	Computer Vision	1 or 2
14406	822	10	Monte Carlo Methods	1 or 2
14401	817	10	Natural Language Processing	1 or 2
14405	821	10	Optimisation for Machine Learning	1 or 2
14402	818	10	Reinforcement Learning and Planning	1 or 2
14403	819	10	Sequence Modelling	1 or 2

Assessment and Examination

- All the modules (except for the research project) will be assessed by means of flexible assessment. This entails a combination of practical assignments and summative assessments.
- All summative assessments will be moderated internally and at least 40% of the final mark will be moderated externally.
- The 60-credit research project will be examined by the supervisor and an independent examiner. A moderator will review the recommendations by the examiner and the supervisor and, if necessary, also examine the project. Either the examiner or the moderator must be external and appointed by the Science Faculty Board.
- To pass the programme, you must obtain at least 50% for the research project and at least 50% for each module.

6.6.2.4 PhD in Applied Mathematics

Programme Code

20710 – 978 (360)

Programme Description

A dissertation containing the results of your original research on a topic in Applied Mathematics is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.6.2.5 DSc in Applied Mathematics

Programme Code

20710 – 998 (360)

Programme Description

For this degree previously published work(s) of a high standard which make a substantial and outstanding contribution to the enrichment of knowledge in Applied Mathematics, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.6.3 Division: Computer Science

6.6.3.1 BScHons in Computer Science

Programme Code

18139 – 797 (128)

Programme Description

The minimum credits required are 128.

Specific Admission Requirements

- A bachelor's degree with Computer Science as major, or an equivalent qualification.
- An average final mark of at least 60% for Computer Science 3.
- At least 32 credits at second-year or third-year level in quantitative modules (such as Mathematics, Applied Mathematics, Physics, Mathematical Statistics or Operations Research).

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Programme Structure

This programme consists of 6 modules of 16 credits each, as well as a compulsory programming project of 32 credits. At most 2 modules may be taken from related departments with the permission of the Department of Mathematical Sciences (Division Computer Science). Not all modules are necessarily offered each year.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins with the start of the academic year.

Programme Content

(credits = 128)

Compulsory Modules

(credits = minimum 32, maximum 64)

Subject Number	Module Code	Credits	Module Name	Semester
63444	771	32	Honours Project in Computer Science	Both

Unless you have completed Computer Science 314 or an equivalent, the following Computer Science module is also compulsory.

Subject Number	Module Code	Credits	Module Name	Semester
64963	714	16	Concurrent Programming I	1

Unless you have completed Computer Science 313 or an equivalent, the following Computer Science module is also compulsory.

Subject Number	Module Code	Credits	Module Name	Semester
14530	711	16	Computer Networks I	1

plus

Elective Modules

(credits = minimum 64, maximum 96)

Choose modules to a minimum value of 64 credits and a maximum value of 96 credits from the list below to reach the required credit total of 128 credits. However, you can also choose modules presented by other departments with the permission of the Computer Science Division in the Department of Mathematical Sciences.

Subject Number	Module Code	Credits	Module Name	Semester
63452	711	16	Automata Theory and Applications	1 or 2
64947	712	16	Advanced Algorithms	1 or 2
64955	713	16	Theoretical Computer Science	1 or 2
63401	715	16	Databases	1 or 2
64971	716	16	Advanced Topics in Computer Science 1	1 or 2
11788	741	16	Machine Learning	1 or 2
14195	742	16	Machine Learning A	1 or 2
64998	742	16	Computer Graphics	1 or 2
65005	743	16	Simulation of Networks	1 or 2
65013	744	16	Concurrent Programming 2	1 or 2
65021	745	16	Software Construction	1 or 2
65048	746	16	Advanced Topics in Computer Science 2	1 or 2
14531	771	16	Principles of Data Science	1 or 2
14533	771	16	Computing and Society	1 or 2
14232	791	16	Artificial Intelligence	1 or 2
62847	792	16	Computer Vision	1 or 2
64572	793	16	Digital Image Processing	1 or 2
13945	794	16	Search and Planning	1 or 2
13944	795	16	Functional Programming	1 or 2
14065	796	16	Software Verification and Analysis	1 or 2
14066	791	16	Space Science Algorithms	1 or 2

Assessment and Examination

All modules make use of flexible assessment and you must achieve a final mark of at least 50% for each module, as well as for the programming project. If you do not pass all modules required for the degree in the first year, you may apply to repeat these modules in the following year.

6.6.3.2 MSc in Computer Science

Programme Code

18139 – 878 (180)

Specific Admission Requirements

- A BScHons degree in Computer Science or an approved equivalent qualification.
- The Department can require supplementary studies, as determined by your supervisor(s) on a case-by-case basis.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Description

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required.

Programme Content

Your individual programme is compiled separately. This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66362	828	180	Thesis Computer Science	Both

Assessment and Examination

After completion of the research, you must submit a thesis to the satisfaction of the examiners and do an oral examination.

6.6.3.3 MSc in Machine Learning and Artificial Intelligence

Programme Code

14371 – 887 (180)

Programme Description

This one-year structured postgraduate programme is aimed at students with a strong mathematical and computational background. It will equip you with a foundation of machine learning and artificial intelligence fundamentals, as well as a suite of sophisticated techniques and concepts at the research forefront of these fields.

Specific Admission Requirements

In order to register for the programme, one of the following qualifications is required:

- An honours degree in Applied Mathematics, Computer Science, Mathematics, or Mathematical Statistics;
- A four-year bachelor's degree in Electrical Engineering;
- A qualification deemed equivalent to the above, in a field closely linked to machine learning.

You will also be expected to have existing and demonstrable proficiency in Python or an equivalent programming language, be comfortable with numerical linear algebra and multivariable calculus, and possess basic knowledge of probability theory and statistics.

Final approval for admission rests with the departmental academic committee in collaboration with the programme coordinator, who also take into account the infrastructure and capacity of the Department.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year.

Duration of Programme

The programme extends over one academic year full-time, or two academic years part-time, beginning in January and ending in December.

Programme Structure

The programme consists of three separate blocks: compulsory core modules, elective modules and a research project. Every block bears 60 credits, bringing the programme total to 180 credits. The modules in a particular block may not all run in parallel over the entire block; scheduling will depend on intermodular content development and the availability of lecturers.

Programme Content

The programme will equip you with specialist knowledge and skills to the level where you will be able to

critically evaluate the suitability of existing theories and techniques for a specific application. The modules (with their associated assignments) and the research project will also develop your abilities to design, select and apply technically advanced methods, techniques and theories to complex practical and theoretical machine-learning and artificial intelligence problems.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
14398	814	15	Applied Machine Learning at Scale	1 or 2
14396	813	15	Foundations of Deep Learning	1 or 2
14394	811	15	Mathematics for Machine Learning	1 or 2
14395	812	15	Probabilistic Modelling and Reasoning	1 or 2
14399	885	60	Research Project (Machine Learning)	1 or 2

plus

Elective Modules

Choose 6 modules to the value of 60 credits. Not all of these modules will necessarily be offered every year.

Subject Number	Module Code	Credits	Module Name	Semester
14404	820	10	Advanced Probabilistic Modelling	1 or 2
14409	825	10	Advanced Topics in Artificial Intelligence	1 or 2
14408	824	10	Advanced Topics in Machine Learning	1 or 2
14407	823	10	Artificial Intelligence and the Brain	1 or 2
62847	842	10	Computer Vision	1 or 2
14406	822	10	Monte Carlo Methods	1 or 2
14401	817	10	Natural Language Processing	1 or 2
14405	821	10	Optimisation for Machine Learning	1 or 2
14402	818	10	Reinforcement Learning and Planning	1 or 2
14403	819	10	Sequence Modelling	1 or 2

Assessment and Examination

- All the modules (except for the research project) will be assessed by means of flexible assessment. This entails a combination of practical assignments and summative assessments.
- All summative assessments will be moderated internally and at least 40% of the final mark will be moderated externally.
- The 60-credit research project will be examined by the supervisor and an independent examiner. A moderator will review the recommendations by the examiner and the supervisor and, if necessary, also examine the project. Either the examiner or the moderator must be external and appointed by the Science Faculty Board.
- To pass the programme, you must obtain at least 50% for the research project and at least 50% for each module.

6.6.3.4 PhD in Computer Science

Programme Code

18139 – 978 (360)

Programme Description

A dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.6.3.5 DSc in Computer Science

Programme Code

18139 – 998 (360)

Programme Description

For this degree published scientific work(s) of high quality, which contributes substantially to the enrichment of knowledge in Computer Science, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.6.4 African Institute for Mathematical Sciences (AIMS)

6.6.4.1 MSc in Mathematical Sciences

Programme Code

58637 – 889 (180)

Programme Description

This a one-year postgraduate programme leads to a structured MSc degree in Mathematical Sciences, which is formally accredited by the Universities of Cape Town, Stellenbosch, and the Western Cape. The programme is taught at the African Institute for Mathematical Sciences (AIMS) in association with the Universities of Cambridge, Oxford and Paris Sud XI. For more information, visit our website at www.aims.ac.za.

Specific Admission Requirements

In order to register for this programme, one of the following qualifications are required:

- A four-year bachelor's degree (NQF level 8) in Mathematics, or any science or engineering subject with a significant Mathematics component;
- An Honours degree (NQF level 8) in Mathematics, or any science or engineering subject with a significant Mathematics component; or
- Any degree considered to be equivalent to the abovementioned degrees.

Your record should demonstrate a strong aptitude in Mathematics. A wide range of qualifications, equivalent to the above requirements, will be considered.

Applications and Selection

AIMS calls for online applications in October and December each year. The call is advertised via the AIMS mailing lists and through the partner universities. Applications that meet the admission requirements are assessed and students are selected by the AIMS Executive Team. Selected students are split equally between the Universities of Cape Town, Stellenbosch and the Western Cape for purposes of registration.

Programme Structure

The programme consists of two components that are grouped into two modules, namely Advanced Topics in the Mathematical Sciences and a research project in the Mathematical Sciences. The module Advanced Topics entails coursework that is divided into submodules. These submodules are generally three weeks long. They are self-contained and very demanding. Each submodule consists of 30 hours' contact time (10 hours per week). Additional tutorials and special lectures are often held in the evenings while students are completing their assignments.

Duration of Programme

The curriculum runs over three semesters and there are two intakes each year – in January and in August.

Programme Content

Advanced Topics in the Mathematical Sciences (28 weeks) (120 credits)

Skills submodules (10 weeks):

Seven submodules of 30 hours each. The skills submodules have a broad focus that ranges from mathematical thinking and numeric computer programming to scientific writing.

Review submodules (6 three-week blocks):

Eleven submodules of 30 hours each.

Review submodules are fundamentally different from one another, and a wide range of topics are offered, which are more flexibly designed. You are required to complete 11 submodules selected from the 18 review submodules offered, with a maximum of two chosen from any three-week block. Choices offered are balanced as far as possible with regard to focus on Mathematics and its applications to Artificial Intelligence, Computer Science, Machine Learning, Physics, Statistics and other interdisciplinary topics, such as Biomathematics. You choose from the list of submodules in consultation with the Academic Director, who

ensures that your chosen modules complement each other. The review submodules provide an overview and in-depth study of topics from a major field of modern scientific work in the Mathematical Sciences and its applications.

Research Project in Mathematical Sciences (8 weeks) (60 credits):

During the research project phase, you work on a research topic with a supervisor, usually from a South African university. It is not expected of you to do original work to achieve a passing grade, but the criterion for an outstanding research project is that it must constitute an original approach to the topic and may lead to publication or form an outstanding introduction to the field that is useful to other students entering the field. During this time, communication skills and computer classes may continue, at the supervisor's discretion.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
11471	871	120	Advanced Topics in the Mathematical Sciences	Both
11472	871	60	Research Project in the Mathematical Sciences	Both

Assessment and Examination

- This programme is assessed continuously through written assignments, tutorials, short tests and presentations as set by the lecturers.
- You do an oral presentation on your written research project to a panel of examiners. This panel consists of the AIMS Director, the AIMS Academic Director, the supervisor, teaching assistant and external examiners.

6.7 Department of Microbiology

6.7.1 BScHons in Microbiology

Programme Code

16284 – 778 (120)

Specific Admission Requirements

- A BSc degree with Microbiology as a major, that means Microbiology 314, 324, 354 and 364 OR
- A BSc degree in Chemistry and Polymer Science with elective modules as in Option 2: Microbiology 314(16), and 324(16) or 364(16).
- An average final mark of at least 60% for Microbiology 3.
- Supplementary work may be required, depending on your background.

The number of students who are accepted each year is limited by the number of places available in the research laboratories.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, submit your application early.

Programme Structure

The programme includes formal modules in Microbiology as well as seminars, self-study and experimental work.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins one week before the general start of classes.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
10439	772	60	Experimental Microbiology	Both
10721	773	30	Techniques in Molecular Microbiology	Both
10483	774	30	Selected Topics	Both

Assessment and Examination

All modules in this honours programme are assessed continuously using a combination of theory, practical work, written assignments, reports and presentations, with an oral examination at the end of the year. The final mark is calculated as a weighted mark according to the credit value of each module. If you fail a module in the honours programme, you may apply to repeat this module in the following year. Admission to the module in the following year is solely at the discretion of the department and is subject to the availability of space.

6.7.2 MSc in Microbiology

Programme Code

16284 – 878 (180)

Specific Admission Requirements

- A BScHons degree in Microbiology or an approved equivalent qualification.
- The Department may also require supplementary work on specific topics.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Description

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required.

Programme content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66281	828	180	Thesis Microbiology	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral examination.

6.7.3 PhD in Microbiology

Programme Code

16284 – 978 (360)

Programme Description

A dissertation containing the results of your independent scientific research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.7.4 DSc in Microbiology

Programme Code

16284 – 998 (360)

Programme Description

For this degree previously published research work(s) of a high standard that has made a substantial and important contribution to the enrichment of knowledge in Microbiology, is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.8 Department of Physics

6.8.1 Postgraduate programmes in Physics

6.8.1.1 BScHons in Physics

Programme Code

12998 – 797 (128)

Specific Admission Requirements

- A BSc degree with Physics as major with an average final mark of at least 60% in Physics 3.

- Applications which deviate from the abovementioned requirement, for example if a BSc degree was obtained elsewhere, will only be considered on recommendation of the Department and approval by the Faculty Committee.
- The Department may require supplementary work, depending on your background.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student, please note that your application may take longer to process due to the verification of qualifications. Therefore, apply early.

Promotion Rules

- To obtain this degree you must pass with an average of at least 50% and achieve a subminimum of 45% in all modules.
- If you achieved at least 40% in a module or modules of 16 credits or less, the Department will allow a second assessment opportunity in the modules concerned.
- If you are taking the Radiation and Health Physics focal area you should note that a final mark of 50% in Physics 718, 750, 751, 752 and 753 is required to be admitted to an internship as a medical physicist.

Programme Structure

The following focal areas are offered:

- BScHons in Physics (Laser Physics focal area);
- BScHons in Physics (Nuclear Physics focal area);
- BScHons in Physics (Radiation and Health Physics focal area); and
- BScHons in Physics (Theoretical Physics focal area).

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins a week before the general start of classes.

Programme Content

The curricula of the respective focal areas are set out below.

Focal area Laser Physics (128 credits)

Compulsory Modules

(credits = 104)

Compulsory modules can only be replaced by alternative modules in consultation with the coordinator of the Laser Physics Honours programme, and with approval of the departmental programme committee.

Subject Number	Module Code	Credits	Module Name	Semester
10445	711	8	Electromagnetism	1
10590	712	8	Lagrange and Hamilton Mechanics	1
10586	714	16	Quantum Mechanics B (Advanced Formalism and Applications)	1
10390	716	8	Atomic Physics	1
10702	721	16	Statistical Physics B (Introduction to Interacting and Non-equilibrium Systems)	2
63274	741	32	Physics Project	2
13934	745	8	Laser Technology	2
17221	772	8	Optics	1

plus

Elective Modules

(credits = 24)

Please note: The elective modules available in any particular year will vary depending on availability of

lecturing staff or visiting lecturers. The programme offering for a given academic year will be finalised and approved by the departmental programme committee before the start of the academic year and communicated to potential students.

Choose three of the following modules to the value of 24 credits.

Subject Number	Module Code	Credits	Module Name	Semester
10752	713	8	Solid State Physics	1
13940	742	8	Special Topics in Applied Photonics	Both
13939	743	8	Special Topics in Biophotonics	Both
12546	744	8	Laser Spectroscopy	2
13936	746	8	Quantum Optics	2
10610	747	8	Molecular Physics	2
13937	773	8	Nonlinear Optics	2
13938	774	8	Special Topics in Optics	Both

Focal area Nuclear Physics (128 credits)

Compulsory Modules

(credits = 112)

Subject Number	Module Code	Credits	Module Name	Semester
10445	711	8	Electromagnetism	1
10590	712	8	Lagrange and Hamilton Mechanics	1
10752	713	8	Solid State Physics	1
10586	714	16	Quantum Mechanics B (Advanced Formalism and Applications)	1
10708	718	8	Radiation Interaction	2
10702	721	16	Statistical Physics B (Introduction to Interacting and Non-equilibrium Systems)	2
63274	741	32	Physics Project	2
10563	748	8	Nuclear Reactions and Nuclear Structure	2
10706	753	8	Radiation Protection	2

plus

Elective Modules

(credits = 16)

Choose two of the following modules.

Please note: All of these modules will not necessarily be presented each year

Subject Number	Module Code	Credits	Module Name	Semester
10587	719	8	Quantum Mechanics C (Functional Integral Formulation)	1
13941	749	8	Selected Topics in Nuclear Physics	2
10753	754	8	Many-body Theory	2
10674	755	8	Relativistic Quantum Field Theory	2

Focal area Radiation and Health Physics (128 credits)

Compulsory Modules

Compulsory modules can only be replaced by alternative Physics modules in consultation with the

coordinator of the Radiation and Health Physics Honours programme, and with approval of the departmental programme committee.

Subject Number	Module Code	Credits	Module Name	Semester
10445	711	8	Electromagnetism	1
10590	712	8	Lagrange and Hamilton Mechanics	1
10752	713	8	Solid State Physics	1
10586	714	16	Quantum Mechanics B (Advanced Formalism and Applications)	1
10390	716	8	Atomic Physics	1
10708	718	8	Radiation Interaction	2
63274	741	32	Physics Project	2
10563	748	8	Nuclear Reactions and Nuclear Structure	2
10467	750	8	Physics of Radiation Dosimetry/Radiology	2
10465	751	8	Physics of Nuclear Medicine	2
10466	752	8	Physics of Radiotherapy	2
10706	753	8	Radiation Protection	2

Focal area Theoretical Physics (128 credits)

Compulsory Modules

(credits = 96)

Subject Number	Module Code	Credits	Module Name	Semester
10445	711	8	Electromagnetism	1
10590	712	8	Lagrange and Hamilton Mechanics	1
10752	713	8	Solid State Physics	1
10586	714	16	Quantum Mechanics B (Advanced Formalism and Applications)	1
13948	719	8	Relativistic Quantum Mechanics	1
10702	721	16	Statistical Physics B (Introduction to Interacting and Non-equilibrium Systems)	2
63274	741	32	Physics Project	2

plus

Elective Modules

(credits = 32)

Please note: The elective modules available in any particular year will vary depending on availability of lecturing staff or visiting lecturers. The programme offering for a given academic year will be finalised and approved by the departmental programme committee before the start of the year and communicated to potential students.

Choose modules from the following list to the value of 16 credits.

Subject Number	Module Code	Credits	Module Name	Semester
13985	757	8	Bayesian Physics	2
10424	758	8	Dynamic Systems and Complexity	1
10753	754	8	Many-body Theory	2
10674	755	16	Relativistic Quantum Field Theory	2
13942	756	8	Selected Topics in Theoretical Physics	2

plus

Choose modules to the value of 16 credits from honours modules in Physics, Mathematics or Applied Mathematics in consultation with the Department of Physics.

6.8.1.2 MSc in Physics

Programme Code

12998 – 878 (180)

Specific Admission Requirements

- An appropriate BScHons degree or an equivalent qualification as approved by the Senate.

Programme Structure

- The Department appoints a supervisor for each student.
- You are expected to do an independent literature review and research in consultation with your supervisor.
- Advanced seminar and/or coursework, as approved by the Department, form an integral part of the MSc studies and contributes towards the final mark for the programme.

Programme Content

This programme consists of both a thesis and coursework.

Compulsory Modules

Subject Number	Module code	Credits	Module Name	Semester
66249	828	156	Thesis Physics	Both
12278	838	24	Advanced Physics Seminar and Coursework	Both

Assessment and Examination

After completion of your research, you must submit a thesis for examination to the satisfaction of the appointed examiners and do an oral examination.

6.8.1.3 PhD in Physics

Programme Code

12998 – 978 (360)

Programme Description

A dissertation on the results of your independent scientific research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.8.1.4 DSc in Physics

Programme Code

12998 – 998 (360)

Programme Description

The DSc degree requires already published scientific work of a high standard that has made a significant and outstanding contribution to the enrichment of knowledge in Physics. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.8.2 Postgraduate programmes in Physical and Mathematical Analysis

6.8.2.1 MSc in Physical and Mathematical Analysis

Programme Code

56855 – 878 (180)

Specific Admission Requirements

An honours degree in Physical and Mathematical Analysis or one of the following BScHons degrees is required:

- Theoretical Physics;

- Mathematics;
- Numerical Mathematics;
- Applied Mathematics; or
- An equivalent qualification approved by the Senate.

Supplementary study may be required from you before research can begin as determined by your supervisor(s).

Programme Structure

A supervisor and co-supervisor from two of the participating departments and/or from an industrial partner are approved by the Physical and Mathematical Analysis programme committee.

You can choose the topic for your thesis, in consultation with the Physical and Mathematical Analysis programme committee, from one of the following interdisciplinary focal areas:

- Numerical Analysis;
- Complex Systems; or
- Data Security.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
66257	828	180	Thesis Physical and Mathematical Analysis	Both

Assessment and Examination

After completion of your research, you must submit a thesis for examination to the satisfaction of the appointed examiners.

Enquiries

For more information, see http://pma.sun.ac.za. See also Section 2.2 of this chapter for general information on the MSc degree at the Faculty of Science.

6.8.2.2 PhD in Physical and Mathematical Analysis

Programme Code

56855 – 978 (360)

Programme Description

A dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.9 Department of Physiological Sciences

6.9.1 BScHons in Physiological Sciences

Programme Code

59803 – 778 (120)

Specific Admission Requirements

- A BSc degree with Physiology 314, 334, 344 and 364 with an average final mark of at least 60% for the four modules.
- If you obtained a BSc degree with Physiology at third-year level from another university and obtained a final mark of at least 60%, your application will also be considered. In that case your marks achieved in Biochemistry courses at this same university will also be taken into consideration.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 31 October of the previous year and submit all supporting documents where applicable. Late applications can be submitted until 30 November. In exceptional cases, if there are any places available, applications will be considered until the beginning of the academic year.

If you are not an SU student historically, please note that your application may take longer to process due to the verification of qualifications.

Programme Structure

The honours programme consists of compulsory modules (90 credits) and elective modules (30 credits). The

department will select the three elective modules for each year, which is then compulsory for the students of the particular year. The lectures build on your existing knowledge of selected topics in physiology that are relevant to lecturers' research focus areas, and include modules that integrate whole-body and systems physiology with cellular and molecular physiology. The practical component introduces students to a vast array of current and relevant research techniques. The research project is conducted under supervision in one of the Department's research laboratories. You will receive training in statistical methods, using the internet for research purposes, presentation skills and critical thinking.

Duration of Programme

The normal duration of the programme is one year, but under exceptional circumstances and at the discretion of the department, it is possible to repeat a module. The programme begins with the start of the academic year.

Compulsory Modules

(credits = 90)

Subject Number	Module Code	Credits	Module Name	Semester
13237	774	20	Metabolism in Health and Disease	1
13235	772	20	Physiology and Pathophysiology	Both
54895	776	30	Research Project in Physiological Sciences	Both
66192	781	20	Research Methodology in Physiological Sciences	Both

Elective Modules

(credits = 30)

Departmental staff will select modules to the value of 30 credits from the following list which will be offered in the particular year.

Subject Number	Module Code	Credits	Module Name	Semester
13233	771	10	Regenerative Physiology in Injury and Disease	1
13236	773	10	Signal Transduction in Physiology and Pathophysiology	1
11260	775	10	Stress Physiology	1
14067	780	10	Haematology and Coagulation	1

Assessment and Examination

This programme is assessed continuously. The final mark is calculated as a weighted mark according to the credit value of each module. To successfully obtain this honours degree, you must achieve a subminimum of 50% for each module.

6.9.2 MSc in Physiological Sciences

Programme Code

59803 – 878 (180)

Programme Description

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required. See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science.

Programme Content

This programme consists of a 100% thesis.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
59803	828	180	Thesis: Physiological Sciences	Both

Assessment and Examination

After completion of the research, you must submit a thesis for examination to the satisfaction of the examiners and do an oral examination.

6.9.3 PhD in Physiological Sciences

Programme Code

59803 – 978 (360)

Programme Description

A dissertation containing the results of your independent research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

6.9.4 DSc in Physiological Sciences

Programme Code

59803 – 998 (360)

Programme Description

For the DSc degree already published scientific work(s) of a high standard that makes a contribution to the enrichment of knowledge in Physiology is required from you. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science.

6.9.5 MSc in Exercise Science

Programme Code

51489 – 887 (180)

Specific Admission Requirements

- A four-year BSc degree on NQF level 8 or a three-year BSc degree followed by a BScHons degree in a related biological science field or an equivalent qualification.
- Undergraduate modules in Physiology and Biochemistry are recommended.
- The programme co-ordinator and the departmental academic committee have the final decision on admission, taking into account the infrastructure and capacity of the Department.

Closing Date for Applications

Apply online at https://student.sun.ac.za by 30 September of the previous year. The Department will consider late applications until 31 October.

Programme Structure

The programme is offered on a full-time basis and consists of three theoretical modules. Sessions that vary from one to four weeks are presented on a full-time basis and consist of intensive lectures, practical classes, demonstrations and seminars. You will receive prescribed reading work, assignments and seminar preparations to be completed at home. In addition, you must complete a research project and submit a written thesis on the project.

Duration of Programme

The programme is offered over a period of two years and begins with the start of the academic year.

Programme Content

Continuous attention is given to professional development with regard to research methodology, computer and laboratory skills and statistics. Furthermore, there will also be a focus on communication skills.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
10630	882	20	Exercise Immunology, Endocrinology and Haematology	Both
10614	883	20	Multidisciplinary Approach to Muscle Physiology	Both
13511	884	20	Exercise Physiology and Metabolism	Both
12919	827	120	Thesis in Exercise Science	Both

Assessment and Examination

- The programme is assessed continuously.
- Examinations and assignments will constitute 33.3% of the final mark for the programme and the thesis the remaining 66.7%.
- The thesis will be assessed by the programme co-ordinator, the supervisor and two independent academics, of which one is external to the University.

- You must attain a minimum of 50% for the thesis to pass the programme and a final mark of 50% for each module.

7. Postgraduate programmes in other faculties

7.1 Faculty of AgriSciences

7.1.1 Department of Genetics

7.1.1.1 Postgraduate programmes in Genetics

a) BScHons in Genetics

Programme Code

13285 – 778 (120)

Specific Admission Requirements

- A BSc degree with Genetics 214, 244 plus 314, 324, 344 and 354 or equivalent modules at other universities.
- An average mark of at least 65% in Genetics in the final year.

Closing Date for Applications

Apply online at https://student.sun.ac.za by the end of October of the previous year. The number of students admitted to this programme annually will be determined by available research laboratory space.

Duration of Programme

The duration of the programme is one academic year and begins at the start of the general academic year.

Programme Content

The programme consists of the six modules listed below. Subject to departmental approval, you may substitute two of the 8-credit theory modules with equivalent 8-credit modules from the BScHons in Plant Biotechnology. You must also complete a research assignment and present the results in the form of a research publication. The Department places strong emphasis on acquiring laboratory skills. As an honours student you are expected to attend departmental seminars and to act as an undergraduate demonstrator.

Compulsory Modules

10481: Genetics: Molecular Techniques	711(16): Genetics: Molecular Techniques
10478: Genetic Data Analysis	713(8): Genetic Data Analysis
11061: Biometrical Applications and Data Analysis in R	721(8): Biometrical Applications and Data Analysis in R
13594: Genomics	716(8): Genomics
13538: Scientific and Proposal Writing	721(8): Scientific and Proposal Writing
18007: Project	741(64): Honours Project in Genetics

plus

Elective Modules

Choose one of the following modules.

13596: Human and Animal Genetics	712(8): Human and Animal Genetics
13537: Plant Genetics and Crop Improvement	722(8): Plant Genetics and Crop Improvement

Assessment and Examination

The programme is assessed by means of flexible assessment. To complete the honours programme successfully, you must complete the compulsory molecular techniques module, all prescribed theory modules and a research project successfully.

b) MSc in Genetics

Programme Code

13285 – 879(180)

Specific Admission Requirements

- An applicable honours degree preferably in Botany, Genetics, Microbiology, Biochemistry, Zoology, Animal Science or Plant Biotechnology; or a relevant four-year BScAgric degree in Plant or Animal Production Systems with Plant, Animal Breeding or Genetics as a subject major.
- An average final mark of 60% for the honours degree, or subject major in the case of a BScAgric degree.

Programme Structure

The programme consists of research on an approved topic as determined by the Department. You must submit a satisfactory thesis on completion of the work. The Department can require supplementary module(s) depending on your background.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science as well as Part 7 (Faculty of AgriSciences) of the Yearbook.

Compulsory Module

62448: Genetics	828(180): Master's thesis: Genetics

Assessment and Examination

An oral examination is required.

c) PhD in Genetics

Programme Code

13285 – 978 (360)

Programme Description

A publication-quality dissertation and an oral examination is required from you. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science as well as Part 7 (Faculty of AgriSciences) of the Yearbook.

d) DSc in Genetics

Programme Code

13285 – 998 (360)

Programme Description

For this degree previously published scientific work(s) of a high standard which has made a substantial and outstanding contribution to the enrichment of knowledge in Genetics. See also Section 2.4 in this chapter for general information on the DSc degree at the Faculty of Science as well as Part 7 (Faculty of AgriSciences) of the Yearbook.

7.1.1.2 Postgraduate programmes in Plant Biotechnology

a) BScHons in Plant Biotechnology

Programme Code

53287 – 788 (120)

Specific Admission Requirements

- A BSc degree approved by the Departmental Postgraduate and Academic Committees with an average final mark of at least 60% in the appropriate modules at third-year level. Suitable modules include Biotechnology, Biochemistry, Genetics and Microbiology.
- You are, however, strongly encouraged to take Genetics 314, 315, 344 and 345 for admission to the honours in Plant Biotechnology.
- Additional work may be prescribed depending on your background.

Closing Date for Applications

Apply online at https://student.sun.ac.za. The number of students admitted to this programme is determined by available research laboratory space.

Duration of Programme

The duration of the programme is one academic year and begins at the start of the general academic year.

Programme Content

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:

- The development of a satisfactory knowledge base;
- The development of a wide-ranging practical and theoretical capability; and
- The development of a professional scientific-methodological and ethical approach.

The programme includes theoretical work, seminars, practical tasks, independent research and independent consultation of the broader biological literature. As an honours student you are expected to attend departmental seminars and to act as an undergraduate demonstrator.

The theory modules consist of a series of contact sessions where 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 them.

You can substitute two of the 8-credit theory modules with equivalent 8-credit modules from the BScHons in Genetics programme. All substitutions must be approved by the Department.

Compulsory Modules

10481: Genetics: Molecular Techniques	715(16): Genetics: Molecular Techniques
13594: Genomics	716(8): Genomics
13538: Scientific and Proposal Writing	721(8): Scientific and Proposal Writing
13537: Plant Genetics and Crop Improvement	722(8): Plant Genetics and Crop Improvement
12582: Research Module in Plant Biotechnology	790(64): Research Module in Plant Biotechnology

plus

Elective Modules

Choose two of the following modules.

17523: Plant Physiology	712(8): Plant Physiology
10475: Integrated Plant Metabolism	713(8): Integrated Plant Metabolism
11061: Biometrical Applications and Data Analysis in R	721(8): Biometrical Applications and Data Analysis in R

Assessment and Examination

- The programme is assessed by means of flexible assessment.
- To complete the honours programme successfully, you must complete the compulsory molecular techniques module, all prescribed theory modules and a research project successfully.

b) MSc in Plant Biotechnology

Programme Code

53287 – 879 (180)

Specific Admission Requirements

- An applicable honours degree preferably in Botany, Genetics, Microbiology, Biochemistry or Plant Biotechnology.

Programme Structure

The programme consists of research on an approved topic as determined by the Department. You must submit a satisfactory thesis on completion of the work. The Department can require supplementary module(s) depending on your background.

See also Section 2.2 in this chapter for general information on the MSc degree at the Faculty of Science, as well as Part 7 (Faculty of AgriSciences) of the Yearbook.

Compulsory Module

66311: Thesis Plant Biotechnology	828(180): Thesis Plant Biotechnology

Assessment and Examination

An oral examination is required.

c) PhD in Plant Biotechnology

Programme Code

53287 – 978 (360)

Programme Description

A publication-quality dissertation and an oral examination is required from you. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science as well as Part 7 (Faculty of AgriSciences) of the Yearbook.

7.2 Faculty of Arts and Social Sciences

7.2.1 Department of Geography and Environmental Studies

7.2.1.1 BScHons in GeoInformatics

Programme Code

12279 – 778 (120)

Specific Admission Requirements

- A BSc degree in Geographical Information Technology or a related subject as major.
- An average final mark of 60% for the major.

Accreditation

This programme, proceeding from an accredited three-year BSc GeoInformatics programme, satisfies the South African Geomatics Council's academic requirements for registration as a Professional Geographical Information Science (GISc) Practitioner. Students who successfully complete this four-year qualification will automatically be able to register as Professional GISc Practitioners in training.

Duration of Programme

This duration of the programme is one year.

Programme Content

This programme consists of lectures and an applied research component. Programme content includes the application of geographic information technology, which includes geographical information systems and remote sensing techniques for the analysis, comprehension, management and resolution of spatial problems concerning human-environment interaction, environmental problems in special environments, and the execution of spatial analyses and modelling.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
63398	712	30	Advanced Remote Sensing	1
49611	713	30	Geographical Information Systems	1
12187	716	30	Spatial Modelling and Geographical Communication	1
63363	742	30	Environmental Geography Research Application	2

Assessment and Examination

This programme is assessed continuously through tests, assignments, a research project, and oral presentations. You have to obtain a sub-minimum of 50% in each module to pass.

Although the programme is presented in English, discussions, tests, examinations, assignments and reports will be accepted and dealt with in English or Afrikaans.

Enquiries

Dr J Kemp

Tel: 021 808 3218

Email: jkemp@sun.ac.za

Departmental website: http://www.sun.ac.za/geography

7.2.1.2 MSc in GeoInformatics

Programme Code

12279 – 879(180)

Specific Admission Requirements

- A BScHons degree in GeoInformatics or an approved equivalent qualification.
- An average final mark of 60% for the BScHons degree.

Programme Content

The development, implementation, management and application of spatial technologies for managing resources, and for spatial analysis and modelling of environmental geographical phenomena and problems are dealt with in this programme.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
12280	875	180	Thesis GeoInformatics	Both

Assessment and Examination

You must submit a thesis. Although the programme is presented in English, discussions and reports can be presented in English or Afrikaans. The 100% thesis is examined according to the University's provisions in Part 1 (General Rules) of the University Yearbook.

Further study possibilities

The successful completion of the MSc in GeoInformatics leads to a PhD in GeoInformatics.

Enquiries

Prof A van Niekerk

Tel: 021 808 3218/3101

Email: avn@sun.ac.za

Departmental website: http://www.sun.ac.za/geography

7.2.1.3 PhD in GeoInformatics

Programme Code

12279 – 978 (360)

Programme Content

A dissertation on the results of your independent scientific research is required. See also Section 2.3 in this chapter for general information on the PhD degree at the Faculty of Science.

7.2.14 BScHons in Geography and Environmental Studies

A new BScHons in Geography and Environmental Studies will be offered from 2025. For enquiries, contact science@sun.ac.za.

7.2.1.5 MSc in Geography and Environmental Studies

Programme Code

49913 – 879 (180)

Specific Admission Requirements

- An appropriate honours degree with Geography and Environmental Studies or an appropriate discipline as major.
- An average final mark of 60% for the BScHons degree.

Programme Content

The programme focuses on the study and resolution of human-environmental problems and environmental phenomena from a spatial perspective. You may do the thesis research on a full-time or part-time basis. The research topic is developed and approved by the Department.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
49913	828	180	Thesis Geography and Environmental Studies	Both

Assessment and Examination

You may present the thesis in English or Afrikaans. The thesis is assessed according to the University's provisions set out in Part 1 (General Rules) of the University Yearbook.

Enquiries

Prof A van Niekerk

Tel: 021 808 3218/3103

Email: avn@sun.ac.za

Departmental website: http://www.sun.ac.za/geography

7.2.1.6 PhD in Geography and Environmental Studies

Programme Code

49913 – 978 (360)

Specific Admission Requirements

- An MSc degree in Geography and Environmental Studies or a related discipline or a master's degree approved by the Senate.

Programme Content

The programme focuses on the study and resolution of environmental problems and phenomena from a spatial perspective. You may do the dissertation research on a full-time or part-time basis. The research topic is developed and approved by the Faculty.

Assessment and Examination

You must submit a dissertation of approximately 90 000 words, in which you show your ability to create new knowledge or to reinterpret existing knowledge about a geographical environmental problem.

You may present your dissertation in English or Afrikaans. The dissertation is assessed according to the University's provisions in Part 1 (General Rules) of the University Yearbook.

Enquiries

Prof A van Niekerk

Tel: 021 808 3218/3103

Email: mailto:avn@sun.ac.za

Departmental website: http://www.sun.ac.za/geography

7.3 Faculty of Economic and Management Sciences

7.3.1 Department of Logistics

7.3.1.1 BScHons in Operations Research

Programme Code

55336 – 779 (120)

Specific Admission Requirements

- A suitable bachelor's degree with applicable modules on third-year level.
- An average final mark of at least 60% for Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics on third-year level, or any degree that the Department of Logistics considers an equivalent qualification.

Duration of Programme

The duration of this programme is one year.

Programme Content

You must earn at least 120 credits as set out in the compulsory modules listed below.

Compulsory Modules

Subject Number	Module Code	Credits	Module Name	Semester
65269	746	12	Applied stochastic simulation (Dept. of Statistics and Actuarial Science)	2
11047	774	35	Research assignment: operational research	Both

Elective Modules

(at least 73 credits)

Subject Number	Module Code	Credits	Module Name	Semester
10906	712	15	Advanced linear programming (Compulsory for students who have not taken Operations Research as a major subject) (Dept. of Logistics)	1
12318	713	15	Metaheuristics (Dept. of Logistics)	1
10925	742	15	Location of facilities (Dept. of Logistics)	2
10932	743	15	Inventory control (Dept. of Logistics)	2
10933	753	15	Forecasting	2
10931	743	15	Game theory (Dept. of Logistics)	1
11907	786	15	Methods of operational research (Dept. of Logistics)	2
10542	782	16	Graph theory (Dept. of Mathematical Sciences)	2
10748	722	12	Applied time series analysis A (Dept. of Statistics and Actuarial Science)	1
10600	721	12	Multivariate methods in statistics A (Dept. of Statistics and Actuarial Science)	1
10601	751	12	Multivariate methods in statistics B (Dept. of Statistics and Actuarial Science)	2
58777	741	12	Data mining (Dept. of Statistics and Actuarial Science)	2
10440	713	12	Experimental design (Dept. of Statistics and Actuarial Science)	1
64009	714	15	Capita selecta (Operations Research) (Dept. of Logistics)	1
64009	744	15	Capita selecta (Operations Research) (Dept. of Logistics)	2
40541	774	15	System dynamics	Both
14692	773	15	Agent-based Modelling	Both

7.3.1.2 MCom and MSc in Operations Research – full thesis option

Programme Code

55336 – 879 (180)

Specific Admission Requirements

- An honours degree in Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics and you must be knowledgeable across the broad spectrum of Operations Research.
- You can also be considered for admission if you are in possession of an equivalent qualification as considered by the Department of Logistics.

Programme Content

If you are registered for Operation Research 879, you must submit a thesis that is the result of your independent research.

7.3.1.3 MCom and MSc in Operations Research – coursework and thesis option

Programme Code

55336 – 899 (180)

Specific Admission Requirements

- An honours degree in Operations Research, Computer Science, Applied Mathematics, Mathematics or Mathematical Statistics and you must be knowledgeable across the broad spectrum of Operations Research.
- You can also be considered for admission if you are in possession of an equivalent qualification as considered by the Department of Logistics.

For information on the MCom in Operations Research (Coursework and Thesis option) please consult Part 10 (Faculty of Economic and Management Sciences) of the Yearbook.

Programme Content

If you are registered for Operations Research 899, you must earn at least 180 credits as set out in the tables below.

Compulsory Module

Subject Number	Module Code	Credits	Module Name	Semester
11243	884	150	Thesis: Operational Research	Both

Elective Modules

(at least 30 credits)

Subject Number	Module Code	Credits	Module Name	Semester
10694	811	15	Bootstrap and other resampling techniques A (Dept. Of Statistics and Actuarial Science)	Both
10695	841	15	Bootstrap and Other Resampling Techniques B (Dept. Of Statistics and Actuarial Science)	2
64009	814	15	Capita Selecta 1 (Operations Research) (Dept. of Logistics)	1
64009	844	15	Capita Selecta 2 (Operations Research) (Dept. of Logistics)	2

7.3.1.4 PhD in Operations Research

Programme Code

55336 – 979 (360)

Programme Description

A dissertation containing the results of your independent research is required. Also consult the Section "Postgraduate Qualifications" in Part 1 (General Rules) of the University Yearbook.

7.3.2 Department of Statistics and Actuarial Science

For information on postgraduate programmes in Mathematical Statistics, please consult Part 10 (Faculty of Economic and Management Sciences) of the Yearbook.

7.4 Faculty of Medicine and Health Sciences

7.4.1 Department of Exercise, Sport and Lifestyle Medicine

For information on postgraduate programmes in Biokinetics and Sport Science, please consult Part 12 (Faculty of Medicine and Health Sciences) of the Yearbook.

Subjects, modules and module contents

1. Definitions and explanations of important terms

It is important that you take note of the definitions of a few terms in order to understand and use this chapter fully. The example below shows how these terms will appear later in this chapter under the module contents.

Example:

11053 Biochemistry

214 (16) Biomolecules: Structure-function Relationships (3L, 3P)

1.1 Explanation of the abovementioned terms

- *Five-digit subject number* – 11053 Biochemistry
  Each subject is identified by this five-digit subject number.

- *Subject name* – 11053 Biochemistry
  The specific name of the subject is presented right next to the five-digit subject number, before the various modules of the subject are offered. Normally the subject name is followed by the module code and the credit value of the specific module, for example in this case: Biochemistry 214 (16).

- *Module code* – 214 (16) Biomolecules: Structure-function Relationships
  The module code consists of a three-digit number that is unique to the specific module. The abovementioned module code "214" has the following meaning:
  - The first digit refers to the year of study in which the module is presented, for example:
    *Year 1: **1**14*
    *Year 2: **2**14*
    Year 3: **3**14
  - The second digit "1" refers to the semester that the module will be presented in and also serves as a number to distinguish between various modules offered within the same specific year of study. The University uses different numbers to indicate the particular semester of a module, either the first or the second semester or modules that are presented in both semesters (which are year modules). The numbers that indicate semesters are as follows:
    - **1**, **2** or **3** – modules are presented in the first semester.
      *Semester 1: 2**1**4, 3**2**4, 3**3**4*
    - **4**, **5** or **6** – modules are presented in the second semester.
      *Semester 2: 3**4**2, 3**5**4, 3**6**4*
    - **7**, **8** or **9** – modules are presented in both semesters, which are year modules.
      *Year module (both semesters): 2**7**8, 2**8**8, 3**9**1*
  - The third digit of the module code 214, in this case "4" serves as a distinguishing digit between various modules of the same subject in a particular year of study.
  - **Please note:** Some of the postgraduate module entries in this Yearbook part deviate from the abovementioned pattern. The five-digit subject number and the three-digit module code in these postgraduate modules are written continuously in the same block.

    66184 715 (24) Generic Scientific Skills

- *Credit value* – 214 (16) Biomolecules: Structure-function Relationships
  The number in brackets indicates the credit value of the particular module, for example Biochemistry 214 (16).

- *Module subject* – 214 (16) Biomolecules: Structure-function Relationships
  This indicates the subject that will be dealt with in this specific module.

- *Teaching load* –

The teaching load of a module is indicated in the block following the module subject. It gives you both the teaching load and the type of teaching per week that you can expect in this particular module. For the module Biochemistry 214 (16) you can expect three lectures and three practical periods each week for the duration of the module.
    - **L** – Lectures lasting 50 minutes each, for example 3L
    - **P** – Practical periods lasting 50 minutes, for example 1P, 2P, 3P
    - **S** – Seminars lasting 50 minutes, for example 1S
    - **T** – Tutorials lasting 50 minutes, for example 1T, 2T

2. Assessment of modules

Modules are assessed according to the rules stipulated in Stellenbosch University's Assessment Policy and the assessments and promotion chapter in the SU Yearbook Part 1 (General Rules).

3. Prerequisite pass, prerequisite and corequisite modules

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

Prerequisite pass module

- A prerequisite pass module is a module that you must **pass** before you can take the module(s) for which it is a prerequisite pass module.

Prerequisite module

- A prerequisite module is a module in which you must obtain a **final mark of at least 40**, before you can take the module for which it is a prerequisite module.
- If you have once complied with a prerequisite rule, your compliance will remain valid for the period given in the applicable assessment rules, even if you repeat the prerequisite module and do not meet the minimum level when repeating the module.
- Please note: You must pass all the modules you used as prerequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

Corequisite module

- A corequisite module is a module that you must register for in an earlier semester than the module for which it is a corequisite, or in the same semester.
- Please note: You must pass all the modules you used as corequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

3.1 Condition for the granting of a qualification or degree

The Faculty will only award a qualification if you have passed all the relevant prerequisite and corequisite modules of the specific degree programme.

- Before making a final selection of elective modules that you want to take in a specific academic year, consult the relevant class and assessment timetables closely. If any two modules occupy the same time slot on a particular timetable, or have assessments scheduled at the same time, you cannot register for both modules because they are an inadmissible combination.

  For more information, please consult My Timetable and the Assessment Timetable.
- Also make sure that you meet the prescribed prerequisite pass, prerequisite and corequisite requirements for each module that you must follow in the prescribed curriculum of your degree programme.

  For more information on these prerequisites, please consult the module contents below.

4. Undergraduate subjects, modules and module contents

Subjects with their accompanying modules, credits, module subjects, teaching loads, language specifications and module contents are presented below.

Faculty of Science Teaching

13623 Science in Context

178 (12) Integrated project in Science (2L, 2T)

The main outcome of this module is a project, exploring Science in context. To develop the expertise required for the project, the following topics will also be covered:

Scientific Communication skills, which focus on writing, reading, listening and speaking in a scientific context; engaging with and understanding relevant academic and scientific texts; understanding text components; presenting data in a coherent manner; editing texts; using referencing methods correctly to avoid plagiarism; using graphics to clarify data.

Graduate attributes which include study and time management skills, group work and the ethics of Science.

Computer skills, which covers basic computer usage as well as development of skills for using word processing, spreadsheet and presentation software for the purpose of compiling, creating, analysing and presenting academic material in a scientific manner.

64007 University Practice in the Natural Sciences

176 (8) University Practice in the Natural Sciences (3L)

Study load: 78 lectures in total, presented as 5L per week in the first semester and 1L per week in the second semester.

For students in the BSc (extended curriculum programmes). It is followed up during the second semester in the different subject-specific modules of Mathematics 176, Physics 176, Chemistry 176 and Biology 146. Basic terminology and concepts are addressed. Study and life skills receive attention. The natural sciences and specifically the subjects taken by the students serve as a context.

Centre for Bioinformatics and Computational Biology

12555 Bioinformatics

312 (8) Introduction to Bioinformatics (3L, 3P)

Introduction to bioinformatics topics, including biological databases, sequence alignment, dynamic programming, scoring matrices, BLAST, hidden Markov models (HMMs), phylogenetics, tree building methods, genome organisation and evolution, genome projects and browsers, evolution of proteins, classification of protein structures.

322 (8) Intermediate Bioinformatics (3L, 3P)

Different BLAST methods, next-generation sequencing technologies, genome assembly, Eulerian paths and cycles, de Brijn graphs, reference genomes, reference genome graphs, three dimensional structures of genomes, read mapping, Burrows-Wheeler transform, variant calling, genome-wide association studies, mapping variants to phenotypes and disease, hidden Markov models (HMMs), the forward–backward algorithm, the Vitterbi algorithm, protein homology modelling, molecular dynamics, ligand docking.

Prerequisite module:

- *Bioinformatics 312*

Department of Biochemistry

11053 Biochemistry

Please note: Students intending to take Biochemistry as a subject are required to take modules such as Biology, Physics and Mathematics during their first year. Chemistry 124 plus Chemistry 144 are taken as the first-year equivalent of Biochemistry.

214 (16) Biomolecules: Structure-function Relationships (3L, 3P)

Introduction to the living cell, bio-elements, and the importance of water as the solvent for biochemical reactions and its role in living systems. Introduction to biomolecules (nucleic acids, proteins, carbohydrates, and lipids): their structures, functions and characteristics. An introduction to protein ligand binding, enzyme catalysis and enzyme kinetics.

The practical component covers basic laboratory skills, e.g. how to weigh, how to prepare a solution, dilutions, the use of a micro pipette, the use of a pH meter and a spectrophotometer. Students will investigate the principles of buffering and how to determine an unknown concentration using a standard curve.

Prerequisite pass modules:

- *Chemistry 124 or 164, 144*
- *Biology 124*

244 (16) Intermediary Metabolism (3L, 3P)

Bioenergetics of metabolism, the metabolism of biomolecules (carbohydrates, lipids and some nitrogen containing compounds). Glycolysis, citric acid cycle and glyoxylate cycle. Oxidative phosphorylation. Photosynthesis. Regulation and integration of metabolism: exploring the implications of metabolic abnormalities in different biological systems.

The practical component includes enzymatic assays, enzyme kinetics, the role of effectors on enzyme activity and the basic principles of chromatography.

Prerequisite module:

- *Biochemistry 214*

315 (16) Biophysical and Structural Protein Biochemistry (3L, 3T)

Biophysical analysis: quantitative, qualitative and structural analysis of biological molecules, with focus on amino acids, peptides and proteins, utilising techniques such as spectrophotometry, fluorescence, mass spectrometry, gel electrophoresis and chromatography.

Advanced protein biochemistry: Protein purification techniques and analysis of protein purity, composition and structure. Protein structure/function relationships are studied in the context of a number of specialised complex protein systems and enzymatic reaction mechanisms.

Prerequisite pass modules:

- *Biochemistry 214, 244*
- *Mathematics (Bio)124 or Mathematics 114*

323 (8) Systems Biology (3L, 3T/3P)

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; mathematical modelling; types of models; modelling with differential equations; examples of models.

Theoretical concepts are applied in tutorial sessions and computer practicals.

Prerequisite pass modules:

- *Biochemistry 214, 244*
- *Mathematics (Bio) 124 or Mathematics 114*

345 (16) Specialised Biochemical Topics (3L, 3T)

Selected topics chosen from the following (two of the following three topics are selected for presentation every year):

Antibiotics: The biochemistry of selected antibiotics and antimicrobial agents.

Intracellular signal transduction pathways integrated with eucaryotic gene expression: ligand-activated receptor signalling; receptor binding theory; cell surface receptors; nuclear receptors; protein-protein interactions; signalling networks and cross talk; regulation of gene expression; chromatin remodelling; promoters and enhancers; transcription factors.

Immunology: Innate and specific acquired immunity; antibody structure and function; defence mechanisms against pathogenic organisms; vaccinations; allergies; immune disorders; differential gene expression in lymphocyte development and immune diagnostic techniques.

Prerequisite module:

- *Biochemistry 315*

365 (16) Practical protein expression, purification and analysis techniques (3L, 3P)

Molecular biology, recombinant protein expression and protein purification techniques. Analysis of DNA and protein purity and integrity. Techniques include: plasmid DNA isolation, PCR, restriction enzyme digests,

agarose gel electrophoresis, preparation of competent cells, transformation, induction of protein expression, immobilised-metal affinity chromatography, desalting, protein concentration determinations, SDS-PAGE, western blot, activity assays and spectrophotometric analyses.

Practicals will be presented during the recess periods, specifically during a) the week before the 2nd semester officially starts, and b) the recess between the 3rd and 4th terms. By registering for this module students confirm that they are available during both these periods.

Prerequisite module:

- *Biochemistry 315*

Biochemistry as a major for the BSc degree

The following modules are required: Biochemistry 214(16), 244(16), 315(16), 365(16), Bioinformatics 312(8), and either Biochemistry 323(8) or Bioinformatics 322(8), and either Biochemistry 345(16) or Applied Chemistry 354(16).

Department of Botany and Zoology

53953 Biodiversity and Ecology

212 (16) Statistics and Other Tools for Biologists (3L, 3P)

This module is a thorough introduction to the key numerical skills and processes underpinning the good practice of biological sciences. It covers experimental design, statistical analyses, the concept of null and alternative hypotheses, data handling and logical interpretation, data presentation and scientific communication, advanced use of Microsoft Excel, PowerPoint and R Statistical Computing free software. Hands-on statistical exercises cover a range of descriptive statistics, parametric and non-parametric analyses, basic data manipulation, plots, linear regression and analysis of variance. Applied scientific investigatory principles to biology are explored using experimental planning (controls, replication, randomisation), ethics, scientific and popular publication processes, and the use of scientific literature.

Corequisite module:

- *Science in Context 178 or Computer Skills 171*

214 (16) Principles of Ecology (3L, 3P)

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 in which students will be taught how to analyse ecological data. There will be a three-day, compulsory field course in which students conduct their own research projects.

Prerequisite pass module:

- *Biology 124 or 144 and a final mark of at least 40% in the other Biology module*

Corequisite module:

- *Biodiversity and Ecology 212 or an equivalent statistical module*

224 (16) Diversity and Function of Invertebrates (3L, 3P)

The focus of this module is invertebrate diversity. Major adaptations in morphology (form) and recent molecular changes in taxonomy, as well as physiological adaptations within the major phyla will be explored. Topics will include: recent developments in phylogenetic classifications within the major groups; physiological challenges, such as those related to respiration, osmoregulation, feeding, locomotion, defence, sensory perception and reproduction, which invertebrates face in their respective environments (marine, freshwater and terrestrial); and what strategies are used to cope with or compensate for these challenges. The practical component of the module will entail laboratory work.

Prerequisite pass module:

- *Biology 144 or 154 and a final mark of at least 40% in the other Biology module*

244 (16) Principles of Evolution (3L, 3P)

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.

Prerequisite pass modules:

- *Biology 124 or 144 and a final mark of at least 40% in the other Biology module*

254 (16) Vertebrate Life (3L, 3P)

The module deals with various aspects of vertebrates: where they originated, present diversity, how they evolved, what they do and how they work. Topics covered 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 seminars and practical sessions with data collected in the laboratory or in the field excursion.

Prerequisite pass module:

- *Biology 144 or 154 and a final mark of at least 40% in the other Biology module*

264 (16) Diversity of Plant Form and Function (3L, 3P)

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 complementary way that will include formal lectures, group discussions, laboratory and field experiments.

Prerequisite pass module:

- *Biology 144 or 154 and a final mark of at least 40% in the other Biology module*

311 (16) Climate and Global Change Challenges (3L, 3P)

The study of global change with a biological perspective brings together historical and current evidence for such changes and summarises its main drivers. Topics include global climate change, anthropogenic drivers such as pollution, invasion biology, land use and ecosystem change. Data at different spatial and temporal scales and at different levels of biological organisation are covered (from species to communities and ecosystems, and from micro to macroscales), highlighting the technologies and numerical techniques used to study these processes. Examples will have a strong African focus, including case studies from the Western Cape province from both faunal and floral perspectives. Important areas of teaching include the relevance of understanding global climate change for African, in particular South African, ecosystems. There is a strong emphasis on appropriate communication regarding all the above topics, both among scientists and between scientists and other stakeholders, including the general public.

315 (16) Ecology Field Course (3L, 3P)

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 during the last two weeks of 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.

This module is a restricted module and largely limited to students registered in the Biodiversity and Ecology programme. Participants may be selected from other programmes based on past performance and available places.

Prerequisite pass modules:

- *Biodiversity and Ecology 212 or 214 and a final mark of at least 40% in the other Biodiversity and Ecology module*

324 (16) Angiosperm Diversity and Evolution (3L, 3P)

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 hybridisation and polyploidy in the diversification of the angiosperm lineage is assessed. Specialised 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.

Prerequisite pass modules: - any two of the following three modules:

- *Biology 124,144,154*

341 (16) Climate and Global Change Solutions (3L, 3P)

This module builds on Global Change 311 (Global Change Challenges). It will expose students to the concepts of adaptation and mitigation of global and climate change, providing them with a variety of tools to develop solutions to the challenges of global change. Topics include the concepts of resilience and resistance from both a biological and a human perspective, spatial planning for biodiversity (with a focus on how conservation outcomes may change with changing climates and species responses), conservation genetics as a tool to support spatial planning and species conservation (including adaptive responses to environmental stressors), carbon storage and trading and their links to ecological restoration (with a focus on blue carbon ecosystems), managing invasive species at national as well as international level, restoration ecology, and policy and legislation to support conservation and management outcomes.

Global Change 311 is not a prerequisite for Global Change 341 (especially for international students). However, it is highly recommended that students do take Global Change 311, because an understanding of the fundamentals of the drivers of climate change and their impact on biodiversity and well-being (which are covered in Global Change 311) will prepare students for the content of Global Change 341 and provide a stronger footing from which to start. Global Change 341 can be taken independently, if necessary, but this will require additional, independent work by students for them to be able to follow the content of the module.

342 (16) Integrative Marine Science (3L, 3P)

This module is presented as five sections that progress from understanding the physical, chemical, geological and biological nature of marine systems to the utilisation, management and protection of marine products systems. Exploration of the physical marine environment focusses specifically on ocean climate and circulation, tides and waves, and coastal and estuarine processes. This is followed by the chemical section, which examines the properties of seawater, focussing on salinity and dissolved gases. The geological section considers plate tectonics, marine provinces and marine sediments. The biological section explores biological life in oceans and adaptations of marine organisms to the different marine environments; productivity and how this feeds into energy and food webs; and benthic, pelagic, island, estuarine and mangrove systems. The final section explores the historical and contemporary reliance of humans on the ocean; consequences of harvesting marine products; the development of marine protected areas and how this often leads to conflict with people who rely on the ocean for their livelihoods or recreation. Throughout the module we will explore skills related to understanding and measuring different processes.

344 (16) Evolutionary Ecology (3L, 3P)

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.

Prerequisite pass modules:

- *Biodiversity and Ecology 212 or 214 and a final mark of at least 40% in the other Biodiversity and Ecology module*

Corequisite module:

- *Biodiversity and Ecology 244*

354 (16) Evolutionary Patterns and Processes (3L, 3P)

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.

Prerequisite pass modules - any three of the following six modules:

- *Biodiversity and Ecology 212, 214, 224, 244, 254, 264*

Biodiversity and Ecology as a major for the BSc degree

The following modules are required: Biodiversity and Ecology 212(16), 214(16), 224(16), 244(16), 254(16), 264(16), 311 (16), 315(16), 324(16), 341(16), 342(16), 344(16), 354(16).

25046 Biology

124 (16) Cell Biology (3L, 3P)

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

Responsible departments: Biochemistry, Botany and Zoology, and Genetics

144 (16) Biodiversity and Ecology (3L, 3P)

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

Responsible departments: Botany and Zoology, and Microbiology

Corequisite module:

- *Biology 124*

146 (16) Principles of Biology (3L, 3P)

For students in the BSc (xtended Degree Programmes).

Introducing biological concepts: 'What is life?', biological evolution, biodiversity and the Tree of Life. The chemical basis of life. Biological molecules. Enzymes. Biological membranes: Structure and function. Cell structure and function: Pro- and eukaryotes, as well as animal and plant cells. Mendelian genetics and inheritance. Introduction to animal phylogeny. Vertebrate life.

Responsible department: Botany and Zoology

154 (16) Functional Biology (3L, 3P)

Plant anatomy and morphology; photosynthesis; water relations; transport in plants; plant mineral nutrition; growth and development; responses to the environment. Functional biology of animals. Introduction to biotechnology.

Responsible departments: Botany and Zoology, and Genetics

Corequisite module:

- *Biology 124*

59404 Botany

354 (16) Diversity of Plant Form and Function (3L, 3P)

Please note: This module will be discontinued after 2024.

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 complementary way that will include formal lectures, group discussions, laboratory and field experiments. Students should master the integration of morphological and physiological evolution across the embryophytes and be able to think and communicate critically about plant form and function.

Prerequisite pass module:

- *Biology 144 or 154 and a final mark of at least 40% in the other Biology module*

Department of Chemistry and Polymer Science

Please note:

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

11479 Chemistry

124 (16) Fundamental Principles of Chemistry I (3L, 3P)

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)

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.

Corequisite module:

- *Chemistry 124*

164 (16) Fundamental Principles of Chemistry (3L, 3P)

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.

If you failed Chemistry 124 in a particular year, you may register for this module in the same academic year only if you achieved a final mark of at least 40% and a practical mark of at least 60%.

Mode of delivery: This hybrid-learning module is offered through online themes using SUNLearn as platform, as well as four face-to-face tutorial sessions.

176 (32) Introduction to Chemistry (3L, 3P)

For students in the BSc (extended curriculum programmes). This module deals with the following themes: Classification of matter; atoms, molecules and ions; stoichiometry; reactions in aqueous solutions; atomic structure; chemical bonding and molecular structure; the periodic table; weak acids and weak bases; electrochemistry; introduction to basic organic chemistry. Examples that illustrate the importance and relevance of science as an everyday phenomenon will be highlighted.

214 (16) Organic Chemistry (3L, 3P)

Reaction mechanisms, including nucleophilic addition and substitution, elimination, electrophilic addition, electrophilic aromatic substitution; organometallic reactions; stereochemistry.

Prerequisite pass modules:

- *Chemistry 124 or 164; and 144*

234 (16) Inorganic Chemistry (3L, 3P)

Periodic trends; structure and bonding in molecules; structure and bonding in solids; acid-base chemistry; main group elements.

Coordination chemistry: Introduction, types of ligands, nomenclature; isomerism in coordination compounds; different geometries; formation constants; crystal field theory.

Prerequisite pass module:

- *Chemistry 124 or 164*

254 (16) Physical Chemistry (3L, 3P)

Chemical thermodynamics; colligative properties; phase diagrams; reaction kinetics; probability and introduction to statistical thermodynamics.

Prerequisite pass module:

- *Chemistry 124 or 164*

Prerequisite module:

- *Mathematics 114*

Corequisite module:

- *Mathematics 144*

264 (16) Chemical analysis I (3L, 3P)

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; introduction to infrared spectroscopy.

Prerequisite pass modules:

- *Chemistry 124 or 164; and 144*

Prerequisite modules:

- *Mathematics 114 or 144 or Mathematics (Bio) 124 or Engineering Mathematics 115 or 145*

314 (16) Chemical Analysis II (3L, 3P)

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) for molecular structure determination;

introduction to analytical mass spectrometry; instrumental chromatographic methods.

Prerequisite pass module:

- *Chemistry 264*

324 (16) Physical Chemistry (3L, 3P)

Quantum mechanical description of atoms and molecules; vibrational and rotational spectra; advanced statistical thermodynamics; introduction to symmetry.

Prerequisite module:

- *Chemistry 254*

Prerequisite pass modules:

- *Mathematics 114, 144*

344 (16) Organic Chemistry (3L, 3P)

Reaction mechanisms, including those pertaining to enolate chemistry, chemo-, stereo- and diastereo-selectivity, controlling geometry of double bonds, pericyclic reactions; stereochemistry; syntheses.

Prerequisite pass module:

- *Chemistry 214*

364 (16) Inorganic Chemistry (3L, 3P)

Stereochemical non-rigidity; structure and strength correlations for acids and bases; structure, bonding and reactivity of transition metal complexes; selective metal-complexation; kinetics and mechanisms of selected inorganic reactions; bio-inorganic chemistry and the role of metal complexes in biological systems; introduction to organometallic chemistry and catalysis; the synthesis and characterisation of inorganic compounds (practicals).

Prerequisite pass module:

- *Chemistry 234*

Prerequisite module:

- *Chemistry 264*

Chemistry as a major for the BSc Degree

The following modules are required: Chemistry 124(16), 144(16), 214(16), 234(16), 254(16), 264(16), 314(16), 324(16), 344(16) and 364(16).

52078 Applied Chemistry

315 (16) Materials Technology (3L, 3P)

Industrial production of polymers (processes and grades). A study of industrial processes for the production of textile fabric structures, including new developments that focus on enhancing performance properties. Introduction to the design of functional textiles. Manufacturing processes for polymeric products including the use of additives and compounding, basics of processing techniques, application of processing techniques. Manufacture and use of composite materials and blends.

Corequisite module:

- *Applied Chemistry 324*

324 (16) Polymer Science I (3L, 3P)

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 biodegradability, polymers and the environment.

Practicals: laboratory work, seminars and tasks.

Prerequisite modules:

- *Chemistry 214, 264*

334 (16) Food and Beverage Chemistry (3L, 3P)

Methods of analysis in the food and beverage industry (infra-red, UV-vis and atomic spectroscopy, calibration-curve error analysis, nuclear magnetic resonance molecular structure analysis and high-performance liquid chromatography); the chemistry of sugars (including the Maillard reaction); the molecular basis for colour in food; chemical aspects of food preservation.

This module may only be taken by students registered for the BSc (Food Science) programme.

Prerequisite pass modules:

- *Chemistry 214, 264*

344 (16) Polymer Science II (3L, 3P)

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.

Prerequisite module:

- *Applied Chemistry 324*

345 (16) Materials Technology 2 (3L, 3P)

Polymers in industrially relevant applications: Topics focusing on applications relevant to textile science (medical and healthcare products, sportswear, geotextiles, etc.) and other polymeric materials (paints, adhesives, foams, smart packaging, etc.). Product design and failure analyses/problem solving with a focus on industrial applications.

The use of polymeric materials in industrially relevant applications. The emphasis will be on the design of polymeric artefacts as well as problem-solving and fault analyses in commercially available products. Topics will include textiles, coatings, packaging materials, foams, adhesives and composites.

Prerequisite module:

- *Applied Chemistry 315*

Corequisite module:

- *Applied Chemistry 344*

354 (16) Medicinal Chemistry (3L, 1T, 1P)

Medicinal chemistry is an interdisciplinary field that applies chemical and biological principles to the design, synthesis and development of new biologically active molecules that can be used to treat diseases. This module covers the core principles of drug discovery, including target selection, development, and use of relevant bioassays to identify hit compounds, computer-aided drug design, and the discovery and optimization of lead compounds, including natural products and repurposed drugs. Strategies to enhance the activity and ADME (absorption, distribution, metabolism, and excretion) properties of lead compounds through structural modification, as well as introductory drug metabolism and pharmacokinetics (DMPK) and the manufacture and delivery systems of drug are also covered. Students will be exposed to the latest advances in the development of therapeutic agents to address Africa's disease burden (e.g. tuberculosis, malaria, HIV/AIDS and cancer).

Prerequisite pass module:

- *Chemistry 264*

Prerequisite modules:

- *Chemistry 214, 234*

48321 Chemistry C

152 (6) Chemistry Laboratory Practicals (3P)

Development of laboratory skills by performing introductory chemistry experiments.

Project.

Prerequisite module:

- *Engineering Chemistry 123*

224 (15) Industrial Chemistry I (4L, 2P)

Eight practicals per semester

Bonding models; solid-state chemistry; introduction to coordination chemistry. Chemical thermodynamics,

statistical mechanical understanding of entropy, applications of Gibbs free energy, chemical and phase equilibrium, electrochemistry, colligative properties, elementary chemical kinetics, basic nomenclature, stereochemistry.

Prerequisite pass modules:

- *Engineering Chemistry 123*
- *Chemistry C 152*

254 (15) Industrial Chemistry II (4L, 2P)

Eight practicals per semester

Organic chemistry: 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.

Prerequisite module:

- *Chemistry C 224*

65692 Chemistry for Health Sciences

112 (8) Chemistry for Health Sciences (2L, 1T)

The module covers areas of general chemistry required as a foundation for studying further in the health science focal areas of physiotherapy and dietetics. It comprises atomic structure and bonding; stoichiometry; gas laws; properties of solutions; chemical kinetics and equilibria; organic chemistry and biomolecules.

50563 Textile Science

254 (16) Fibre Science (3L, 3P)

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 performance properties and functional textiles for niche markets.

Prerequisite modules:

- *Chemistry 124 or 164; and 144*

Department of Earth Sciences

64165 Geo-environmental Science

154 (16) Introduction to Earth Systems Science (3L, 3P)

Introduction to Earth Systems Science; 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; Geology of South Africa; Energy and mineral resources; Humans and tectonics: earthquakes and volcanoes; The hydrosphere; Surface-water processes; Groundwater processes; Theory of the origin and evolution of life.

12239 Earth Science Field Skills

172 (8) Earth Science Field Skills (2P)

Students taking the Earth Science Programme must enrol in this module. The module is composed of field or practical work, throughout the year, some of which may be scheduled during holidays or on weekends. The following aspects of Earth Science field skills will be covered: Defining lithological packages, recognizing map scale; working with topographic and geological maps and aerial photos to record information and to locate yourself, using GIS platforms to record spatial information; mineralogy, identification of sedimentary, metamorphic and igneous rocks and structures and their depositional or emplacement significance; practical consideration of natural environment, measuring the impact of human population on natural environment.

Corequisite modules:

- *Geo-environmental Science 124, 154*

272 (16) Earth Science Field Skills (2P)

A compulsory module for students taking the Earth Science Programme. The module is composed of sixteen days' or equivalent period of time compulsory field, practical or project work, spread over one year. This could be on weekends and during term breaks. Field, practical or project 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.

Prerequisite pass modules:

- *Earth Science Field Skills 172*
- *Geo-environmental Science 154*

Prerequisite module:

- *Geo-environmental Science 124*

Corequisite modules:

- *Geology 224, 244, 254*
- *Environmental Geochemistry 214*

374 (16) Earth Science Field Skills (3,5P)

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.

Prerequisite pass modules:

- *Earth Science Field Skills 272*
- *Geology 224, 244, 254*

Corequisite modules:

- *Geology 314, 324, 344, 354*

13374 Geology

224 (16) Introduction to Mineralogy (3L, 3P)

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.

Prerequisite modules:

- *Geo-environmental Science 124*
- *Chemistry 124 or 164*

Prerequisite pass module:

- *Geo-environmental Science 154*

244 (16) Physical Earth Sciences and Structural Geology (3L, 3P)

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 sub-minimum of 50% for practical work is required to obtain admission to the examination.

Prerequisite pass modules:

- *Geo-environmental Science 124, 154*
- *Geology 224*

Corequisite module:

- *Earth Science Fields Skills 272 or Environmental Field Skills 271*

254 (16) Optical Mineralogy and Petrography (3L, 3P)

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.

Prerequisite pass modules:

- *Geo-environmental Science 124, 154*
- *Geology 224*
- *Chemistry 124 or 164*

314 (16) Igneous Petrology (3L, 3P)

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 led 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 sub-minimum of 50% for practical work is required to obtain admission to the examination.

Prerequisite module:

- *Chemistry 144*

Prerequisite pass modules:

- *Geology 224, 244, 254*
- *Chemistry 124 or 164*

Corequisite module:

- *Earth Science Field Skills 374*

324 (16) Sedimentology and Stratigraphy (3L, 3P)

Origin, composition and classification of sedimentary rocks. Sedimentary textures and structures. Facies analysis and depositional environments. Basin analysis and palaeogeography. Sequence analysis and cyclicity. Stratigraphic principles. South African stratigraphy. Well log/core correlation/interpretation. Sedimentary log description.

A sub-minimum of 50% for practical work is required to obtain admission to the examination.

Prerequisite module:

- *Chemistry 144*

Prerequisite pass modules:

- *Geology 224, 244*
- *Chemistry 124 or 164*

Corequisite module:

- *Earth Science Field Skills 374 or Environmental Field Skills 372*

344 (16) Economic Geology (3L, 3P)

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 sub-minimum of 50% for practical work is required to obtain admission to the examination.

Prerequisite module:

- *Chemistry 144*

Prerequisite pass modules:

- *Geology 224, 244*
- *Chemistry 124 or 164*

354 (16) Metamorphic Petrology and Tectonics (3L, 3P)

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.

Prerequisite module:

- *Chemistry 144*

Prerequisite pass modules:

- *Geology 224, 244, 254*
- *Chemistry 124 or 164*

364 (16) Hydrogeology (3L, 3P)

Hydrological cycle; Darcy's Law, hydraulic conductivity, permeability and porosity; aquifers, aquitards and aquicludes; saturated and unsaturated zones and the water table; steady state and non-steady state flow; recharge and discharge processes; composition of groundwater; isotope hydrology; groundwater resource evaluation and management; South African Water Act.

Prerequisite pass modules:

- *Environmental Geochemistry 214*
- *Geology 244*

Corequisite module:

- *Environmental Field Skills 372 or Earth Science Field Skills 374*

13622 Environmental Field Skills

271 (8) Environmental Field Skills (2P)

A compulsory module for students taking the Geo-environmental Science focal area of 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 environmental field skills: Collection and preservation of water samples, appropriate sampling methodologies, measuring physical and geochemical properties of water in the field; practical use of environmental geochemistry to understand interactions between different water bodies and the impact of human activities on the quantity and quality of water in these bodies; practical understanding of the role of geomorphology on controlling water movement, recharge and discharge processes; practical understanding of the role of soils in controlling groundwater compositions and storage.

Prerequisite modules:

- *Geo-environmental Science 124, 154*
- *Chemistry 124 or 164; and 154*

Corequisite modules:

- *Environmental Geochemistry 214*
- *Geography 265*
- *Geology 244*

372 (8) Environmental Field Skills (2P)

A compulsory module for students taking the Geo-environmental Science focal area of 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 environmental field skills: Measuring physical and geochemical properties of surface water and groundwater in the field; practical use of environmental geochemistry to understand interactions between different water bodies and the impact of human activities on the quantity and quality of water in these bodies; practical understanding of the role of geomorphology on controlling water movement, and the sedimentological record this leaves; practical understanding modern and ancient sedimentological settings.

Prerequisite modules:

- *Environmental Geochemistry 214*
- *Geography 265*
- *Environmental Field Skills 271*

Corequisite modules:

- *Environmental Geochemistry 314*
- *Geography 334*
- *Geology 324, 364*

63991 Environmental Geochemistry

214 (16) Introduction to Environmental Geochemistry (3L, 3P)

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).

Prerequisite pass module:

- *Geo-environmental Science 154*

Prerequisite modules:

- *Geo-environmental Science 124*
- *Chemistry 124 or 164; and 144*

314 (16) Environmental Geochemistry (3L, 3P)

Application of redox, acid-base chemistry, thermodynamics and kinetic principles to environmental geochemistry. Surface complexation reactions; contaminants in soils; chemical evolution of surface and subsurface water; wastewater evolution; contaminant transport processes and reactions; geomaterials and human health; sampling and monitoring of air, soils and water; a brief introduction to physics and chemistry of the atmosphere.

Prerequisite pass modules:

- *Environmental Geochemistry 214*
- *Chemistry 264*
- *Mathematics 114 or Mathematics (Bio) 124*

Corequisite module:

- *Chemistry 234*

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).

Department of Mathematical Sciences

Division: Mathematics

21539 Mathematics

114 (16) Calculus (5L, 2T)

Any student who wishes to take this module must have achieved a mark of at least 6 (or 70%) for Mathematics on the NSC or the IEB school-leaving certificate.

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)

Complex numbers; transcendental functions; techniques of integration; improper integrals; conic sections; polar co-ordinates; partial derivatives; introduction to matrices and determinants.

Prerequisite module:

- *Mathematics 114*

154 (16) Foundational and Discrete Mathematics (4L, 2T)

Introduction to fundamental mathematical structures: sets, relations, functions. Formal systems and propositional logic, mathematical proofs and different proof methods. Elementary combinatorics: counting principles, pigeonhole principle, recursions. Important properties and types of functions and relations, e.g. equivalence and order relations. Selected practical applications, in particular in the context of computer science.

186 (32) Introductory Mathematics (3L, 3T)

For BSc (extended curriculum programme) and BEng (extended curriculum programme) students.

Any student who wishes to take this module must have achieved a mark of at least 5 (or 60%) for Mathematics on the NSC or the IEB school-leaving certificate.

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) Advanced Calculus and Linear Algebra (4L, 2T)

Advanced Calculus: Functions of more than one real variable, multiple integrals, line integrals, surface integrals, the divergence theorem.

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.

Prerequisite pass modules:

- *Mathematics 114, 144*

244 (16) Analysis and Linear Algebra (4L, 2T)

Analysis: Improper integrals, sequences and series, power series and Taylor's theorem, second-order linear differential equations.

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.

Prerequisite module:

- *Mathematics 214*

278 (32) Foundations of Abstract Mathematics I (3L, 2P)

Out of the three tutorial periods, one is a scheduled tutorial, and two are for independent work on assignments.

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 to 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)

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.

Prerequisite pass modules:

- *Mathematics 214, 244*

324 (16) Complex Analysis (3L, 3T)

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.

Prerequisite pass modules:

- *Mathematics 214, 244*

344 (16) Discrete Mathematics (3L, 3T)

Discrete Mathematics, or "Concrete Mathematics", as it is called in a famous book, deals with concrete objects that are inherently discrete, 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.

Prerequisite pass modules:

- *Mathematics 214, 244 or equivalent modules*

345 (16) Logic (2L, 4T)

Out of the four tutorial periods, two are scheduled tutorials and two are for independent work on assignments

This module gives an introduction to mathematical logic and formal mathematical languages, with a special emphasis on those languages that can be used for foundation of mathematics.

Prerequisite pass modules:

- *Mathematics 114, 144 or equivalent modules*

365 (16) Real Analysis (3L, 3T)

The aim of this module is to introduce and investigate the concepts, spaces, examples, and results that provide the foundation for wide-ranging developments in analysis. Typical topics studied are real numbers and their properties, basic theorems about the real numbers (including the fundamental results about sequences, functions, sequences of functions, etc.), introduction to metric spaces.

Prerequisite pass modules:

- *Mathematics 214, 244*

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

Out of the four tutorial periods, two are scheduled tutorials and two are for independent work on assignments.

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.

Admission subject to approval by the Department of Mathematical Sciences.

Mathematics as a 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), 345(16), 365(16), or Mathematics 378(32) together with two modules from Mathematics 344(16), 345(16), 365(16), or Mathematics 314(16), 324(16), Financial Mathematics 378(32).

66176 Biomathematics

374 (16) Project on Biological Modelling (1P)

Research project on a topic in biomathematics designed to provide students with experience in applying mathematical and statistical models.

Please note: The schedule of the weekly practical can be individually determined by the student in consultation with the project leader.

56847 Financial Mathematics

378 (32) Financial Mathematics (3L, 3T)

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.

Prerequisite pass modules:

- *Mathematics 214, 244*

Prerequisite modules:

- *Mathematical Statistics 214, 245, 246*

21547 Mathematics (Bio)

124 (16) Mathematics for the Biological Sciences (4L, 2T)

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)

For students in the BSc (extended curriculum programmes).

Any student who wishes to take this module must have achieved a mark of at least 4 (or 50%) for Mathematics on the NSC or the IEB school-leaving certificate.

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)

Any student who wishes to take this module must have achieved a mark of at least 6 (or 70%) for Mathematics on the NSC or the IEB school-leaving certificate or must have successfully completed the first year of a suitable extended curriculum programme.

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)

Complex numbers; transcendental functions; integration techniques; improper integrals; conic sections; polar

coordinates; partial derivatives; introduction to matrices and determinants.

Prerequisite module:

- *Engineering Mathematics 115*

214 (15) Differential Equations and Linear Algebra (4L, 2T)

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.

Prerequisite pass module:

- *Engineering Mathematics 115 or 145*

Prerequisite module:

- *Engineering Mathematics 145*

242 (8) Series and Partial Differential Equations (2L, 1T)

Infinite series and Taylor series; Fourier series; introduction to partial differential equations; Fourier transforms.

Prerequisite pass module:

- *Engineering Mathematics 145 or 214*

Prerequisite module:

- *Engineering Mathematics 214*

Division: Applied Mathematics

56820 Probability Theory and Statistics

114 (16) Probability Theory and Statistics (3L, 3T)

(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 BCom students.

20710 Applied Mathematics

144 (16) Modelling in Mechanics (3L, 3T)

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.

Prerequisite module:

- *Mathematics 114*

Corequisite module:

- *Mathematics 144*

214 (16) Applied Matrix Methods (3L, 3T)

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.

Prerequisite module:

- *Mathematics 144*

244 (16) Applied Differential Equations (3L, 3T)

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.

Prerequisite modules:

- *Mathematics 114, 144*

314 (16) Applied Discrete Mathematics (3L, 3T)

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.

Prerequisite module:

- *Applied Mathematics 214 or Mathematics 214*

324 (16) Numerical Methods (3L, 3T)

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.

Prerequisite module:

- *Mathematics 114*

354 (16) Flow Modelling (3L, 3T)

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.

Prerequisite module:

- *Applied Mathematics 144*

364 (16) Applied Fourier Analysis (3L, 3T)

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.

Prerequisite pass modules:

- *Mathematics 114, 144 or Engineering Mathematics 115, 145*

476 (16) Numerical Methods (3L)

The module focuses on numerical methods for matrix computations. We look at the effective solution of square linear systems, least-squares problems, and the eigenvalue problem. We consider direct as well as iterative methods, with special attention to sparse matrices and structured matrices. Pitfalls such as numerical instability and ill-conditioning are pointed out. Model problems are drawn from partial differential equations and image processing. Theory, algorithmic aspects and applications are emphasised in equal measure.

482 (16) Graph Theory (3L)

This module serves as a broad introduction to the field of graph theory by exposing students to a number of important problems and subfields of the discipline, such as optimal paths in networks, optimal spanning trees, planarity, vertex and edge colouring, Eulerian graphs and Hamiltonicity, tournaments, domination and independence, and Ramsey theory. Although this module focuses on the theoretical aspects of these concepts, the applications thereof include optimal route planning and production scheduling, planning of communication network infrastructure, the construction of timetables, placement of facilities in networks, vehicle problems, and the travelling salesperson problem.

483 (16) Applied Markov Processes (3L)

This module gives an introduction to Markov processes, focusing on their application for modelling dynamical systems perturbed by noise or manmade systems in which randomness or uncertainties play an important role. The theory covers Markov chains in discrete and continuous time, random walks, Brownian motion, stochastic differential equations, and stochastic calculus. Applications include population dynamics, queues, particle systems, diffusions, noise-perturbed dynamical systems, stochastic control, and finance. The module also has tutorials on simulation methods (in MATLAB or Python).

492 (16) Computer Vision

The first part of the module covers the basics of image processing, feature detection and matching, projective geometry, perspective transformations, robust model estimation with RANSAC, the pinhole camera model, and stereo vision for depth estimation. The second part focuses on deep neural networks, and specifically convolutional neural networks for image classification, object detection, and image segmentation. Relevant machine learning concepts, including training by stochastic gradient descent, are also introduced.

493 (16) Digital Image Processing

Basic greyscale transformations and image enhancement techniques in the spatial domain; Fourier analysis in two dimensions and image enhancement techniques in the Fourier domain; image restoration; morphological filters; image compression techniques; image segmentation, representation, description and recognition.

Applied Mathematics as a 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).

14736 Data Science Research in Applied Mathematics

472 (40) Data Science Research Project

The research assignment provides students with a comprehensive learning experience that integrates knowledge from previous courses. Students will integrate knowledge and experiences gained from all previous modules and apply this to a data-rich research topic. They will have the opportunity to synthesise what they have learned and apply that knowledge to new, complex situations. Students should engage in the entire process of solving a real-world data science problem, from collecting and processing actual data and applying suitable and appropriate analytical methods to the problem, to communicating the results clearly and comprehensibly.

Prerequisite pass modules:

- *Applied Mathematics 314, 354, 364*
- *Data Science 344*
- *Mathematical Statistics 312*

20753 Applied Mathematics B

124 (15) Statics (4L, 2T)

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)

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.

Corequisite module:

- *Engineering Mathematics 115*

Prerequisite module:

- *Applied Mathematics B 124*

224 (15) Dynamics of Rigid Bodies (3L, 3T)

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.

Prerequisite module:

- *Applied Mathematics 144 or Applied Mathematics B 154*

242 (8) Vector Analysis (2L, 1.5T)

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.

Corequisite module:

- *Applied Mathematics B 224*

Prerequisite module:

- *Engineering Mathematics 145*

252 (8) Applied Mathematics for Civil Engineers (2L, 1T)

Mathematical modelling: correct identification of problems and specification of assumptions; formulation of ordinary and partial differential equations; analytical solutions; interpretation of a solution in terms of the initial problem.

36323 Numerical Methods

262 (8) Numerical Methods (2L, 1T)

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.

Prerequisite module:

- *Engineering Mathematics 214*

Division: Computer Science

18139 Computer Science

113 (16) Computer Science for Actuarial Studies (3L, 3P)

Introduction to computer programming from a financial perspective. Basic financial problems are rephrased in terms of analytical problem solving. Standard imperative programming constructs including types of variables, assignments, if-then-else and loops, and recursive approaches are covered as needed in financial programming. Static data structures (in particular arrays) and declarative programming models such as spreadsheets are also covered.

Corequisite modules:

- *Actuarial Science 112*
- *Mathematics 114*

114 (16) Introductory Computer Science (3L, 3P)

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).

Corequisite module:

- *Mathematics 114*

144 (16) Introductory Computer Science (3L, 3P)

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.

Prerequisite module:

- *Computer Science 113 or 114*

214 (16) Data Structures and Algorithms (3L, 3T)

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

analysis of algorithms.

Prerequisite pass module:

- *Computer Science 144*

Prerequisite module:

- *Mathematics 114*

244 (16) Computer Architecture (3L, 3P)

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.

Prerequisite module:

- *Computer Science 214*

313 (16) Computer Networks (3L, 3P)

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

Prerequisite modules:

- *Computer Science 214, 244*

314 (16) Concurrency (3L, 3P)

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.

Prerequisite modules:

- *Computer Science 214, 244*

For programmes in Engineering:

Prerequisite modules:

- *Computer Science E 214*
- *Computer Systems 245*

315 (16) Machine Learning (3L, 3T)

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

Prerequisite modules:

- *Computer Science 144 or Computer Science E214*
- *Mathematical Statistics 245, 246; or Systems and Signals 344*
- *Mathematics 214 or Applied Mathematics 214 or Engineering Mathematics 214*

343 (16) Databases and Web Centric Programming (3L, 3P)

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. Virtualisation. Cloud Computing.

Prerequisite module:

- *Computer Science 214*

For programmes in Engineering:

Prerequisite modules:

- *Computer Science E 214*
- *Computer Systems 245*

344 (16) Program Design (3L, 3P)

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.

Prerequisite module:

- *Computer Science 214*

345 (16) Computability and Automata (3L, 3T)

Introduction to automata theory and formal languages, computability and complexity. Regular languages,

context-free languages and grammars. Turing machines. P vs NP problem and NP completeness.

Prerequisite module:

- *Computer Science 214*

411 (16) Computer Networks (3L, 1P)

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

Prerequisite modules:

- *Computer Science 214, 244*

412 (16) Advanced Algorithms

This module continues from Computer Science 214 and covers advanced topics in the design and analysis of algorithms and associated data structure. Topics include a selection from algorithm design techniques, linear programming, approximation algorithms, randomised algorithms, probabilistic algorithms, parallel algorithms, number-theoretic algorithms, cryptanalysis, computational geometry, computational biology, network algorithms, and complexity theory.

441 (16) Machine Learning

This module is an introduction to selected topics in machine learning.

491 (16) Space Science Algorithms

Algorithms and techniques in Space Science, with applications.

495 (16) Functional Programming

This module gives an introduction to the functional programming paradigm.

Computer Science as a major for the BSc degree

The following modules are required: Computer Science 113(16) or 114(16), 144(16), 214(16), 244(16), 343(16), 344(16), and two of 313(16), 314(16) and 315(16).

14738 Data Science Research in Computer Science

471 (40) Data Science Research Assignment

The research assignment provides students with a comprehensive learning experience that integrates knowledge from previous courses. Students will integrate knowledge and experiences gained from all previous modules and apply this to a data-rich research topic. They will have the opportunity to synthesise what they have learned and apply that knowledge to new, complex situations. Students should engage in the entire process of solving a real-world data science problem, from collecting and processing actual data and applying suitable and appropriate analytic methods to the problem, to communicating the results clearly and comprehensibly.

Prerequisite pass modules:

- *Computer Science 343, 344*
- *Data Science 344*
- *Mathematical Statistics 312*

12263 Scientific Computing

272 (5) Scientific Computing (2L)

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.

372 (5) Scientific Computing (2L)

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.

Prerequisite module:

- *Scientific Computing 272*

50040 Computer Skills

171 (4) Computer Skills (1L)

Study load: 26 lectures in total, presented as 2L per week every second week.

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.

176 (8) Computer Skills (1L, 4T)

This module is taken by students in the BSc (extended curriculum programmes). Utilisation of computers in computer users' areas on campus. Introduction to an operating system, internet, email, word processing, spreadsheet and presentation software.

272 (5) Computer Skills (2L)

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.

Prerequisite module:

- *Computer Skills 171 or Science in Context 178*

372 (5) Computer Skills (2L)

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

Prerequisite module:

- *Computer Skills 272*

59536 Computer Science E

214 (15) Object-Oriented Programming (3L, 3P)

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.

Prerequisite pass module:

- *Computer Programming 143*

Prerequisite modules:

- *Engineering Mathematics 115, 145*

414 (15) Machine Learning (3L, 3T)

This module is identical to Machine Learning A 742.

Prominent machine learning concepts and tasks. Selected feature extraction or dimensionality reduction techniques. Introduction to probabilistic modelling and latent variable models. Fundamental paradigms in parameter estimation.

Prerequisite modules:

- *Computer Science E 214 or Computer Science 144*
- *Mathematics 214 or Applied Mathematics 214 or Engineering Mathematics 214*
- *Mathematical Statistics 245 and 246; or Systems and Signals 344*

Department of Microbiology

16284 Microbiology

214 (16) Introductory Microbiology (3L, 3P)

History, microscopy, classification, structure and function (bacteria and archaea), nutritional requirements and growth factors, nutrient uptake, energy generation, culture media, growth curves, continuous culture, physical and chemical control, environmental factors, biofilm formation and quorum sensing and antimicrobial therapy.

Prerequisite pass modules:

- *Biology 124 or 144*
- *Chemistry 124 or 164; and 144*

244 (16) Microbial Diversity (3L, 3P)

Kingdoms of life, and modern microbial taxonomy and introductory microbial genomics. Prokaryotes, archaeal cell structure and function, nonproteobacterial Gram-negative bacteria, Proteobacterial classes, Firmicutes and Actinobacteria. Fungal groups, cell structure and function. Structure of viruses and virus taxonomy and multiplication strategies. Microbiology of water and soil environments, different metabolic types of micro-organisms, the role of different microbial taxa in biogeochemical cycles and energy flow in the food web, the dependence of animals and plants on microorganisms, including symbiotic associations, microbe-plant associations and microbe-insect associations, interactions between micro-organisms.

Prerequisite pass modules:

- *Biology 124 or 144*
- *Chemistry 124 or 164; and 144*

314 (16) Microbial Molecular Biology (3L, 3P)

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 in bacteria and yeasts, bacteriophage replication, induction and molecular applications. Production of industrially important heterologous proteins in yeast. Key concepts of yeast recombinant DNA technology.

Prerequisite pass module:

- *Microbiology 214*

Prerequisite modules:

- *Microbiology 244*
- *Biochemistry 214, 244*

324 (16) Microbial Physiology and Metabolism (3L, 3P)

Elemental composition, carbon and energy flows, oxidation-reduction reactions, energy production through fermentation, respiration and photosynthesis, Pasteur and Crabtree effects, 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 (wastewater treatment, overproduction of citric acid and lysine), quorum sensing, the systems biology of metabolism.

Prerequisite pass module:

- *Microbiology 214*

Prerequisite modules:

- *Microbiology 244*
- *Biochemistry 214, 244*

354 (16) Industrial Microbiology (3L, 3P)

Fermentations, including food fermentations. Specialised food fermentations, e.g. biological preservatives, preparation and the role of microorganisms. Quality control. The occurrence of pathogens and food-spoiling bacteria and their control. Industrial production of enzymes, antibiotics, pharmaceutical products, influence of substrate on production levels.

Prerequisite pass module:

- *Microbiology 214*

Prerequisite module:

- *Microbiology 244*

364 (16) Microbial Ecology (3L, 3P)

Introduction to environmental microbiology, overview of microbial environments, including earth, aquatic and extreme niches, methods and technology in microbial ecology, role of microorganisms in biogeochemical cycling, microbial communication and interactions, application of microbes in environmental and industrial remediation. The practical component includes problem identification, writing project proposals, project management and presentation.

Prerequisite pass module:

- *Microbiology 214*

Prerequisite module:

- *Microbiology 244*

Microbiology as a major for the BSc degree

The following modules are required: Microbiology 214(16), 244(16), 314(16), 324(16), 354(16), 364(16).

Department of Physics

12998 Physics

114 (16) Introductory Physics A (3L, 3P)

Introduction to mechanics, the understanding of motion of bodies in general and the conserved quantities contained within the laws of motion that are the foundations for all of physics. Quantities relevant to the physics of mechanical systems in different situations are introduced, including for collisions, in stationary states, during rotation, and how these are pertinent when describing the flow of heat and fluids. This course explores both experimental and theoretical aspects of Newtonian mechanics and thermodynamics, laying the foundation for further understanding of physics. The mathematical tools of calculus are used throughout.

Corequisite module:

- *Mathematics 114*

144 (16) Introductory Physics B (3L, 3P)

Introduction to electrical charges and their interaction. The physics of moving charges and magnetism, in preparation for advanced understanding of light, electrical circuits and materials. The special theory of relativity in mechanics and electromagnetism. The mathematical tools of calculus are used throughout.

Prerequisite modules:

- *Physics 114*
- *Mathematics 114*

Corequisite module:

- *Mathematics 144*

176 (32) Preparatory Physics (3L, 3P)

Students follow this module in the BSc extended curriculum programmes in AgriSciences and Science and for the BEng. The module focuses on the nature of physics with the following themes as content: Mechanics,

electromagnetism, modern physics.

224 (16) Classical Mechanics (3L, 3P)

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, harmonic oscillator, free and forced linear oscillations with damping, introductory Langrangian and Hamiltonian dynamics, conservation laws.

Prerequisite pass modules:

- *Physics 114, 144*

Prerequisite modules:

- *Mathematics 114, 144*

254 (16) Electromagnetism, Waves and Introduction to Quantum Physics (3L, 3P)

Electrostatic fields; magnetic fields; electromagnetic induction and alternating currents, Maxwell's equations and electromagnetic waves. Dipole radiation, wave motion with boundary conditions, interference and diffraction, physical and Fourier optics, quantum wave-functions and wave-particle duality, particle in a box, introduction to the Schrödinger equation in one dimension,

Prerequisite modules:

- *Mathematics 114, 144*
- *Physics 224*

314 (16) Statistical Physics A (Introductory Thermodynamics and Statistical Mechanics) (3L, 3P)

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, black body radiation and other applications.

Prerequisite modules:

- *Physics 254*
- *Mathematics 214, 244 or Applied Mathematics 214, 244*

334 (16) Quantum Mechanics A (3L, 3P)

Schrödinger equation; harmonic oscillator, spherically symmetric potentials, orbital angular momentum: Eigenvalues and spherical harmonic functions. The hydrogen atom. Time-independent perturbation theory, spin and application to the atom.

Prerequisite pass module:

- *Physics 224*

Prerequisite modules:

- *Physics 254*
- *Mathematics 214, 244 or Applied Mathematics 214, 244*

342 (8) Electromagnetism and Relativity (1.5L, 1.5P)

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

Prerequisite modules:

- *Mathematics 214, 244 or Applied Mathematics 214, 244*
- *Physics 224, 254*

344 (16) Simulation and Inference in Stochastic Systems (3L, 3P)

Simulation and numerical inference of key stochastic systems such as random walks. Information-based probability and core probabilistic concepts, deduction and induction, Bayes' Theorem. Characterisation and calculation with distributions and data, transformations, generating functions, connections to statistical physics.

Prerequisite module:

- *Mathematics 214 or Applied Mathematics 214 or Physics 224*

352 (8) Applications of Quantum Mechanics (1.5L, 1.5P)

Magnetic dipole moments, spin-orbit coupling, radiation transition rates, Zeeman effect. Electrons in periodic crystal potentials. Nuclear structure and properties, radioactive decay, nuclear scattering.

Prerequisite modules:

- *Physics 254, 334*

372 (8) Project (Theoretical Physics) (0.7L, 0.7P)

Application(s) of topics forming part of the BSc programme in Physics, focal area Theoretical Physics.

384 (16) Experimental Work in Physics (3L, 3P)

(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.

Corequisite modules:

- *Physics 342, 352 or 372*

412 (16) Lagrange and Hamilton Mechanics

Degrees of freedom, generalised coordinates, Lagrange equations of the first and second kinds, applications. Small oscillations, variational calculus. Hamilton's principle, Noether's theorem.

421 (16) Statistical Physics B

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).

457 (8) Bayesian Physics

Brief review of Bayesian probability basics. Conditional probability, product rule, Bayes' theorem. Important discrete and continuous distributions. Parameter estimation and model comparison relation to machine learning, application to data analysis. Symmetries, entropy and information gain. Varying additional topics depending on time available.

458 (8) Dynamic Systems and Complexity (4L, 1T)

Introduction to nonlinear dynamic systems, modelling, continuous and discrete mappings, stability analysis, hierarchy of chaos, strange attractors, universality and Feigenbaum constants. Hamiltonian chaos, KAM theorem.

Physics as a 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) or 344(16).

For specialisation in Theoretical Physics the following third-year modules are required: Physics 314(16), 334(16), 342(8), 344(16) and Project (Theoretical Physics) 372(8) or Physics 352(8).

14739 Data Science Research in Statistical Physics

473 (40) Data Science Research Assignment

The research assignment provides students with a comprehensive learning experience that integrates knowledge from previous courses. Students will integrate knowledge and experiences gained from all previous modules and apply this to a data-rich research topic. They will have the opportunity to synthesise what they have learned and apply that knowledge to new, complex situations. Students should engage in the entire process of solving a real-world data science problem, from collecting and processing actual data and applying suitable and appropriate analytic methods to the problem, to communicating the results clearly and comprehensibly.

Prerequisite pass modules:

- *Physics 314, 334, 344*
- *Data Science 344*
- *Mathematical Statistics 312*

Other modules in Physics

19267 Special Physics

111 (8) Physics for Health Sciences (2L, 1T)

Structure of matter, kinematics, statics, dynamics, heat, temperature, wave motion and electricity.

13005 Physics (Bio)

134 (16) Introductory Physics for Biological Sciences A (3L, 3P)

Selected topics, relevant to the biological sciences, from introductory mechanics, hydrostatics and optics.

Corequisite module:

- *Mathematics (Bio) 124 or Mathematics 114*

154 (16) Introductory Physics for Biological Sciences B (3L, 3P)

Selected topics, relevant to the biological sciences, from introductory electricity, magnetism, thermodynamics, gas laws, atomic physics, radioactivity, oscillations and waves.

Prerequisite module:

- *Physics (Bio) 134*

59420 Engineering Physics

113 (8) Physics for Engineering students (2L, 0.5P, 0.5T)

Introduction to physics and physical quantities, including introduction to atomic physics; oscillatory motion, introduction to wave motion, superposition and standing waves, sound waves, light, refraction, polarisation; introduction to nuclear physics.

152 (6) Physics for Engineering students (2L, 1T)

Introduction to basic relativity and basic quantum mechanics. Continued study of waves, acoustics and optics based on Engineering Physics 113.

Prerequisite module:

- *Engineering Physics 113*

Department of Physiological Sciences

13080 Physiology

114 (12) Introductory Overview of Physiology (3L)

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)

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)

Prerequisite module:

- *Physiology 114*

214 (16) Physiological Principles and Systems (3L, 3P)

Textbook-based overview of the following physiological principles and systems: homeostasis and body fluids, cell membranes, general physiological control systems, nervous, special senses, hormonal, digestive (basic single stomach) systems, and also typical diseases applicable to these systems.

For the Human Life Sciences programme, and the interdisciplinary focal area Applied Medicinal Chemistry:

Prerequisite modules:

- *Biology 124, 154*

Corequisite module:

- *Biochemistry 214*

For the interdisciplinary focal area Biomedical Mathematical Sciences:

Prerequisite module:

- *Biology 124*

Corequisite module:

- *Biochemistry 214*

244 (16) Systems in Physiology (3L, 3P)

Textbook-based overview of the following physiological systems of the body: muscle and respiratory systems, acid/base balance, blood, renal and reproductive systems.

Prerequisite module:

- *Physiology 214*

Corequisite module:

- *Biochemistry 244*

314 (16) Integrated Physiology (3L, 3P)

This module will concentrate mainly on integrated physiology and will cover a selection of the following topics: Systems physiology and homeostasis, endocrinology and metabolism, cardiovascular physiology and neurophysiology.

Prerequisite pass modules:

- *Physiology 214, 244*

Prerequisite modules:

- *Biochemistry 214, 244*

334 (16) Metabolic Physiology (3L, 3P)

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 and protein metabolism.

Prerequisite pass modules:

- *Physiology 214, 244*

Prerequisite modules:

- *Biochemistry 214, 244*

344 (16) Cellular Physiology (3L, 3P)

This module will concentrate mainly on cellular physiology and will cover a selection of the following topics: Membrane and cell communication, immunology, oxidative stress, muscle satellite cells and stem cells.

Prerequisite modules:

- *Biochemistry 214, 244*
- *Physiology 314*

364 (16) Clinical Applied Physiology (3L, 3P)

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: cancer, body composition, obesity, diabetes, anorexia, bone physiology and pathophysiology, mechanisms of muscle atrophy and conditions leading to muscle atrophy, ageing, HIV/AIDS and opportunistic diseases.

Prerequisite pass modules:

- *Physiology 214, 244*

Prerequisite modules:

- *Biochemistry 214, 244*

Physiology as a major for the BSc degree

The following modules are required: Physiology 214(16), 244(16) 314(16), 334(16), 344(16) and 364(16).

Faculty of AgriSciences

Department of Conservation Ecology and Entomology

55638 Conservation Ecology

314 (16) Biome Ecology (3L, 3P)

Introduction to biomes and ecosystem services; key drivers; social-ecological systems of dynamics and biome-level management issues; ecology of tropical and afromontane forests, woodlands, savannahs, treeless vegetation types; wetlands; animal diversity-habitat interactions; patterns of endemism; biological

invasion and its management.

Department of Genetics

11061 Biometry

212 (8) Introductory Biometry (2L, 1T or 1P)

Role of statistics in research; methods of tabulation and graphical representation of data; descriptive measures of locality, variation and association; the elementary principles of estimation, randomisation, sampling methods, unbiasedness and sampling distributions; simple and multiple linear regression; introduction to hypothesis testing; contingency tables and chi-squares tests; tests for normality. All data will be analysed using applicable software.

Prerequisite module:

- *Mathematics (Bio) 124 or Mathematics 114*

242 (8) Applications in Biometry (2L, 1T or 1P)

Treatment and experimental design; efficiency of estimation; analysis of variance; F-test for homogeneity of variance, one- and two sample hypothesis tests for means, multiple comparisons procedures; confidence intervals; non-parametric tests. All data will be analysed using applicable software.

Prerequisite module:

- *Biometry 212*

13285 Genetics

214 (16) Introductory Genetics (3L, 3P)

The fundamental concepts that underlie the inheritance of biological traits are studied with reference to the genotype-phenotype paradigm and the molecular basis of genetic diversity. Cellular mechanisms and components, including the cell cycle, mitosis and meiosis, chromosomes and genes are related to the principles of heredity: Mendelian genetics and extensions; linkage and recombination; linkage analysis and gene mapping; sexual reproduction and sex determining chromosomes; and chromosomal aberrations. The implications of such processes are further discussed at the organismal and population levels of biology with an introduction to population and quantitative genetics: population diversity; genotype and allele frequencies; the Hardy-Weinberg law and deviations; and complex and multifactorial traits.

Prerequisite pass module:

- *Biology 124*

Prerequisite modules:

- *Mathematics (Bio) 124 or Mathematics 114 or 144*
- *Animal Science 144 or Biology 144 or 154 or Crop Protection 152 or Probability Theory and Statistics 114*

215 (16) Introductory Microbial Biotechnology (3L, 3P)

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 microbial biotechnology by focussing on the most important aspects of first- and second-generation microbial biotechnology. Themes that will be discussed include bioprospecting, fermentation and bioreactors, microbial metabolic pathways for respiration and fermentation, production of baker's yeast and single-cell protein, the beer- and wine-making processes, production of bio-ethanol and the production of pharmaceutically important compounds and enzymes.

Responsible departments: Biochemistry, Genetics, Microbiology, Plant Pathology and the South African Grape and Wine Sciences Research Institute (SAGWRI) at Stellenbosch University

244 (16) Introductory Molecular Biology (3L, 3P)

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 bioinformatics.

Prerequisite module:

- *Genetics 214*

245 (16) Introductory Plant and Animal Biotechnology (3L, 3P)

This module follows on from the Genetics 215 module and introduces the student to first- and second-generation biotechnology in eukaryotic systems, including plants, animals and humans. First-generation biotechnology entails the use of organisms/biological systems as they are, e.g. 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 aquaculture, aquatic bioremediation, aquatic bioprocessing, embryogeny, assisted reproduction and embryo manipulation, cell and tissue culture for both plant and animal systems, micropropagation, and the identification, characterisation and production of valuable natural products and pharmaceuticals in plants.

Presented by departments of Genetics and Plant Pathology, and the South African Grape and Wine Sciences Research Institute (SAGWRI) at Stellenbosch University

314 (16) Genomes and Genome Analysis (3L, 3P)

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.

Prerequisite pass module:

- *Genetics 244*

315 (16) Advanced Biotechnology (3L, 3P)

This module focuses on topical and contemporary aspects of microbial, plant and animal biotechnology. It covers advanced recombinant DNS methodologies and how they can be purposed to genetic interventions that ultimately improve human well-being. Some of the themes covered during the module are (i) metagenomic libraries and their uses, (ii) the creation of plant based-GMOs and their applications, and (iii) the creation of animal based-GMOs and their applications.

Prerequisite module:

- *Genetics 245*

324 (16) Molecular Population Genetics (3L, 3P)

The genetic structure and dynamics of populations are investigated, especially with the use of molecular markers, including frequencies of alleles and genotypes, heterozygosity, linkage disequilibrium; random mating and the Hardy-Weinberg principle; factors that determine genetic variation: mutation, migration, selection and population size; subdivided and genetic relationships between populations are also discussed. Emphasis is placed on applications in molecular population genetics, phylogenetics and population genomics.

Prerequisite pass module:

- *Genetics 214*

Corequisite module:

- *Genetics 244*

344 (16) Advanced Topics in Molecular Genetics (3L, 3P)

Various advanced topics are addressed in this module and may include the following: diagnostic applications in human genetics; DNA fingerprinting and forensic science; applications from genome projects; personalised medicine and pharmacogenetics; neurogenetics; epigenomics; genetic modification; gene therapy; genome editing; synthetic biology; viruses and the exploitation of their genomes.

Prerequisite pass module:

- *Genetics 244*

345 (16) Economic and Legal Aspects of Biotechnology (3L, 3P)

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, trademarks 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.

354 (16) Quantitative genetics (3L, 3P)

Quantitative traits and continuous variation; components of phenotypic and genetic variances; resemblance between relatives; estimation of heritability and breeding value; selection methods and genetic improvement; correlated traits; multiple traits selection; principles of marker-based selection; mapping and

characterising of quantitative trait loci.

Prerequisite modules:

- *Genetics 324*
- *Biometry 212 and 242 or*
- *Psychology 243 and 253 or*
- *Mathematical Statistics 214 or*
- *Biodiversity and Ecology 212*

Department of Soil Science

14176 Soil Science

214 (16) Introduction to Soil Science (3L, 3P)

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.

Prerequisite module:

- *Chemistry 144*

Faculty of Arts and Social Sciences

Department of General Linguistics

10294 General Linguistics

178 (24) Introduction to Linguistics (3L, 1T)

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)

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.

Prerequisite pass module:

- *General Linguistics 178*

318 (24) Advanced Linguistics (4L)

Theoretical concepts and mechanisms in modern theories of language structure (syntax and morphology), with specific focus on the analysis of empirical phenomena relating to word and sentence structure in languages belonging to various families; *capita selecta* which contribute to the realisation of the outcomes of the module (e.g. variation in language, language origin, language change).

Prerequisite pass module:

- *General Linguistics 278*

348 (24) Advanced Linguistics (4L)

Fundamental principles, key concepts and research methods employed in various areas of applied linguistics, including (critical) discourse analysis, psycholinguistics, and language planning and language policy; *capita selecta* which contribute to the realisation of the outcomes of the module (e.g. topics in sociolinguistics, language acquisition, intercultural communication).

Prerequisite pass module:

- *General Linguistics 278*

Department of Geography and Environmental Studies

64165 Geo-environmental Science

124 (16) Introduction to Human-Environmental Systems (3L, 3P)

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.

56502 Geography and Environmental Studies

265 (16) Environmental Studies (3L, 3P)

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.

Prerequisite module:

- *Geo-environmental Science 124*

334 (16) Environmental Processes and Hazards (3L, 3P)

Geomorphological processes and physical landscape change in southern Africa relating to weathering, arid landscapes, granite landscapes and coastal zones. An introduction to natural hazards and the relationships between natural processes and biogeophysical hazards. A strong focus on analytic techniques for assessment of geomorphological processes and natural hazards.

Prerequisite module:

- *Geography and Environmental Studies 265 or Geographical Information Technology 214*

358 (16) Environmental Studies (3L, 3P)

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.

Prerequisite module:

- *Geography and Environmental Studies 265 or Geographical Information Technology 214*

Geography and Environmental Studies as a major for a BSc degree

The following modules are required: Geo-environmental Science 124(16), 154(16); Geography and Environmental Studies 265(16), 334(16), 358(16); Geographical Information Technology 214(16), 241(16), 312(16), 341(16).

12923 Geographical Information Technology

141 (16) Nature of Geospatial Data (3L, 1P)

This module focuses on the fundamentals of geoinformation science and cartography. It introduces spatial awareness to be able to recognise patterns and relationships among objects on maps; data collection methods specifically designed for spatial data; data modelling of geographical data as raster or vector; spatial thinking to explore and understand problems using data from physical, urban and environmental geography contexts. The module will serve as an introduction to the professions of geoinformatics practitioner and geospatial data scientist.

211 (16) Earth Observation (3L, 3P)

Principles of remote sensing and earth observation; the electromagnetic spectrum; reflectance characteristics of various objects on the earth's surface; atmospheric interaction with electromagnetic energy; digital imagery; image resolution; satellite systems; image enhancement and pre-processing;

unsupervised and supervised image classification; accuracy assessment; GIS integration.

Corequisite module:

- *Mathematics 114 or Mathematics (Bio) 124*

214 (16) Geographical Information Systems (3L, 3P)

Introductory overview and understanding 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 cartographic visualisation with a GIS; GIS applications.

Prerequisite module:

- *Mathematics 114 or Mathematics (Bio) 124*

241 (16) Spatial Data Management (3L, 3P)

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.

Prerequisite module:

- *Geographical Information Technology 141 or 214*

242 (16) Digital Photogrammetry (3L, 3P)

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.

Prerequisite modules:

- *Geographical Information Technology 211*
- *Mathematics 114 or Mathematics (Bio) 124*

311 (16) Spatial Data Acquisition (3L, 3P)

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.

Prerequisite module:

- *Geographical Information Technology 241*

312 (16) Spatial Analysis (3L, 3P)

Query operations and query languages; Geometric measures; Spatial analytical operations; Surface analysis; Geostatistics; Network analysis; Analysis design; Fuzzy sets.

Prerequisite module:

- *Geographical Information Technology 214 or 241*

341 (16) Spatial Modelling (3L, 3P)

Models in science; Spatial models: types, construction, design and development; Cartographic modelling: terminology, methodology, in and outputs, functions.

Prerequisite module:

- *Geographical Information Technology 312*

342 (16) Earth Observation (3L, 3P)

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.

Prerequisite module:

- *Geographical Information Technology 211*

Geographical Information Technology as a major for a BSc degree

The following modules are required: Geo-environmental Science 124(16), 154(16); Geographical Information Technology 211(16), 214(16), 241(16), 242(16), 311(16), 312(16), 341(16), 342(16).

Department of Information Science

14689 Organisational Informatics

214 (16) Principles of Information Systems (3L, 1T)

This is a theoretical module that covers the core principles of information systems and how they are developed, used and managed in contemporary practice. Students will explore themes such as technological infrastructure of information systems, the role of information systems in business operation, and the management of information systems development projects.

244 (16) Introduction to Application Design (2L, 2P)

This module introduces students to computer application development on both a theoretical and practical level. The module requires no experience of computer programming. An understanding of fundamental concepts in programming such as data types, variables, input, output, flow control (including iteration and decision structures), modules and functions is established. Students implement these principles through the use of a contemporary programming language. Additionally, students will learn to use key web development standards, including HTML and CSS.

Exclusions: This module may not be taken simultaneously with or after having completed Computer Science 114.

318 (24) Systems Analysis and Design (3L, 3P)

This module addresses systems analysis and design in the context of information systems projects. It adopts a practical orientation and aims, firstly, to expose students to the key principles of information systems analysis and design from the perspective of a systems analyst. Systems analysis activities and the associated documentation and modelling standards are presented. This is followed by the essential aspects of systems design, including the relevant techniques and standards. Students apply these principles through practical case-based assignments.

Prerequisite modules:

- *Organisational Informatics 214*
- *Organisational Informatics 244 or Computer Science 114*

348 (24) Systems Development (2L, 4P)

This module integrates and extends knowledge and skills from earlier modules in Socio- and Organisational Informatics. The module covers systems development approaches and project management, as well as advanced design and deployment concepts. Students undertake a group-based project to design and develop a fully functional information system using appropriate modern development technologies, design approaches and project management methodologies.

Prerequisite module:

- *Organisational Informatics 318*

Prerequisite pass module:

- *Organisational Informatics 244 or Computer Science 114*

58173 Socio-informatics

214 (16) Interaction Design (2L, 2P)

This module concerns the design of interfaces for computer applications. Students will be introduced to current approaches to information architecture and application structure, and to the key principles of interface design and human computer interaction. The module is practice-oriented, using a modern design platform to perform practical assignments.

244 (16) Information Society (3L, 1T)

Pervasive digital media, expanding information occupations and the development of the internet have combined to give rise to the global information society. In this module, students will study this information explosion by critically examining the major theoretical approaches to informational development with reference to the work of prominent theorists such as Castells, Schiller, Habermas and Giddens.

348 (24) Computational Social Science (3L, 3P)

This module introduces students to the interdisciplinary field of computational social science, which combines insights from computer and information science, sociology and social network analysis, economics, political science and public health to equip students to answer social science questions using computational methods. No prior computer programming knowledge is required. Students will learn to ask social science questions and to answer these questions by collecting and analysing data from digital

sources. Students will acquire skills in data analysis programming languages and in data analysis techniques for working with digital trace data.

Department of Music

50652 Music Technology

112 (6) Music Technology (2L)

Music and computers: MIDI; notation software; sequencing software; basic principles of sound recording and editing; the physiology of hearing; music in film/advertisements; video and soundtracks; basic web design and HTML.

142 (6) Music Technology (2L)

Music and computers: MIDI; notation software; sequencing software; basic principles of sound recording and editing; the physiology of hearing; music in film/advertisements; video and soundtracks; basic web design and HTML.

222 (8) Music Technology (1L, 1P)

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)

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)

Projects regarding sound recordings and sound-orientated programming.

Department of Psychology

18414 Psychology

114 (12) Psychology as a Science (2L, 1T)

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)

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.

213 (8) Approaches to Psychological Theories of the Person (1.5L)

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.

Prerequisite pass modules:

- *Psychology 114, 144*

223 (8) Human Development in Context (1.5L)

In this module human development is studied, with specific reference to the South African context.

Prerequisite pass modules:

- *Psychology 114, 144*

243 (8) Research Design in Psychology (1.5L)

This module will equip students with knowledge and skills to evaluate the scientific literature in psychology. The module covers the core theoretical elements of both quantitative and qualitative research methodology using examples of current psychosocial issues.

Prerequisite pass modules:

- *Psychology 114, 144*

314 (12) Psychopathology (4L)

In this module abnormal behaviour is studied, from different perspectives and classification systems, with specific reference to the mental health context in South Africa.

Prerequisite pass modules – any three of the following four modules:

- *Psychology 213, 223, 243, 253*

324 (12) Social Psychology (4L)

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.

Prerequisite pass modules – any three of the following four modules:

- *Psychology 213, 223, 243, 253*

348 (24) Psychological Interventions (4L)

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.

Prerequisite pass modules – any three of the following four modules:

- *Psychology 213, 223, 243, 253*

Psychology as a major for the BSc degree

The following modules are required: Psychology 114(12), 144(12), 213(8), 223(8), 243(8), 314(12), 324(12) and 348(24).

Faculty of Economic and Management Sciences

Department of Business Management

48550 Business Management

113 (12) Business Management (3L, 1P)

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.

Department of Economics

12084 Economics

114 (12) Economics (3L, 1T)

Problems economists address: inequality, poverty, economic growth, sustainability, scarcity, choice. Economic decision-making: incentives, relative prices, economic rent, labour, production, opportunity cost. Economic relationships and interactions: game theory, equity, efficiency. Markets: demand and supply, price-taking and competitive markets, elasticity, labour market. Market dynamics: rent-seeking, market failure, externalities and government policies.

144 (12) Economics (3L, 1T)

The module introduces students to economic application and policy, with a strong focus on South Africa by exploring contemporary economic issues: inflation, unemployment, economic growth, external stability and a

fair distribution of income.

The aggregate economy in the short term and long term: measuring the aggregate economy, the multiplier model, unemployment and fiscal policy, inflation and monetary policy, the money market and the South African Reserve Bank (SARB), technological change and income inequality.

Globalisation: international trade, migration and investment.

Corequisite module:

- *Economics 114*

214 (16) Economics (3L, 1T)

Macroeconomics: business cycle measurement, consumer and firm behaviour, closed one-period macroeconomic models, consumption and savings decisions in a two-period model.

Microeconomics: goods and factor markets, demand theory, production and cost theory, market structures and the theory of the firm, welfare theory.

Prerequisite pass modules:

- *Economics 114, 144*

244 (16) Economics (3L, 1T)

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.

Prerequisite pass modules:

- *Economics 114, 144*

Corequisite module:

- *Economics 214*

318 (24) Economics (4L, 1T)

Introduction to econometrics: statistical concepts, the classical linear model of regression, multicollinearity, autocorrelation, heteroscedasticity, dummy variables, estimation of regression models.

Macroeconomics: mathematical techniques, economic growth, business cycle, monetary and fiscal policy.

Introduction to game theory: mathematical techniques, different types of games, equilibrium concepts.

Prerequisite pass module:

- *Economics 214*

Prerequisite module:

- *Economics 244*

348 (24) Economics (4L, 1T)

This module focuses on the economic policy debate in a developing country. This includes economic policy criteria, structural characteristics of the South African economy, economic thought and systems, and growth and development policies, which include demand and supply aspects of economic growth, sectoral and spatial development, distribution of income and social expenditure, competition policy, environmental economics, labour policy, education and investment in human capital and the macroeconomic policy debate.

Prerequisite pass module:

- *Economics 214*

Prerequisite module:

- *Economics 244*

Corequisite module:

- *Economics 318*

Department of Logistics

55336 Operations Research

214 (16) Network Optimisation (3L, 3P)

Introduction to network modelling. 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 (generalised centres and medians), maximum flow problems. Applications using suitable software.

Prerequisite modules:

- *Mathematics 114, 144*

244 (16) Linear Programming (3L, 3P)

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, matrix games. Zero-sum games. Special cases of the simplex algorithm (transport, transhipment, assignment and minimum cost flow). Applications using suitable software.

Prerequisite module:

- *Mathematics 114*

Prerequisite pass module:

- *Mathematics 144*

314 (16) Combinatorial Optimisation (3L, 3P)

Binary and integer programming (branch-and-bound methods, cut level methods), heuristics (*n*-Opt procedures). Applications with respect to assignment problems, colouring problems, covering problems and domination problems, Hamiltonian graphs (the travelling salesperson problem). Knapsack problems. Deterministic dynamic programming. Applications using suitable software.

Prerequisite module:

- *Operations Research 244 OR*

Prerequisite pass modules:

- *Business Analytics 214 and 244 with an average final mark of at least 80%, and a pass mark in a departmental cross-over assessment*

322 (16) Stochastic Methods of Operations Research (3L, 3P)

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). Stochastic dynamic programming. Applications using suitable software.

Prerequisite pass modules:

- *Probability Theory and Statistics 114 or 144 OR*
- *Business Analytics 214 and 244 with an average final mark of at least 80%, and a pass mark in a departmental crossover assessment*

344 (16) Optimisation (3L, 3P)

Introduction to optimisation and functions in R*n*, unconstrained optimisation (search methods and gradient methods), constrained optimisation (Lagrange multipliers, quadratic programming, separable optimisation). Goal programming. Applications by means of suitable software.

Corequisite module:

- *Operations Research 244 OR*

Prerequisite pass modules:

- *Business Analytics 214 and244 with an average final mark of at least 80%, and a pass mark in a departmental crossover assessment*

352 (16) Decision Modelling (3L, 3P)

Decision analysis cycle, problem structuring, decision criteria, decision trees, influence diagrams, multi-criteria decision analysis, utility theory, multi-attribute utility theory, analytical network process, fuzzy modelling and optimisation, decision-making software, decision support systems.

Prerequisite pass modules:

- *Probability Theory and Statistics 114 or 144 OR*
- *Business Analytics 214 and 244 with an average final mark of at least 80%, and a pass mark in a departmental crossover assessment*

Department of Statistics and Actuarial Science

Actuarial Science

Please note:

Proficiency in English is an academic requirement for all Actuarial Science modules

43214 Actuarial Science

112 (8) Theory of Interest (2L, 1T)

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

- This module is more intensive than Theory of Interest 152.
- 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).
- Students are required to complete at least 80% of all assigned classwork/tutorials. In cases where this requirement is not met, students will fail the module.

211 (18) Financial Mathematics (4L)

Basic concepts of financial mathematics, compound interest functions, discounted cash flows, pricing of loans and other securities, annuities, as well as the use of MS Excel to perform calculations.

Prerequisite pass modules:

- *Actuarial Science 112 AND*
- *Probability Theory and Statistics 144 with a final mark of at least 65% AND Mathematics 114, 144 with an average final mark of at least 60% OR*
- *Mathematics214 with a final mark of at least 55%*

Corequisite modules:

- *Mathematics 214*
- *Mathematical Statistics 214*

54690 Financial Risk Management

212 (8) Institutional Investment Management (3L, 2P)

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.

Prerequisite pass modules:

- *Mathematics 114, 144*
- *Probability Theory and Statistics 144*
- *Theory of Interest 152 or*
- *Actuarial Science 112*

Corequisite modules:

- *Actuarial Science 211,*
- *Mathematical Statistics 214*

242 (8) Derivatives (2L, 1P)

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.

Prerequisite pass modules:

- *Mathematics 114, 144*
- *Probability Theory and Statistics 144*
- *Theory of Interest 152 or*
- *Actuarial Science 112*

Prerequisite module:

- *Financial Risk Management 212*

Corequisite modules:

- *Actuarial Science 211*
- *Mathematical Statistics 214, 245, 246*

252 (6) Financial Mathematical Statistics (3L)

Analyses of financial returns, principal components, risk factor sensitivities and cash flow mapping. Introduction to programming.

Prerequisite pass modules:

- *Actuarial Science 112*
- *Mathematics 114, 144*
- *Probability Theory and Statistics 144*

Corequisite modules:

- *Actuarial Science 211*
- *Mathematics 214, 244*
- *Mathematical Statistics 214, 245, 246*
- *Financial Risk Management 212, 242*

56820 Probability Theory and Statistics

144 (16) Probability Theory and Statistics (3L, 3T)

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, normal.

14026 Data Science

141 (16) Data Science (4L, 2P)

Fundamental data science concepts; data-analytic thinking; types of data; the data cycle; CRISP data mining process; describing a dataset numerically; describing a dataset graphically; organising data; file formats; data manipulation in the R software; introduction to predictive modelling; overfitting; data leakage; model evaluation; other data science tasks and techniques; data ethics; communicating results.

241 (16) Data Science (4L, 2P)

Introduction to Python; Python commands and file systems; programming structures; data sources; data collection; optimisation; resampling and the bootstrap; naïve Bayes classification; application of linear models; data ethics.

Prerequisite pass modules:

- *Data Science 141*
- *Mathematical Statistics 214 OR*
- *Probability Theory and Statistics 114 or 144 with at least 60% AND*

Prerequisite module:

- *Mathematical Statistics 214*

316 (16) Data Science (4L, 2P)

In this module, supervised machine learning approaches and unsupervised machine learning are discussed.

Supervised learning uses labelled datasets and can be separated into two types of problems, namely classification and regression. Classification problems can be solved by a multivariate technique, namely discriminant analysis that separates two or more groups of observations based on variables measured on each sample unit. The naïve Bayes classifier is another effective classification algorithm for discriminating between two or more groups. To measure the classification accuracy of these techniques, cross validation and bootstrap resampling procedures are also discussed. In regression problems the relationship between dependent and independent variables is investigated. Popular regression algorithms are regularized regression, principal component regression and partial least squares regression. For classification and regression problems, tree-based methods, such as random forests and boosting, can also be applied as modelling techniques.

Unsupervised learning uses unlabelled datasets and is associated with tasks in clustering and dimensionality reduction. Clustering is done according to a similarity measure for grouping data objects together. Modern clustering techniques such as k-means, Gaussian mixture models and spectral clustering are discussed. Dimensionality reduction is the statistical technique of reducing the number of random variables in a problem by obtaining a set of principal variables. Specifically, principal component analysis and independent component analysis are discussed.

Prerequisite pass module:

- *Data Science 241*

Corequisite module:

- *Mathematical Statistics 312*

346 (16) Data Science (4L, 2P)

In this module big data and deep learning are discussed.

Big data refers to a body of data that is so large, fast or complex that it is difficult or impossible to process using traditional methods. Big data analysis challenges include capturing, storing, searching, sharing, transferring, visualising, querying and updating data sources.

Cloud computing services are one way of managing big data. Cloud computing entails the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user.

Natural-language processing, a subfield of linguistics, computer science and artificial intelligence, is also applied to big data. Natural-language processing is concerned with the interactions between computers and human language, in particular, how to program computers to process and analyse large amounts of natural-language data so that the computer may perform repetitive tasks automatically.

Neural networks are a subset of machine learning and lie at the heart of deep learning algorithms. Neural networks rely on training data to learn and improve the accuracy of the network over time. Once the network is fine-tuned for accuracy, using backpropagation, it is utilised as a powerful tool for classifying and clustering data at high velocity.

Prerequisite modules:

- *Data Science 316*
- *Mathematical Statistics 312*

22853 Mathematical Statistics

Mathematical Statistics

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 BCom 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)/245(8) and 246(8), 318(32)/312(16) and 316(16), 344(16) and 364(16) are required.

214 (16) Distribution Theory and Introduction to Statistical Inference (4L, 2P)

Continuous stochastic variables; expected value and variance of a continuous stochastic variable; important continuous distributions; uniform, normal, exponential, gamma, beta. Moments and moment-generating functions for discrete and continuous distributions. Bivariate probability distributions; marginal and conditional distributions; the multinomial and bivariate normal distribution; Determining the distribution of functions of variables. The central limit theorem (without proof). Samples and sampling distributions: the standard parametric cases. Interval estimation and hypothesis testing: applying these principles in the

standard cases of parametric inference. Data representation and description, calculating and interpreting sample parameters.

Prerequisite pass modules:

- *Probability Theory and Statistics 114 or 144*
- *Mathematics 114, 144 with an average final mark of at least 60%, OR*
- *Mathematics 214 with a final mark of at least 55%*

245 (8) Statistical Inference (2L, 1P)

Introduction to statistical inference. Principles of point estimation: the Cramer-Rao theorem and its application, efficiency, minimum variance unbiased estimators, consistency. Method-of-moments estimators. Maximum likelihood estimators. The Neyman-Pearson lemma: proof and applications. Likelihood ratio tests. Parametric estimation theory and hypothesis testing. Bayesian inferential statistics.

Prerequisite pass module:

- *Mathematical Statistics 214*

246 (8) Linear Models in Statistics (2L, 1P)

Advanced matrix algebra. Stochastic vectors and matrices. The multivariate normal distribution. Maximum likelihood estimation of parameters in the multivariate normal distribution. Distributions of quadratic forms. The simple linear regression model. The method of least squares. Inference in the simple linear regression model. Introduction to R software.

Prerequisite pass module:

- *Mathematical Statistics 214*

312 (16) Statistical Inference and Probability Theory (3L, 1P)

Advanced distribution theory, sequences of random variables, limit theory for sequences, generating functions, sampling distributions and approximations. Sufficiency. Different approaches to inference. Goodness-of-fit methods. Bayes inference: Decision theory and Bayes risk using loss functions, Bayesian belief networks and Bayesian classification. Markov chain Monte Carlo simulation techniques: Gibbs sampling and Metropolis-Hasting algorithms.

Prerequisite pass module:

- *Mathematical Statistics 245*

Prerequisite modules:

- *Mathematical Statistics 246 with a final mark of least 40%*
- *Mathematics 214*

316 (16) Regression and Predictive Modelling (3L, 1P)

Fitting regression models by means of matrices. The multiple linear regression model. Inference in the multiple linear regression model. Residual analysis. Variable selection techniques. Ridge regression. Lasso regression. Linear methods for classification. The use of R software to fit models in practice.

Prerequisite pass module:

- *Mathematical Statistics 246*

Prerequisite modules:

- *Mathematical Statistics 245 with a final mark of least 40%*
- *Mathematics 214, 244*

344 (16) Stochastic Processes and Statistical Learning (3L, 1P)

Introduction to stochastic processes. Markov processes and their applications. Introduction to martingale theory and applications. Introduction to statistical learning.

Prerequisite modules:

- *Mathematical Statistics 312, 316*

364 (16) Time Series (3L, 1P)

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.

Prerequisite modules:

- *Mathematical Statistics 312, 316*

19658 Statistics

318 (24) Linear and Econometric Models (4L, 2T)

Regression analysis: The multiple linear regression model. Maximum likelihood estimators; Residual analysis; Outliers and influential observations; Unequal variances; Multicollinearity; Power transformations; Variable selection; Weighted least squares; Logistic regression; Ridge regression; Robust regression; Principal component regression; Dummy variables and ANOVA; Log-linear model; Econometric models.
Multivariate methods: Presentation of multivariate data; The multivariate normal distribution; Tests for normality; Hypothesis testing for one and two population mean vectors; Confidence regions and simultaneous confidence intervals; Multivariate control charts; Multivariate analysis of variance; Linear discriminant analysis; The use of the software R, STATISTICA and SAS to apply regression analysis and multivariate methods to datasets.

Prerequisite pass modules:

- *Statistics 214, 224, 244 or Mathematical Statistics 214, 245, 246*

348 (24) Statistical Practice (4L, 2T)

Probability theory: Discrete probability distributions (the binomial, geometric, negative binomial, hypergeometric and Poisson distributions); Moments and moment generating functions; Continuous probability distributions (the normal, gamma and beta distributions); Functions of random variables (the method of transformations, the method of moment generating functions, and order statistics).
Advanced statistical inference: Properties of estimators (unbiasedness, efficiency, consistency, sufficiency, robustness); Method-of-moments estimation; Maximum likelihood estimation; Likelihood ratio tests.
Time series analysis: Time series decomposition methods; Single exponential smoothing; Holt's method; Holt-Winter's method; Multiple regression in time series analysis; Box-Jenkins methodology for ARIMA models; Using the R and STATISTICA software to apply time series models.
Stochastic simulation: Generating random numbers from different distributions using R; Inverse transform method; Acceptance-rejection method; Practical applications of simulation using R.
Bayesian inference: Bayes' theorem; Bayesian priors, posteriors and estimators; Bayesian credibility intervals; Bayes hypothesis testing.

Prerequisite module:

- *Statistics 318*

14223 Statistics and Data Science

188 (18) Statistics and Data Science (3L, 2P)

Linear programming: Graphical techniques to solve problems with two variables; Shadow prices; Sensitivity analyses. (Only applies to BAcc students).

Data science: Fundamental concepts; the data cycle; Data ethics.

Descriptive statistics: Various data types; Graphical representation of data; Descriptive measures of location, spread and association; Box plots.

Sampling techniques: Simple random; Stratified; Systematic; Cluster; Probability proportional to size.

Probability theory: Basic probability concepts; 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; Binomial, hypergeometric and Poisson distributions.

Continuous random variables and probability distributions: Expected value, variance and standard deviation of a continuous random variable; The uniform, normal and exponential distributions.

Sampling distributions: Central limit theorem; Sampling distributions of the mean and a proportion; Sampling distribution of the difference between two means and two proportions.

Inferential statistics: Interval estimation and hypothesis testing for the mean, a proportion, the variance and the standard deviation; Interval estimation and hypothesis testing for the difference between two means, two proportions and the ratio of two variances.

Regression analysis: The simple and multiple linear regression model; The method of least squares estimation; Inference on the model parameters and coefficient of correlation; Residual analysis.

Faculty of Engineering

Department of Electrical and Electronic Engineering

12599 Electrotechnique

143 (15) Introduction to Circuit Theory (3,5L, 1P, 2T)

Introduction to basic circuit terminology and elements, including dependent sources; Ohm's law, Kirchhoff's laws; node-voltage analysis and mesh-current analysis; superposition; Thévenin and Norton equivalents; basic DC power and energy concepts; introduction to capacitors and inductors; first-order RC and RL circuit steady-state and transient analysis; modelling of physical systems using RL and RC circuits; introduction to magnetic circuits.

36153 Computer Systems

214 (15) Introduction to Computer Systems (3L, 2P, 1T)

Boolean algebra; combinational and sequential circuit analysis and design; state machines; central processing unit; assembler language programming.

Prerequisite modules:

- *Computer Programming 143; or*
- *Computer Science 114 and 144*

245 (15) Microprocessors (3L, 3P)

Microprocessor programming; basic microprocessor architecture; bus, memory and input-output systems.

Corequisite module:

- *Computer Systems 214*

46779 Systems and Signals

214 (15) Introduction to Systems and Signals (3L, 1P, 2T)

Sinusoidal steady-state analysis; phasors; sinusoidal power and energy concepts; transient and phasor analysis of second-order RLC circuits; instantaneous and average power; ideal operational amplifiers; two-port parameters.

Corequisite modules:

- *Electrotechnique 143*

244 (15) Frequency Domain Techniques (3L, 1,5P, 1,5T)

The Laplace transform and its application to dynamic circuits; impulse and step response; convolution; transfer functions; Bode plots; basic passive filters; basic active filters; Fourier series and its application to circuits; Fourier transform and its applications to circuits; filters.

Corequisite modules:

- *Electrotechnique 143*
- *Engineering Mathematics 214, 242*

46833 Design (E)

314 (15) Digital Design (1L, 3P)

Design philosophy; design techniques; milestones; data interpretation; development of simple software and hardware in order to demonstrate a small functional microprocessor system; debugging of digital circuits; report writing.

Corequisite module:

- *Computer Systems 245*

14019 Data Engineering

245 (12) Big Data Platforms (3L, 1P, 1T)

The various technologies and infrastructure required to support effective decision-making based on big data, including databases for big data, data warehouses, data platforms, data streams, data fusion and data visualisation.

Prerequisite module:

- *Computer Programming 143 or Computer Science 144*

314 (15) Data Engineering (3L, 1,5P, 1,5T)

Fundamentals of neural networks and their application in engineering problems. Limitations of neural networks. Feedforward neural networks, auto-encoders, convolutional neural networks and recurrent neural networks. A major design assignment that also involves experiments for validation, culminating in a report.

Prerequisite modules:

- *Engineering Mathematics 214*
- *Systems and Signals 344 or Mathematical Statistics 214.*

Faculty of Law

Department of Mercantile Law

14441 Intellectual Property Law for Science, Engineering and Technology

314 (16) Intellectual Property Law for Science, Engineering and Technology

The primary purpose of this module is to provide an overview of intellectual property law and business forms, focussing on the South African context, but with international awareness, and to equip students with the knowledge, specific skills, applied competence and insight into innovation management, IP protection and management thereof.

Faculty of Medicine and Health Sciences

Department of Biomedical Sciences, Division of Anatomy and Histology

12558 Anatomy

214 (16) Basic Anatomy of the Human Body (3L, 3P)

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.

Prerequisite modules:

- *Biology 124, 144 or 154*

244 (16) Basic Anatomy of the Human Body (3L, 3P)

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.

Prerequisite module:

- *Anatomy 214*

314 (16) Advanced Anatomy of the Human Body (3L, 3P)

Dissection-based study of the anatomy of the digestive, urogenital and endocrine systems. Textbook-based study of the organs of special sense, namely vision, hearing, posture and balance, taste, smell, proprioception and co-ordination.

Prerequisite modules:

- *Anatomy 214, 244*

324 (16) Applied Anatomy (4T)

An e-learning based study of applied anatomy topics, mainly of the nervous and musculoskeletal systems of the human body.

Prerequisite modules:

- *Anatomy 214, 244*

344 (16) Advanced Anatomy of the Human Body (3L, 3P)

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.

Prerequisite modules:

- *Anatomy 214, 244, 314*

364 (16) Clinical Anatomy (4T)

An e-learning based study of aspects of clinical anatomy, mainly of the nervous and musculoskeletal systems of the human body.

Prerequisite modules:

- *Anatomy 214, 244*

Department of Exercise, Sport and Lifestyle Medicine

54429 Applied Kinesiology

313 (12) Coaching Strategies (2L, 2P)

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.

Prerequisite pass module:

- *Kinesiology 182*

314 (12) Scientific Base of the Fitness Industry (2L, 2P)

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)

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.

344 (12) Sport and Recreation for Persons with Disabilities (2L, 2P)

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)

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.

353 (12) Scientific Base of Sport Coaching (2L, 2P)

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.

Prerequisite pass module:

- *Kinesiology 182*

19305 Kinesiology

162 (8) Anatomy (2L, 1P)

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)

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.

312 (8) Sport Injuries (2L)

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)

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)

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)

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)

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.

44229 Movement Education, Sport and Recreation

212 (8) Teaching and Programme Development (2L, 4P)

Teaching expertise, management skills and motivational strategies, design of physical activity programmes, planning and presenting teaching.

222 (8) Adapted movement programmes (2L)

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)

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)

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.

Prerequisite pass module:

- *Kinesiology 182*

54607 Sport Science

222 (8) Motor Learning (2L)

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)

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):

Prerequisite modules:

- *Physiology 114, 144*

252 (8) Sport Physiology (2L)

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):

Prerequisite modules:

- *Physiology 114, 144*

262 (8) Applied Biomechanics (2L, 1P)

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.

Prerequisite pass module:

- *Kinesiology 162*

382 (6) Professional Applications (2L, 2P)

Application of education and programme design; skills training and fitness development; alternative approaches to learning in physical activities; educational and career opportunities.

Division for Learning and Teaching Enhancement

SU Language Centre

(In consultation with the faculties of Science, and Arts and Social Sciences)

64866 Scientific Communication Skills

116 (12) Scientific Communication Skills (3L, 3T)

For students in the BSc (extended curriculum programmes). 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.

146 (6) Scientific Communication Skills (3L)

For BSc students in the BSc (extended curriculum programmes). 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.

5. Postgraduate module contents of specific postgraduate degree programmes

Department of Biochemistry

BScHons in Biochemistry

11412 – 711 (10) Practical Protein Biochemistry

Advanced protein purification and analytical techniques

This practical module focusses on the following techniques: chromatography, electrophoresis, protein and enzyme activity determinations, plasmid DNA preparation, restriction enzyme digestion, polymerase chain reaction, preparation of competent cells, transformation and heterologous protein expression. The module includes the theory and applications of protein purification techniques, as well as experimental data analysis. Knowledge gained will be transferred to Biochemistry 365 students during the June and September recess practicals, where the Honours students are required to assist with the presentation.

11413 – 712 (10) Steroid Hormones

Research approaches to investigate the mechanism of action of steroid hormones

Central to all biological and cellular events, including development, differentiation and response to extracellular and intracellular signals, is the cell's ability to regulate the expression of genes. Steroid hormones are essential constituents in the intercellular communication system that maintains homeostasis in higher organisms. The module, in the form of a workshop, involves the discussion and critical analysis of some of the theory and techniques used to study the transcriptional control of gene expression by steroid receptors in eukaryotes. Integration between the methods used to investigate the mechanism of action of steroid hormones and the theory behind steroid receptor dependent regulation of transcription will facilitate greater understanding of both processes as well as illustrating how theory and method are employed together to answer questions in science.

14046 – 713 (10) Soft Skills

Soft skills in the biochemical sciences

The aim of this module is to equip students with the diverse skills needed to present, communicate (both orally and in writing) and critically analyse research results in the diverse fields that encompass biochemical research. The three subcomponents (presentation skills, writing skills, and data analysis skills) of the module will each provide training in one of the central aspects of these skills, and will develop the student's abilities to function as a biochemical scientist in a range of environments.

11415 – 714 (10) Systems Biology

Computational and experimental systems biology

We discuss how networks of coupled enzyme-catalysed reactions work together as a system, the behaviour of different metabolic structures, the control of metabolism, and how this behaviour can be usefully described and studied using the framework of control analysis. Using a hands-on approach, students are introduced to kinetic modelling on the computer as a tool for studying the behaviour of metabolic pathways. Students are trained in collecting enzyme kinetic data and fitting these to a rate equation to obtain kinetic parameters for kinetic model construction.

14069 – 715 (10) Advanced Gene Expression

Control of gene expression of the immunoglobulin genes

In this module the complexities of the control of gene expression of the immunoglobulin genes of higher vertebrates will be studied as an example of eukaryotic gene expression. The theories and mechanisms giving rise to the generation of diversity of antibody binding sites, the mechanisms of class switching, the actual transcriptional control of gene expression particularly as influenced by antigen composition, and gene silencing mechanisms will be discussed.

14047– 716 (10) Biophysical and Bio-analytical Techniques

Analytical techniques for identification and quantification of biomolecules (e.g. advanced chromatography and mass spectrometry) are discussed. Students are introduced to biophysical techniques for structural analysis and characterisation of biomolecules (e.g. advanced mass spectrometry, fluorescence and circular dichroism), method development and validation, as well as data analysis and interpretation.

11418 – 717 (10) Specialised Topics

Specialised topic by visiting professor

A visiting professor presents a specialised topic of his or her choice. Details will be communicated to the students at the beginning of the semester.

11420 – 718 (10) Chemical Biology Topics

Selected topics in chemical biology

Chemical biology refers to research performed at the interface of chemistry and biology, and often entails the application of chemical knowledge (as it applies to molecules in regard to their reactivity and interactions) in answering questions, solving problems and developing tools relevant to metabolism and cell biology. In this module, students will be introduced to the approach and methods of chemical biology research, with the aim of developing an appreciation of how it can contribute to our understanding of living systems.

54895 – 741 (60) Research Project (Biochemistry)

The research project consists of the formulation of a hypothesis and writing of a research proposal, the design and execution of experiments, time management, analysis of results and the drawing of conclusions. The research results are reported in article format and presented as a short oral and poster.

18325 – 742 (10) Seminar

The seminar in biochemistry consists of a literature review on a selected biochemistry subject and a short oral presentation of the material. The written seminar typically has the format of a review article. The writing and presentation components of the Soft Skills module serve as basis for the writing and presentation of the seminar respectively.

Department of Botany and Zoology

BScHons in Biodiversity and Ecology

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) Plants and Animals in Extreme Environments

(3) Evolutionary Ecology of Plants and Animals

(4) Global Change Biology

More information on these topics can be found at academic.sun.ac.za/botzoo/.

Department of Chemistry and Polymer Science

BScHons in Chemistry

10382 – 711 (20) Analytical techniques

Molecular spectroscopy: NMR, IR, MS; separation science.

10638 – 712 (20) Organic chemistry

Modern synthetic methods.

10462 – 713 (20) Physical chemistry

Theoretical molecular models, applications of symmetry, advanced reaction kinetics.

10384 – 714 (20) 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

Special topics.

63258 – 744 (30) Research project in Chemistry

Research project in Chemistry.

BScHons in Polymer Science

10382 – 711 (20) Analytical techniques

Molecular spectroscopy: NMR, IR, MS; separation science.

10490 – 712 (20) Advanced Analytical Polymer Science

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 (30) Research Project in Polymer Science

A research project must be completed by the student (under supervision).

10658 – 724 (20) Polymer Chemistry

Structure/property relationships; polymer morphology; synthesis of polymers; degradation and stabilisation of polymer materials; inorganic polymers.

10463 – 744 (15) Physical Polymer Science

Phase diagrams; classification systems; crystallisation; morphology; flow; the glassy state; viscoelasticity; refraction; yield; fatigue; complex rheology; reinforcement; environmental stress resistance of polymers.

11421 – 754 (15) Special Topics in Polymer Science

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.

Department of Earth Sciences

BScHons in Earth Sciences

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 sedimentological and stratigraphic concepts and relationship to tectonic models. Includes two 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

Application of geochemical proxies for environmental processes; environmental sampling, analysis and interpretation of environmental datasets, hydrogeological concepts, use of isotope tracers to understand element movement in the regolith and water systems.

Department of Mathematical Sciences

Division: Computer Science

BScHons in Computer Science

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 a selection from: algorithm-design techniques, linear programming, approximation algorithms, randomised algorithms, probabilistic algorithms, parallel algorithms, number-theoretic algorithms, cryptanalysis, computational geometry, computational biology, network algorithms, and complexity theory.

64955 – 713 (16) Theoretical Computer Science

Advanced topics in formal languages and automata theory, including various models of computation and descriptional complexity.

Prerequisite pass module:

- *Computer Science 345 or Automata Theory and Applications 711*

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 optimisation, 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.

14530 – 711 (16) Computer Networks 1

Introduction to networks in general and the internet in particular. Architecture and protocols. Allocation of resources and congestion control. Network security, Network applications. Network research technique.

11788 – 741 (16) Machine Learning

This module is an introduction to selected topics in machine learning.

14195 – 742 (16) Machine Learning A

Prominent machine learning concepts and tasks. Selected feature extraction or dimensionality reduction techniques. Introduction to probabilistic modelling and latent variable models. Fundamental paradigms in parameter estimation.

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.

14232 – 791 (16) Artificial Intelligence

Introduction to a selection of topics in artificial intelligence and optimisation

Meta-heuristics. Swarm intelligence, including particle swarm optimisation and the ant colony meta-heuristic. Evolutionary computation, including genetic algorithms, genetic programming, evolutionary programming, evolutionary strategies, differential evolution, cultural algorithms, and coevolution. Hyper-heuristics. Fitness landscape analysis. Optimisation problems, including unconstrained, constrained, multi-objective, many-objective, dynamic, multi-modal and large-scale optimisation problems.

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.

13945 – 794 (16) Search and Planning

This module studies a selection of search and planning algorithms.

13944 – 795 (16) Functional Programming

This module gives an introduction to the functional programming paradigm.

14065 – 796 (16) Software Verification and Analysis

Introduction to various techniques for software quality management.

14066 – 791 (16) Space Science Algorithms

Algorithms and techniques in Space Science, with applications.

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.

13360 – 771 (12) Statistical Learning Theory

Module at honours level presented by the Faculty of Economic and Management Sciences, Department of Statistics and Actuarial Science.

13361 – 771 (12) Mathematical Statistics for Data Scientists

Module at honours level presented by the Faculty of Economic and Management Sciences, Department of Statistics and Actuarial Science.

58777 – 741 (12) Data Mining

Module at honours level presented by the Faculty of Economic and Management Sciences, Department of Statistics and Actuarial Science.

14531 – 771 (16) Principles of Data Science

The data science pipeline. Data retrieval and cleaning. Information retrieval. Data analysis. Data visualisation. Presentation and communication of data analysis results. Best practices in big data. Data ethics.

14533 – 771 (16) Computing and Society

Theory, domains and critique of topics relating to Computing and Society, such as human-centred computing; social development theories, critical analysis of case studies; methods and ethics; and challenges of sustainable community engagement.

Division: Applied Mathematics

MSc in Machine Learning and Artificial Intelligence

14398 – 814 (15) Applied Machine Learning at Scale

The module considers how machine learning is applied to internet-scale systems. Topics include A/B testing, ranking, recommender systems, modelling internet users and entities they engage with online, network effects, online advertising, and real-time auctions.

14396 – 813 (15) Foundations of Deep Learning

A recap of machine learning fundamentals, followed by topics specific to neural networks: multilayer perceptrons, deep feedforward neural networks, gradient-based training and backpropagation, convolutional neural networks, recurrent neural networks, attention mechanisms, auto-encoders, and deep generative models.

14394 – 811 (15) Mathematics for Machine Learning

A review of fundamental mathematical concepts necessary for graduate studies in machine learning and artificial intelligence. Concepts are drawn from linear algebra, multivariate calculus, optimisation, and statistics.

14395 – 812 (15) Probabilistic Modelling and reasoning

An introduction to probabilistic modelling and reasoning in the context of modern machine learning and artificial intelligence. Topics include sum-product decomposition, classic hidden Markov models, expectation maximisation, probabilistic graphical models, data completion, and the basics of information theory.

14399 – 885 (60) Research Project

An individual research project on an approved topic related to advanced machine learning and/or artificial intelligence, guided by an academic supervisor, that results in a high-quality conference or journal style paper and oral presentation.

62847 – 842 (10) Computer Vision

Convolution neural networks for image classification, with extensions like transfer learning and visual attention. Further computer vision tasks include object segmentation, colourisation, style transfer and automated image captioning. Variational auto-encoders and generative adversarial networks.

14401 – 817 (10) Natural Language Processing

Machine learning perspectives on the parsing, understanding and generation of natural human language. Topics include word embeddings and representations, part-of-speech tagging, topic modelling, machine translation with seq2seq models, sentence classification and sentiment analysis.

14402 – 818 (10) Reinforcement Learning and Planning

The module covers the basics of reinforcement learning (RL) and planning: decision and control theory, Markov decision processes, exploration, Q-learning and policy gradients, hierarchical RL, model-based RL, and multi-agent RL.

14403 – 819 (10) Sequence Modelling

Techniques to model and predict temporally varying data. Classical-state space models like hidden Markov models, recurrent neural networks and common modular ways to construct them (using e.g. long short-term memory), concurrent networks, and methods to combine the above.

14404 – 820 (10) Advanced Probabilistic Modelling

Approximate inference techniques for probabilistic graphical models, including belief propagation and variational inference. Bayesian non-parametric models, specifically Gaussian processes and Dirichlet processes. Common tricks in probabilistic modelling for machine learning, including collapsed Gibbs sampling.

14405 – 821 (10) Optimisation for Machine Learning

Applications of high-dimensional optimisation in machine learning, with topics including duality, Lagrange multipliers, quasi-Newton methods, stochastic and mini-batch gradient descent, Nesterov momentum, common practical stochastic methods, weight perturbation, conjugate exponential families and variational inference.

14406 – 822 (10) Monte Carlo Methods

Monte Carlo methods form a principal tool for statistical inference in machine learning. Topics include Metropolis-Hastings methods and various sampling strategies (Gibbs, importance, slice and exact), as well as inference techniques, annealing and thermodynamic integration.

14407 – 823 (10) Artificial Intelligence and the Brain

The module covers topics from neuroscience that have inspired AI research, from the point of view of mathematical modelling and algorithms. These include Hebbian learning, the canonical microcircuit, predictive coding, and dopamine-coded reward prediction. The module also covers the visual hierarchy as inspiration for computer vision, and the auditory processing system as inspiration for language and sequence modelling.

14408 – 824 (10) Advanced Topics in Machine Learning

The module is reserved for advanced topics in machine learning. Exact content is determined on a capita selecta basis

14409 – 825 (10) Advanced Topics in Artificial Intelligence

The module is reserved for advanced topics in artificial intelligence. Exact content is determined on a capita selecta basis

Department of Microbiology

BScHons in Microbiology

10439 – 772 (60) Experimental Microbiology

Research projects: Students are allocated to a research laboratory where they conduct an independent research project. Assessment is based on a research proposal, independent research in the laboratory and oral presentation of results.

Literature review: A written literature review and oral presentation on a Microbiology related topic.

Oral examination: General knowledge in Microbiology is assessed.

10721 – 773 (30) Techniques in Molecular Microbiology (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, DNA sequencing, isolation and analysis of gDNA, mRNA and proteins, construction of DNA libraries. General techniques such as confocal microscopy, bioinformatics and statistical analysis.

10483 – 774 (30) Selected Topics (3L, 4P)

Selected topics are presented as mini-modules by lecturers or visiting researchers. Topics such as genome dynamics, biology of yeasts, transcriptional control of eukaryotic genes, taxonomy of fungi and environmental microbiology are covered.

Department of Physics

BScHons in Physics

10445 – 711 (8) Electromagnetism (1.5L, 1.5P)

Electrostatics and magnetostatics applications to boundary value problems, multipole expansions, time-dependent fields, gauge transformations, absorption and dispersion of electromagnetic waves in different media, moving charges and 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 and charged particles with matter, isotope production with reactors and accelerators, nuclear fission as a source of radiation, lasers and microwaves as sources of radiation.

13948 – 719 (8) Relativistic Quantum Mechanics (1.5L, 1.5P)

Relativistic dispersion relations and quantum mechanics. Klein Gordon equation, Klein paradox. Dirac equation and spin. Covariance of the Dirac wave-function, chirality. Minimal coupling. Non-relativistic limit and Pauli equation. Relativistic treatment of the hydrogen atom. Maxwell equation as gauge theory. Radiation gauge.

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.

13940 – 742 (8) Special Topics in Applied Photonics (1.5L, 1.5P)

The content may include aspects of light-matter interaction, quantum mechanics and quantum optics, atomic, molecular, solid state, or plasma physics and experimental design. The content may be of interdisciplinary nature.

13939 – 743 (8) Special Topics in Biophotonics (1.5L, 1.5P)

The content may include aspects of light-matter interaction, quantum mechanics, topics from biology, chemistry or mathematical sciences, spectroscopic techniques, imaging and microscopy. The content will be of interdisciplinary nature.

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. Examples of applications of spectroscopic techniques.

13934 – 745 (8) Laser Technology (1.5L, 1.5P)

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. Resonator types and designs. Q-switching, gain switching, mode locking, single-mode operation, wavelength tuning. Current laser systems. Applications: Scientific, industrial, communications, medical, military.

13936 – 746 (8) Quantum Optics (1.5L, 1.5P)

Field quantisation and coherent states of light, atom-field interactions (classical and single photon interactions), classical and quantum coherence, non-classical states of light, theory of spontaneous emission, selected applications such as single photon experiments and cavity quantum electrodynamics and entanglement.

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 and high-energy nuclear reactions.

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).

13941 – 749 (8) Selected Topics in Nuclear Physics (1.5L, 1.5P)

A selection of topics from: nuclear and particle physics, radiation and health physics, quantum mechanics, statistical physics, data analysis or experimental techniques in nuclear physics.

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, Fluoroscopy, Mammography, Computed 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); variational principles and the Hartree-Fock approximation; screening and linear response; Bogoliubov transformations; superconductivity and magnetic flux quantisation.

10674 – 755 (16) Relativistic Quantum Field Theory (3L, 3P)

Module introduces quantum field theory.

Lagrange formalism in field theory and Noether currents. Covariant quantisation of Klein-Gordon and Dirac fields. Particle interpretation, spin and statistics. Functional calculus, Grassmann variables, functional integral quantisations of gauge theories. Perturbation theory and Feynman rules. Cross-sections and decay widths in particle physics. Effective Potentials. Regularisation and renormalisation. Asymptotic freedom in gauge theories.

13942 – 756 (8) Selected Topics in Theoretical Physics (1.5L, 1.5P)

A selection of topics from: cosmology, general relativity, quantum mechanics, statistical physics, biological physics, or condensed matter physics.

13985 – 757 (8) Bayesian Physics (1.5L, 1.5P)

Brief review of Bayesian probability basics. Conditional probability, product rule, Bayes' theorem. Important discrete and continuous distributions. Parameter estimation and model comparison relation to machine learning, application to data analysis. Symmetries, entropy and information gain. Varying additional topics depending on time available.

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: Modelling, continuous and discrete mappings, stability analysis, hierarchy of chaos, strange attractors, universality and Feigenbaum constants, Hamiltonian chaos, KAM theorem.

17221 – 772 (8) Optics (1.5L, 1.5P)

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. Diffraction theory. Fourier optics, diffractive optics.

13937 – 773 (8) Nonlinear Optics (1.5L, 1.5P)

Principles of non-linear optics. Non-linear polarisation, non-linear optical coefficients, harmonic generation and phase matching.

Anisotropy, optical modulation: Electro-optical, magneto-optical and acousto-optical modulation.

13938 – 774 (8) Special Topics in Optics (1.5L, 1.5P)

The content may include aspects of electromagnetism, optics and nonlinear optics, lasers, light-matter interaction, quantum optics and experimental design. The content may be of interdisciplinary nature.

MSc in Physics

66249 – 828 (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 – 838 (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.

Department of Physiological Sciences

BScHons in Physiological Sciences

13233 – 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.

13235 – 772 (20) Physiology and Pathophysiology

Advanced physiology and biochemistry including adaptive responses to physiological and environmental perturbations such as exercise, injury and hypoxia. A systems perspective in the context of neurodegeneration, with a focus on mitochondria and proteotoxicity as well as cardiotoxicity will be provided to integrate molecular mechanisms with cellular dysfunction.

13236 – 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 under 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).

13237 – 774 (20) Metabolism in Health and Disease

In-depth study of metabolism will be undertaken, using the body as unit model. Both molecular pathways and whole-body integrated physiology will be investigated in non-communicable diseases of lifestyle (diabetes, hypertension, dyslipidaemia, obesity).

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 (30) 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.

14067 – 780 (20) Haematology and coagulation

The structure and function of the haematological system will be discussed, with a particular focus on RBCs, platelets and plasma protein involvement in the coagulation system. Pathological changes to these cells and proteins will be covered, with special focus on changes during inflammation.

66192 – 781 (20) Research Methodology in Physiological Sciences

This module consists of three components: a theoretical introduction, followed by practical laboratory training and a practical project. The theoretical introduction discusses scientific method, laboratory layout and label, experimental design, methods of data collection, analysis and critical evaluation of data and research ethics (animal and human). General and technique-specific theoretical and practical laboratory training follows, with a focus on molecular, histological and tissue culture techniques, including a practical project where technique consolidation and data collection, analysis and the derivation of conclusions occurs.

MSc in Exercise Science

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.

13511 – 884 (20) Exercise Physiology and Metabolism

Exercise performance and metabolism responses to exercise at the whole-body level. Integration of exercise physiology and biochemical knowledge to understand metabolism at intermediary and tissue levels in response to acute exercise and adaptations to training, The scientific basis for the design of training programmes. Background to illicit anabolic steroids and various supplements and how to deal with these on a scientific basis.

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 Genetics

BScHons in Genetics

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.

13596 – 712 (8) Human and Animal Genetics

This module focuses on historical and current medical and ethical aspects of human and animal genetics in practice. By means of lectures, guest speakers and round-table discussions, etc. the latest technology, applications and consequences of genetics will be reviewed.

10478 – 713 (8) Genetic Data Analysis

The Genetic Data Analysis module is aimed at the application of population and quantitative genetics theory in the analysis and interpretation of molecular genetic data. Specific emphasis is placed on acquiring practical skills for the composition of genetic datasets, conducting appropriate statistical analyses for answering particular research questions, and the interpretation of results within a biologically relevant context. Examples are taken from a number of fields, including agricultural, conservation and medical genetics and used as a training model on a continuous basis.

11061 – 721 (8) Biometrical Applications and Data Analysis in R

Data processing and graphical procedures with R. Simple descriptive statistics; t-tests for single populations, independent sample t-tests and paired t-tests for two populations; analysis of variance: completely random design, random-blocks design, Latin-square design, cross-classification designs; repeated-measures analysis of variance; multiple-comparison procedures. Power analysis. Non-parametric tests: Mann-Whitney, Wilcoxon, Kruskal-Wallis and Friedman; linear regression and correlation; polynomial regression, multiple regression; selection of independent variables with stepwise regression and all-subset regression; covariance analysis; categorical data analyses (Chi-squared tests); logistic regression. This module is presented in two blocks of five half days each in the first semester.

Students with different undergraduate Statistics modules must obtain at least 50% for an admission examination.

Prerequisite modules:

- *Biometry 212 and 242 or 211*

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.

13594 – 716 (8) Genomics

A good understanding of the genome, as well as the effective analysis thereof, is a prerequisite to succeed in plant, microbe and animal improvement, especially considering matters associated with the complexity of 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.

13538 – 721 (8) Scientific and Proposal Writing

This module is aimed at introducing genetics and biotechnology students to the non-biological aspects of scientific research, such as the development of a funding proposal and the art of scientific writing. Students will also 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, good laboratory practice, quality control and project management in a research environment.

13537 – 722 (8) Plant Genetics and Crop Improvement

Plant breeding objectives; reproduction in plants; cell and tissue culture; breeding strategies for self- and cross-pollinating crops; the utilisation of hybrid vigour; mutation breeding; breeding for insect and disease resistance; variations in chromosome number and its exploitation in breeding programmes; plant breeders' rights.

BScHons in Plant Biotechnology

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.

13537 – 722 (8) Plant Genetics and Crop Improvement

Plant-breeding objectives; reproduction in plants; cell and tissue culture; breeding strategies for self- and cross-pollinating crops; the utilisation of hybrid vigour; mutation breeding; breeding for insect and disease

resistance; variations in chromosome number and its exploitation in breeding programmes; plant breeders' rights.

12582 – 790 (64) Research Module in Plant Biotechnology

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.

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 plant nutrition and water uptake and their relation to crop productivity, whereas the second part deals with hormonal and signalling 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.

11061 – 721 (8) Biometrical Applications and Data Analysis in R

Data processing and graphical procedures with R. Simple descriptive statistics; t-tests for single populations, independent sample t-tests and paired t-tests for two populations; analysis of variance: completely random design, random-blocks design, Latin-square design, cross-classification designs; repeated-measures analysis of variance; multiple-comparison procedures. Power analysis. Non-parametric tests: Mann-Whitney, Wilcoxon, Kruskal-Wallis and Friedman; linear regression and correlation; polynomial regression, multiple regression; selection of independent variables with stepwise regression and all-subset regression; covariance analysis; categorical data analyses (Chi-squared tests); logistic regression. This module is presented in two blocks of five half days each in the first semester.

Prerequisite modules:

- *Biometry 212 and 242 or 211*

Students with different undergraduate Statistics modules must obtain at least 50% for an admission examination.

13594 – 716 (8) Genomics

A good understanding of the genome, as well as the effective analysis thereof, is a prerequisite to succeed in plant, microbe and animal improvement, especially considering matters associated with the complexity of 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.

13538 – 721 (8) Scientific and Proposal Writing

This module is aimed at introducing genetics and biotechnology students to the non-biological aspects of scientific research, such as the development of a funding proposal and the art of scientific writing. Students will also 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, good laboratory practice, quality control and project management in a research environment.

Faculty of Arts and Social Sciences

Department of Geography and Environmental Studies

BScHons in GeoInformatics

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.

Prerequisite pass module:

- *Geographical Information Technology 214 or 241*

12187 – 716 (30) Spatial Modelling and Geographical Communication

Application and development of spatial models through the use of geographical information systems.

Prerequisite pass modules:

- *Geographical Information Technology 341*
- *Computer Science 114 or Socio-informatics 224 or Socio-informatics 254*

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.

63398 – 712 (30) Advanced Remote Sensing

Characteristics and use of the salient hyperspectral data sources and radar 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, ENVI, Erdas, PCI).

Prerequisite pass module:

- *Geographical Information Technology 342*

BScHons in Geography and Environmental Sciences

63371 – 711 (30) Environmental Analysis and Synthesis

This module provides students with an introduction to systems thinking. Instead of studying and analysing environmental and social systems individually in this module, it is acknowledged that interactions and interconnections are embedded here. Throughout the module, we refer back to the question: "How can a systems perspective help us understand the geographic, environmental and social character of the world we live in?" Students are introduced to and explore a range of weekly themes (and case studies, where applicable) with the aim to analyse complex social ecological systems, identify contesting perspectives and interests embedded in such systems, and how this relates to social and environmental change. Environmental decision-making (and its associated processes and tools) and governance are explored, as well as environmental and social justice issues.

Prerequisite pass module:

- *Geography and Environmental Studies 344 or 358 or 334*

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 programme of reporting to a departmental panel and student peers.

14259 – 771 (30) Applications in Geomorphology

The focus of this module is to develop an understanding of the primary geomorphic processes and the associated landscape patterns and features that occur in dryland fluvial environments. The module integrates fluvial geomorphology and wetland science literature to provide a holistic understanding of biophysical processes that typically occur along drainage lines in dryland regions. During the module, students will critically engage with literature from the temperate latitudes of the globe, and probe its applicability in the semi-arid subtropics.

Prerequisite module:

- *Geography and Environmental Science 334 or 358*

Research centres, bureaus and institutes

In this chapter the research and service bodies that reside at the Faculty of Science are presented.

1. Centre for Bioinformatics and Computational Biology

History

The Centre for Bioinformatics and Computational Biology (CBCB) was established in 2017 to promote and develop bioinformatics and computational biology as a field at Stellenbosch University. The CBCB comprises members with expertise in bioinformatics from three faculties and diverse departments, including Biochemistry, Genetics, Microbiology, and Human Genetics and Molecular Biology, and also the South African Grape and Wine Sciences Research Institute (SAGWRI) at Stellenbosch University. The CBCB teaches modules in the undergraduate Interdisciplinary BSc (focal area Bioinformatics and Computational Biology), and administers the BScHons, MSc and PhD degrees in bioinformatics and computational biology.

Objectives

The CBCB provides a critical mass of expertise in a nurturing environment that advances bioinformatics and computational biology at Stellenbosch University. We also conduct novel and innovative research in bioinformatics, including the development of resources and tools to pursue important questions in molecular life sciences and biology, thereby contributing to a deeper understanding of the chemistry of life, and advancing human, plant and animal health and human quality of life. The Centre also trains students in the discipline of bioinformatics and computational biology and prepares them for careers as bioinformaticians and computational biologists. The CBCB collaborates with national and international, including African, training and research networks.

Contact details

For more information, visit www.sun.ac.za/sci-bioinformatics or contact Prof Hugh Patterton at hpatterton@sun.ac.za or 021 808 2774.

2. Laser Research Institute

History

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 state-of-the-art laser facilities and is involved in world-class research projects. There is 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.

Objectives

The Institute 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 consist of various modules in physics, as well as a selection from chemistry, biological sciences, mathematics, applied mathematics and computer science. The BScHons year is devoted to several modules specific to the field of laser physics, as well as a practical laser project.

The Institute's excellence is due to the research conducted by MSc and PhD students making use of the excellent facilities and supervision. The Institute hosts two research chairs, the DSI-SARChI Chair in Photonics, Ultrafast and Ultra-intense Laser Science and the CSIR Research Chair in Quantum, Optical and Atomic Physics. Projects range from basic research funded by the National Research Foundation and the CSIR National Laser Centre, to applied research funded by private sector companies. Generous bursaries are available for MSc and PhD students in the fields of laser spectroscopy, femtosecond laser applications, laser beam shaping, quantum information science and nanophotonics, 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 BSc studies.

Contact details

For more information, visit www.laser-research.co.za or contact Dr Pieter Neethling at pietern@sun.ac.za or 021 808 3365.

3. South African Centre for Epidemiological Modelling and Analysis

History

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 Innovation (DSI) and the National Research Foundation (NRF) in South Africa. The Centre is situated at Stellenbosch University.

Objectives

SACEMA's vision is to improve health in Africa, and particularly South Africa, through epidemiological modelling and analysis. Trained in mathematics, biology, physics, economics, statistics, and epidemiology, SACEMA's researchers bridge disciplines to understand disease dynamics and improve real-world outcomes.

Contact details

For more information, visit www.sacema.org or contact Prof Juliet Pulliam at pulliam@sun.ac.za or 021 808 2786.

4. Stellenbosch University Water Institute

History

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.

Objectives

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.

Contact details

For more information, visit www.sun.ac.za/water or contact Prof Gideon Wolfaardt at gmw@sun.ac.za or 021 808 3039.

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Appendix 1

The minimum programme specific admission requirements for mainstream programmes for applicants with school-leaving qualifications other than the National Senior Certificate (NSC) and the Independent Examination Board school-leaving certificate (IEB)

(International school-leaving qualifications have to meet the requirements for university exemption as determined by the Matriculation Board, Universities South Africa)

International qualifications	Minimum admission requirements
An average performance level of at least 65% A performance level of at least 50% in Afrikaans or English	
HIGCSE and Namibian NSSC	
If you take Physics or Chemistry as university subjects: Physical Sciences OR Natural Sciences OR Chemistry AND Physics If you take Mathematics 114, 144 and Physics 114, 144: Mathematics If you take Mathematics (Bio) 124 and Physics (Bio) 134, 154: Mathematics	 3 2 3
AS level	
If you take Physics or Chemistry as university subjects: Physical Sciences OR Natural Sciences OR Chemistry AND Physics If you take Mathematics 114, 144 and Physics 114, 144: Mathematics If you take Mathematics (Bio) 124 and Physics (Bio) 134, 154: Mathematics	 D B C
A level	
If you take Physics or Chemistry as university subjects: Physical Sciences OR Natural Sciences OR Chemistry AND Physics If you take Mathematics 114, 144 and Physics 114, 144: Mathematics If you take Mathematics (Bio) 124 and Physics (Bio) 134, 154: Mathematics	 E D E
IB HL	
If you take Physics or Chemistry as university subjects: Physical Sciences OR Chemistry AND Physics If you take Mathematics 114, 144 and Physics 114, 144: Mathematics If you take Mathematics (Bio) 124 and Physics (Bio) 134, 154: Mathematics	 2 4 3

IB SL	
If you take Physics or Chemistry as university subjects:	
Physical Sciences OR Chemistry AND Physics	2
If you take Mathematics 114, 144 and Physics 114, 144:	
Mathematics	5
If you take Mathematics (Bio) 124 and Physics (Bio) 134, 154:	
Mathematics	4

1. Mathematics, Chemistry and Physics on IGSCE/GCSE/NSSC OL Gr 11 level does **not** qualify for admission.
2. Contact the Stellenbosch University International Services Centre (SUI) at interoff@sun.ac.za or +2721 808 2565 for the minimum admission requirements for school leaving qualifications not listed in the table above.

School of Tomorrow*

Programmes	Admission requirements	National Benchmark Tests
All programmes	As for NSC/IEB	Academic Literacy 60 Quantitative Literacy 60 Mathematics 55

* As applicant from the "School of Tomorrow" school system you can only obtain a university exemption certificate on recommendation of the Faculty of Science. Your selection is thus dependent on meeting the programme specific admission requirements, as well as performance in the National Benchmark Tests (unless you sit the NSC exams in which case these results will apply).

Appendix 2

Minimum admission requirements for the BSc (extended curriculum programmes)

An applicant who accepted a conditional offer for a programme in the Faculty of Science, but whose school-leaving results do not meet the minimum admission requirements of that programme, may be considered for an extended curriculum programme; provided that the applicant:

- has not been registered previously at Stellenbosch University or at any other higher education institution; and
- complies with the socio-economic status (SES) requirements of the University's Admission Policy; and
- falls into one of the following categories:

Programmes	**Minimum admission requirements – National Senior Certificate (NSC) and International Examination Board (IEB)**					
	A final mark of at least 4 (50%) in Afrikaans or English (Home Language or First Additional Language) AND Comply with one of the following three combinations:					
	Combination 1 minimum requirements		Combination 2 minimum requirements		Combination 3 minimum requirements	
Biological Sciences	Mathematics	5 (≥60%)	Mathematics	≥55%	Mathematics	5 (≥60%)
	Physical Science	4 (≥50%)	Physical Science	4 (≥50%)	Physical Science	≥45%
	Average (without LO*)	≥60%	Average (without LO*)	≥65%	Average (without LO*)	≥65%
Physical and Mathematical Sciences	Mathematics	6 (≥70%)	Mathematics	≥65%	Mathematics	6 (≥70%)
	Physical Science	4 (≥50%)	Physical Science	4 (≥50%)	Physical Science	≥45%
	Average (without LO*)	≥60%	Average (without LO*)	≥65%	Average (without LO*)	≥65%

*Life Orientation