**Postal Address:** University of Cape Town  
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7701 RONDEBOSCH

**Dean's & Faculty Offices:** Chris Hani Building  
University Avenue North Road  
Upper Campus

**Office Hours:** Mondays to Fridays: 08h30 - 16h30

**Telephones:**  
Dean's Office (021) 650 2711  
Faculty Office (021) 650 2712  
Accounts and Fees (021) 650 4076/2134  
Admissions (021) 650 2128

**Internet:**  
UCT's Home Page [http://www.uct.ac.za](http://www.uct.ac.za)  
Science Home Page [http://www.science.uct.ac.za](http://www.science.uct.ac.za)  
Dean's Office sci-science@uct.ac.za  
Faculty Office iapo@uct.ac.za

The Admissions Office and Student Records Office are located in the Masingene Building, Middle Campus, and are open from 08h30 to 16h30. The Cashier's Office is located in Kramer Building, Middle Campus, and is open from 09h00 to 15h30.

**This handbook is part of a series that consists of**

- **Book 1:** Undergraduate Prospectus  
- **Book 2:** Authorities and information of record  
- **Book 3:** General Rules and Policies  
- **Book 4:** Academic Calendar and Meetings  
- **Book 5:** Student Support and Services  
- **Book 6-11:** Handbooks of the Faculties of Commerce, Engineering & the Built Environment, Health Sciences, Humanities, Law, Science  
- **Book 12:** Student Fees  
- **Book 13:** Bursary and Loan Opportunities for Undergraduate Study  
- **Book 14:** Financial assistance for Postgraduate Study and Postdoctoral Research
SCIENCE FACULTY GENERAL CODE OF CONDUCT

In keeping with UCT policy, the Science Faculty is dedicated to providing an environment that is inclusive and free of discrimination, violence, bullying and harassment for everyone, regardless of gender, race, sexual orientation, disability, country of origin, physical appearance, age, mental or physical health, HIV-status, political opinion or religion. We do not tolerate discrimination, violence, bullying and harassment, in any form, towards our academic and PASS staff, postdocs, students or visitors.

All communication should be professional and appropriate. This applies to general conduct in the Faculty, but also presentations and posters at conferences and in meetings, in laboratories, and in the field. Sexist, racist, and other exclusionary imagery and language – including “jokes” – are not appropriate and will not be tolerated.

Violations of this code may be reported to staff within individual departments, and/or the Faculty, and/or the UCT Office for Inclusivity and Change, which could lead to possible disciplinary actions. In those cases the UCT Office for Inclusivity and Change (OIC) will hear both parties involved on the shortest possible notice. Based on the outcome, further actions may be taken.

UCT Transformation plans and policies, including a statement of values, plans and policies around employment equity, anti-discrimination and inclusivity, can be found here:

https://www.uct.ac.za/main/explore-uct/transformacion/plans-policies

The Science Faculty is mindful of the wide range of cultural backgrounds and expectations held by our academic and PASS staff, postdocs, students and visitors. Anyone who is uncertain about what is deemed appropriate behaviour should visit the above website and the resources and links therein.

The University has made every effort to ensure the accuracy of the information in its handbooks. However, we reserve the right at any time, if circumstances dictate (for example, if there are not sufficient students registered), to

(i) make alterations or changes to any of the published details of the opportunities on offer; or
(ii) add to or withdraw any of the opportunities on offer.

Our students are given every assurance that changes to opportunities will only be made under compelling circumstances and students will be fully informed as soon as possible.
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GUIDE TO THE USE OF THIS HANDBOOK

The following is a general overview of the structure of this Handbook for the guidance of users. The contents are organised in a number of different sections (see below) each of which has a particular focus. The sections are interlinked by cross-references where relevant.

(a) **General Information:** This section includes information on the offices and staff in the Faculty with whom students may interact in the course of their studies, as well as explanatory notes on the course code system, terminology, term dates, etc.

(b) **Degrees:** This section lists the qualifications offered by the Faculty, as well as defining the rules for each of the various degrees. These rules should be read in conjunction with the general University rules in the General Rules & Policies Handbook (Handbook 3). Students are expected to acquaint themselves with the rules in both Handbooks and to check annually whether the rules or curriculum requirements have changed since the last edition.

The compulsory courses to be included in the curriculum of each undergraduate major offered in the Faculty are listed in this section.

The areas of study or disciplines for postgraduate studies are included in the postgraduate degrees section.

(c) **Departments and Courses Offered:** This section contains entries for each department in the Faculty. Each section lists members of staff, the research areas and units and details of the courses offered and administered by each department. The detailed course information must be read together with the curriculum and degree information as noted above in section (b).

(d) **Schedule of Courses:** The full list of undergraduate courses offered by the Faculty is set out in this section in alpha-numeric order (i.e. based on the course code prefix) and includes lecture, practical and tutorial times together with course entry requirements for some courses.

Another list groups courses by the semester and lecture period in which it is offered.

(e) **Additional Information:** This section is at the back of this Handbook and includes lists of staff who are Fellows and Distinguished Teachers in the Faculty, as well as the various student prizes, class medals and scholarships awarded on academic merit and contains information on the criteria for the Dean's Merit List.
## Officers in the Faculty

**Dean of the Faculty of Science:**
Professor M F Ramutsindela, MA *UNIN* PhD *London*
Chris Hani Building
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**Deputy Dean, Transformation:**
To be advised

**Deputy Dean, Undergraduate Studies:**
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**Deputy Dean, Postgraduate Studies & Research:**
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Senior Student Advisors in the Faculty

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Chemical, Molecular & Cellular Sciences  
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8 GENERAL INFORMATION

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neill.robertson@uct.ac.za

Departments in the Faculty

<table>
<thead>
<tr>
<th>Department</th>
<th>Location:</th>
<th>Telephone:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeology</td>
<td>Beattie Building</td>
<td>(021) 650 2353</td>
</tr>
<tr>
<td>Astronomy</td>
<td>R W James Building</td>
<td>(021) 650 5830</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>H W Pearson Building &amp; J Day Building</td>
<td>(021) 650 3603</td>
</tr>
<tr>
<td>Chemistry</td>
<td>P D Hahn Building</td>
<td>(021) 650 2525</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Computer Science Building</td>
<td>(021) 650 2663</td>
</tr>
<tr>
<td>Environmental &amp; Geographical Science</td>
<td>EGS Building</td>
<td>(021) 650 2874</td>
</tr>
<tr>
<td>Geological Sciences</td>
<td>Geological Sciences Building</td>
<td>(021) 650 2931</td>
</tr>
<tr>
<td>Human Biology (Faculty of Health Sciences)</td>
<td>Anatomy Building, Health Sciences campus</td>
<td>(021) 406 6235</td>
</tr>
<tr>
<td>Mathematics &amp; Applied Mathematics</td>
<td>Mathematics Building</td>
<td>(021) 650 3191</td>
</tr>
<tr>
<td>Molecular &amp; Cell Biology</td>
<td>Molecular Biology Building</td>
<td>(021) 650 3270</td>
</tr>
<tr>
<td>Oceanography</td>
<td>R W James Building</td>
<td>(021) 650 3277</td>
</tr>
<tr>
<td>Physics</td>
<td>R W James Building</td>
<td>(021) 650 3326</td>
</tr>
<tr>
<td>Statistical Sciences</td>
<td>P D Hahn Building</td>
<td>(021) 650 3219</td>
</tr>
</tbody>
</table>
Administrative offices dealing with student matters

Query: Academic transcripts/degree certificates, deferred examinations
Whom to approach: Student Records Office, Masingene Building, Middle Campus
Telephone: (021) 650 3595

Query: Admission queries, curriculum matters, registration issues
Whom to approach: Academic Administration, Science Faculty Office, Room 6.54, P D Hahn Building
Telephone: (021) 650 3023

Query: Fee problems/accounts
Whom to approach: Central Fees Office, Kramer Law Building
Telephone: (021) 650 2142

Query: Fee payments
Whom to approach: Cashier’s Office, Kramer Law Building
Telephone: (021) 650 2207/2146

Query: Financial assistance
Whom to approach: Student Financial Aid Office, Kramer Law Building
Telephone: (021) 650 2125

Query: Computer laboratory queries
Whom to approach: P D Hahn extension, Scilab D
Telephone: (021) 650 4772

Faculty Student Councils
The Science Students’ Council (SSC) and the Science Postgraduate Students’ Council (SPGSC) form an important part of the Governance and Committee structures in the Faculty of Science (see booklet "Faculty of Science, Governance and Committees").

Undergraduates:
The Science Students’ Council (SSC) is elected annually by the undergraduate students in the Faculty of Science. The SSC office is located in the P D Hahn Building, Level 6, Room 6.76.1 and may be contacted via email: SSC@myuct.ac.za.

Postgraduates:
The Science Postgraduate Students’ Council (SPGSC) is elected by the postgraduate students in the Faculty of Science. The SPSC represents the postgraduate students on the executive committee of the University Postgraduate Students’ Council. The Chairperson of the SPGSC may be contacted via email: sciencepgsc@gmail.com.

The Postgraduate Centre is housed in the Otto Beit Building, Upper Campus. This state-of-the-art facility houses the executive committee of the Postgraduate Students Council (PSC) as well as the Postgraduate Funding Office. The centre is equipped with IT facilities and includes a seminar room. This facility is open to all Master’s and Doctoral students as well as postdoctoral research fellows. Postgraduates are encouraged to make full use of this centre, in particular, the Funding Office, which administers all postgraduate bursaries and scholarships. The Postgraduate Centre may be contacted at gradcentre@uct.ac.za.

Term dates for 2022
Please refer to the website: http://www.staff.uct.ac.za/staff/calendar/terms

Explanatory Notes on Course Codes
The curriculum for the Bachelor’s degree in the Faculty of Science is based on a semester system, where a semester course is equivalent to a half-year of academic study. Courses for the Bachelor’s degree may be completed in one semester (i.e. a "half-course") or over two semesters (ie. a "full-course"). In this respect, the following codes are used:
F first-semester half-course
S second-semester half-course
H half-course taught over the whole year*
W full-course taught over the whole year
X special allocation
Z any other combination

* H courses in the EDP may be of the "intensive type" ie: half credit but full contact time over the whole year.

Summer/Winter Term courses:
P November
   — December
L June
   — July

**CEM1000W** Chemistry 1000
CEM designates a Chemistry course
1 designates a first-year course
000 serves to distinguish this from other first-year Chemistry courses
W designates a full-course taught over the whole year

**BIO3002F** Marine Ecosystems
BIO designates a Biology course
3 designates a third-year course
002 serves to distinguish this from other third-year Biology courses
F designates a first-semester course.

**NOTE:** second-year and third-year courses are usually regarded as 'senior courses' in terms of meeting the curriculum requirements for the Bachelor’s degree in the Faculty of Science.

**Essential Terminology**

**Pre-requisite courses**
Most courses at UCT (except some first-year courses) require prior knowledge either in the same discipline or in other disciplines. The courses which are required to be completed prior to taking another course are called pre-requisites. The concepts and knowledge learnt in these previous courses needs to be applied in the later course; i.e. a pre-requisite is the foundation upon which the later course is built. Pre-requisite rules will be applied consistently because not to do so will jeopardise your chances of success.

**Co-requisite courses**
Some courses have particular courses as co-requisites, which means that students need to register for two or more courses at the same time. Where a course has a co-requisite of another course, it implies that the courses integrate closely with each other, and it is essential to learn and apply the concepts in both courses at the same time.

**Classification of results - Refer to General Rules G26**
**DP (Duly Performed certificate) and DPR (Duly Performed certificate Refused) - Refer to General Rules GB9**
Academic departments at UCT support continuous learning and assessment. This means that you will be required to engage with the coursework and perform consistently well from the beginning of the course. This will earn you the right to attempt the final assessment – the examination. Earning this right is called being given a DP (Duly Performed Certificate). If you have not attended lectures, practicals and tutorials, or missed a test without being excused, or do not achieve the sub-minimum
mark (see below) for the coursework, you will be refused this Duly Performed certificate (DPR) and you will not be eligible to sit the examination. Check the DP requirements carefully in each course to make sure that you comply.

**Sub-minimum**
Many courses will require you to achieve a sub-minimum mark in your coursework and/or the final examination. This means that if you do not achieve this sub-minimum mark you will not be awarded a DP (if you fail to meet the sub-minimum in your coursework) or a F (Fail) if you do not get the sub-minimum in the final examination. Check the rules for your course in the Faculty Handbook to see whether there is a sub-minimum.

**Progression status**
At the end of every year, after the November examination period, the Faculty Examinations Committee (FEC) provides every student in the faculty with a progression status which is reflected on the student’s academic transcript. The purpose of this code is to describe accurately the student’s academic status in the faculty.

*One of the following descriptions will appear on the transcript:*
- Academically eligible to continue - may return the next year
- Concession (FEC) to continue - may return the next year, but with specific conditions
- Concession (FEC) to change field/specialisation/degree within Faculty - may return the next year but in a different field of study
- Status pending FEC decision - status dependent on further information and final decision
- Academically not eligible to continue - may not return the next year
- Status pending: continue if SUPP/DE exams passed - may return conditional on passing SUPP/DE
- Qualifies for award of degree/diploma - have met all the requirements for the award of degree
- Qualification depends on supp/DE results - award of degree conditional on passing SUPP/DE

**Supplementary examinations**
*Refer to this Handbook Rule FB4.1-4.2 and General Rules G23*

**Deferred examinations**
*Refer to General Rules G27 & 28*
DEGREES OFFERED IN THE FACULTY

This is to confirm that by virtue of inclusion on the Institution's DHET approved Programme and Qualification Mix (PQM), all qualifications listed below are accredited by the Council on Higher Education's permanent sub-committee - the Higher Education Quality Committee. Where a SAQA ID is not listed, the qualification is awaiting the issue of this number. The higher education sector has undergone an extensive alignment to the Higher Education Qualification sub Framework and thus all institutions are awaiting the finalisation of the process and completion of the awarding of SAQA ID’s.

Please consult Handbook 2 or the HEQsF Programme and Qualification Mix (PQM) on the Institutional Planning Department's website, as approved by the Department of Higher Education and Training, for a list of all UCT's accredited qualifications.

i) Bachelor of Science (BSc) degree [SAQA ID 117697]
ii) Bachelor of Science Honours (BSc Hons) degree [SAQA ID 116322]
iii) Master of Science (MSc) degree [SAQA ID 116422]
iv) Master of Philosophy (MPhil) degree
v) Doctor of Philosophy (PhD) degree
vi) Doctor of Science (DSc) degree [SAQA ID 19751]

Rules for Degrees in the Faculty

The following rules are specific to the Faculty of Science. They must be read in conjunction with the general University rules (G and GB) for degrees and diplomas in Book 3 of this series.

General Rules for Bachelor of Science (BSc) degree

FB1 Except by permission of Senate, all students registered in the Faculty of Science will be subject to the general rules of either the BSc degree or the BSc Extended Degree Programme, and the associated curricular rules for majors.

Duration of the Bachelor of Science degree

FB2.1 The curriculum for the Bachelor of Science degree shall extend over not less than three academic years of study.

FB2.2 The curriculum which includes the Extended Degree Programme for Science (EDP) will usually extend over four academic years of study.

FB2.3 Continuation on the three year BSc degree curriculum, or placement on the EDP, will be based on level of performance in a set of tests at the end of the first quarter, together with other information such as the NBT and NSC results, and one-on-one consultations with Student Academic Advisors.

NOTE: At the discretion of the Dean, the Faculty may admit candidates for the BSc degree who, due to special circumstances, are unable to study on a full-time basis. Students would complete the degree over an extended period of time by taking a reduced number of courses each year, but would attend normal lectures and practicals as scheduled in the University timetable. All enquiries should be directed to the Faculty Manager (Academic).
Restriction on registration and examination

FB3 A student shall not register for more than:
(a) the equivalent of four half-courses in each semester in the first academic year of study;
(b) the equivalent of three half-courses in each semester in any other year of study.
This restriction also applies to the number of courses for which a student may be examined.

Policy
Permission of Senate to waive these restrictions will only be considered under the following circumstances:
(a) where a student registering for the first time for the first year of a BSc degree has achieved outstanding results in all NSC subjects;
(b) where a student who has been registered for the BSc degree for at least one semester has obtained an average of 50% or more in all courses written in the most recent set of ordinary examinations and/or tests, (i.e. in June or November)

Note: Waivers to students who satisfy either of the above will depend on an assessment by a Student Adviser or Deputy Dean, on the merits of each individual case.

Supplementary examinations

First-year students

FB4.1 The Senate may permit a first-year student who has registered for a Bachelor’s degree in the Faculty of Science, and who has failed the ordinary examination in one or more courses, to write supplementary examinations in a maximum of three full-year courses or the equivalent.

Policy and guidelines:
(a) A supplementary examination may (not will) be awarded to a student who has obtained marks from 45% to 49% in a first-year course in any Science Faculty department.
(b) A supplementary examination may be awarded to a student who has obtained marks from 40% to 49% in first-year courses in Mathematics, except for MAM1000W, MAM1019H, MAM1043H, MAM1044H and all MAM courses offered to other faculties, where the conditions in (a) above apply.
(c) A department (other than Mathematics - see (b)) may recommend the award of a supplementary examination to a student who has obtained marks from 40% to 44% in a first-year course provided that the Head of the Department submits a written recommendation and motivation to reach the Dean before the meeting of the Faculty Examinations Committee.
(d) Where a student is awarded supplementary examinations in more than three full-year courses or the equivalent, the student must choose which supplementary examinations to write in terms of the restriction detailed in FB4.1 above.
Students other than first-year students

FB4.2 The Senate may permit a student other than a first-year student to write supplementary examinations in a maximum of two full-year courses or the equivalent, only one of which may be a third-year course.

Policy and guidelines:
(a) Departments will act according to guidelines (a), (b) and (c) listed under FB4.1 in respect of first-year courses.
(b) A supplementary examination in a senior course may be awarded if the mark obtained is at least 45% and if the department concerned recommends it.
(c) A finalist who has obtained marks from 40% to 44% in any course, which is the only credit outstanding for the award of the degree, may be awarded a supplementary examination if the department concerned recommends it.
(d) Where a student is awarded supplementary examinations in more than two full-year courses or the equivalent, or more than one full-year third-year course or the equivalent, the student must choose which supplementary examinations to write in terms of the restriction detailed in FB4.2 above.

FB4.3 The decision on whether or not to award a supplementary examination, in accordance with the policies outlined above, shall be taken by the Senate on the recommendation of the Head of the Department concerned and be based on the student's academic performance in the course concerned, except that the Senate may decide to award, or refuse to award, a supplementary examination in a course or courses taking account of the student's overall academic record.

Refusal of readmission to the Faculty and related matters

Bachelor of Science degree (excluding EDP)

FB5.1 Except by permission of Senate, a student who has registered for the Bachelor of Science degree, shall not be permitted to reregister in the Faculty unless the student has completed:
(a) by the end of the first year of registration, one and a half courses or the equivalent, specific to a major;
(b) by the end of the second year of registration, three and a half courses or the equivalent, including all required first-year courses;
(c) by the end of the third year of registration, five and a half courses or equivalent, including one and a half senior courses;
(d) by the end of the fourth year of registration, seven and a half courses, including the equivalent of three full-year senior courses;
(e) by the end of the fifth year of registration, students are expected to complete all the requirements of the degree.
Extended Degree Programme (EDP)

Except by permission of Senate, a student who is registered on the EDP shall not be permitted to reregister in the Faculty unless the student has completed:

(a) by the end of the first year of registration, one full-year course, or the equivalent in half courses;
(b) by the end of the second year of registration, three full-year courses or the equivalent, including two and a half courses specific to the majors;
(c) by the end of the third year of registration, five full-year courses or the equivalent, of which at least one shall be a senior course;
(d) by the end of the fourth year of registration, seven full-year courses, of which at least two and a half shall be senior courses.
(e) by the end of the fifth year of registration, students are expected to complete all the requirements of the degree.

In addition to the readmission requirements listed in FB5.1 and FB5.2 above, the fulfilment of other specific requirements may be required by individual majors. These requirements will be communicated to students.

General

Except by permission of Senate, where the academic circumstances of a student do not permit the application of Rules FB5.1-FB5.3, a student shall be required to complete the equivalent of two full-year courses per year of study.

In special cases, or in the case of undergraduates transferring from other faculties or other universities, the Senate may impose probationary academic requirements which must be fulfilled before the student shall be permitted to renew registration in the Faculty in the following year.

A student who fails to complete the University examination in a course after two years of study may, at the discretion of Senate, be excluded from further attendance of such a course.

Except by permission of Senate, a student who has been refused permission to reregister in another faculty may not register in the Faculty of Science.

Re-registration in the Faculty does not imply a right to register for senior courses in subjects for which the student has completed prerequisite courses.

Transfer from other faculties into the Faculty of Science

Except by permission of Senate, a student who, after a year or more in another faculty, wishes to register in the Faculty of Science, shall, as a minimum:

(a) satisfy the normal school-leaving subject entry requirements for admission to the BSc degree, and
(b) have complied with the provisions of Rule FB5.1-FB5.3 as appropriate, as applicable mutatis mutandis.
Curricula rules for the Bachelor of Science (BSc) degree

All bachelor degree curricula in the Faculty of Science include courses carefully selected to provide adequate foundation for and depth in the major disciplines, as well as providing generic skills to function as a graduate. All curricula therefore require students to achieve skills in numeracy, computer literacy, problem solving and communication in the context of their majors.

Students must choose one or more majors, with curricula including compulsory courses as outlined under rules FB7.6 and FB7.7 below. The general rules governing BSc curricula are rules FB7.1 to FB7.5 which stipulate the minimum number of courses required, and the range of choices possible.

All curricula can lead to postgraduate study.

Total number of courses

FB7.1 The curriculum shall include the equivalent of at least nine full-year courses of which at least six full-year courses must be Science courses. A maximum of three full-year courses or the equivalent may be counted from other faculties.

Number of senior courses

FB7.2 The curriculum shall include the equivalent of at least four full-year senior courses or the equivalent, of which at least three shall be Science courses, and the equivalent of two full-year courses shall be third-year (level 7) courses. This applies even where the curriculum includes only one major.

Mathematics

FB7.3 The curriculum shall include at least a half Science course in Mathematics (18 NQF credits, level 5) plus a half Science course in Statistics (18 NQF credits, level 5), or a full Science course in Mathematics (36 NQF credits, level 5).

Elective courses

FB7.4 Any course in the Faculty of Science may be taken as an elective. Courses from other Faculties may also be taken as electives, but subject to the following constraints and approval by a Student Adviser or Deputy Dean:

- Only courses with a NQF credit value of 18 or more will be counted (a first year half course in the Science Faculty has a NQF credit value of 18).
- If the equivalent of two or less full Science courses are replaced by courses from another faculty, any courses not specifically excluded by Science Faculty rules can be chosen (Refer to “Non-Science electives in the Bachelor of Science (BSc) degree” at the back of this book).
- If more than two full year Science courses are replaced with electives from another faculty, then the further electives must form part of a hierarchical sequence linked to those already completed.
- Courses taught by the Faculty of Science for other faculties are not available for students registered in Science. However, students transferring into Science from other faculties may be able to count such courses towards their Science curriculum, with the credit weighting, equivalence and conditions established by the Departments concerned.
NOTE: Refer to “Non-Science electives in the Bachelor of Science (BSc) degree” at the back of this book for details on non-Science courses that do or do not carry credit in the Science curriculum.

FB7.5 In order to satisfy the requirement of competencies including numeracy, computer literacy, problem solving and communication or as a measure of integrated assessment, a Student Adviser may add one or more compulsory courses to a curriculum.

Major(s)

FB7.6 The curriculum shall include at least one major from the following list:
- Applied Biology**
- Ecology & Evolution**
- Applied Mathematics
- Environmental & Geographical Science
- Applied Statistics
- Genetics
- Archaeology
- Geology
- Astrophysics
- Human Anatomy & Physiology
- Biochemistry
- Marine Biology
- Biology
- Mathematical Statistics
- Business Computing*
- Mathematics
- Chemistry
- Ocean & Atmosphere Science
- Computer Science
- Physics
- Computer Engineering*
- Quantitative Biology
- * These majors may only be taken in conjunction with a major in Computer Science.
- ** These majors may only be taken by students first registered prior to 2019.

NOTE: Acceptance into the Science Faculty does not guarantee acceptance into your chosen major. Formal acceptance for specific majors only takes place at the start of the second year on registration for the second year level courses. A number of majors (currently Biology, Biochemistry, Genetics, Geology and Human Anatomy & Physiology) have limits on the number of students accepted into second year level courses. Selection criteria, based on academic performance in first year courses, are outlined to students during the first year of study. Students will be advised in their first year to take courses which could lead to several majors. Students are encouraged to consult timeously with the relevant Department or Student Adviser regarding possible restrictions.

NQF credit requirements for the Bachelor of Science (BSc) degree

FB7.7 Read in conjunction with rule FB7.1-FB7.6.
All courses have been assigned a credit value and level, according to the Higher Education Qualifications Sub-Framework (HEQSF).

The standard BSc degree requires:
(a) a total of 420 NQF credits (nine full-year courses). A minimum of 396 NQF credits will be accepted where the second major or suite of hierarchical courses includes at least one senior full course from another Faculty.
(b) a minimum of 276 NQF credits from Science courses (the equivalent of six full-year courses)
(c) a minimum of 120 NQF credits at level 7
(d) two majors, or a curriculum leading to only one major provided it includes at least 120 NQF credits at level 7.

A third-year half course may be counted toward more than one major. However,
DEGREES OFFERED IN THE FACULTY

the curriculum must contain at least two distinct third-year (level 7) semester
courses recognised by the Faculty for each major.

FB7.8 Compulsory courses to be completed for each Science major:

NOTE 1: The compulsory courses listed below are the minimum which a student must complete for
the major, in addition to those listed in FB7.3. Courses deemed by the Faculty as equivalent can be
substituted as appropriate, for example: MAM1005H+MAM1006H is deemed equivalent to
MAM1000W; CEM1009H+CEM1010H is deemed equivalent to CEM1000W, etc.

NOTE 2: All courses taught in other Faculties that are required/compulsory for a major in the
Science Faculty will be counted as Science courses for the purpose of rules FB7.1 and FB7.2. For
example, the specific EEE courses listed as compulsory for the major in Computer Engineering, the
specific HUB courses listed as compulsory for the major in Human Anatomy & Physiology, the
specific INF courses listed as compulsory for the major in Business Computing.

Major in Applied Biology (for students registered before 2019 only)
[BIO01]

First Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO1000F</td>
<td>Cell Biology</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>BIO1004F/S</td>
<td>Biological Diversity</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>CEM1000W</td>
<td>Chemistry 1000</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>Either</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1004F</td>
<td>Mathematics 1004</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1000W</td>
<td>Mathematics 1000</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>STA1007S</td>
<td>Introductory Statistics for Scientists</td>
<td>18</td>
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Second Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
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<th>NQF Credits</th>
<th>NQF Level</th>
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<tbody>
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<td>BIO2010F</td>
<td>Principles of Ecology &amp; Evolution</td>
<td>24</td>
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<tr>
<td>BIO2011S</td>
<td>Life on Land: Animals</td>
<td>24</td>
<td>6</td>
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<tr>
<td>BIO2012S</td>
<td>Life on Land: Plants</td>
<td>24</td>
<td>6</td>
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<tr>
<td>BIO2013F</td>
<td>Life in the Sea</td>
<td>24</td>
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<td>Recommended:</td>
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<tr>
<td>STA2007F/H/S</td>
<td>Study Design &amp; Data Analysis for Scientists</td>
<td>24</td>
<td>6</td>
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</table>

Third Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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<tbody>
<tr>
<td>BIO3013F</td>
<td>Global Change Ecology</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>BIO3014S</td>
<td>Conservation: Genes, Populations &amp; Biodiversity</td>
<td>36</td>
<td>7</td>
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</tbody>
</table>
**Major in Applied Mathematics**  
**[MAM01]**  
*Students who major in Applied Mathematics and wish to progress to Applied Mathematics Honours are strongly recommended to complete the project course MAM3055Z: Project in Applied Mathematics*

### First Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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<tr>
<td>MAM1043H</td>
<td>Modelling &amp; Applied Computing</td>
<td>18</td>
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<td>MAM1044H</td>
<td>Dynamics</td>
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### Second Year Core Courses

<table>
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<td>MAM2046W</td>
<td>Applied Mathematics 2046</td>
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### Third Year Core Courses

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<td>MAM3040W</td>
<td>Applied Mathematics 3040</td>
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**Major in Applied Statistics**  
**[STA01]**  
*Students who major in Applied Statistics and wish to progress to Statistics Honours must complete one semester of Computer Science I*

### First Year Core Courses

**Either**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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<tbody>
<tr>
<td>MAM1004F</td>
<td>Mathematics 1004</td>
<td>18</td>
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<tr>
<td>and</td>
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<tr>
<td>MAM1008S</td>
<td>Introduction to Discrete Mathematics</td>
<td>18</td>
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<td>or</td>
<td></td>
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<tr>
<td>MAM1000W</td>
<td>Mathematics 1000 or equivalent</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>STA1007S</td>
<td>Introductory Statistics for Scientists</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STA1000F/S/P/L</td>
<td>Introductory Statistics</td>
<td>18</td>
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**Second Year Core Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA2007F/S/H</td>
<td>Study Design &amp; Data Analysis for Scientists</td>
<td>24</td>
<td>6</td>
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<tr>
<td>or</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>STA2020F/S</td>
<td>Applied Statistics</td>
<td>24</td>
<td>6</td>
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<tr>
<td>STA2030S</td>
<td>Statistical Theory</td>
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### Third Year Core Courses

<table>
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<tr>
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<th>NQF Level</th>
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<tbody>
<tr>
<td>STA3022F</td>
<td>Applied Multivariate Data Analysis</td>
<td>36</td>
<td>7</td>
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<td>or</td>
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<tr>
<td>STA3036S</td>
<td>Operational Research Techniques</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>STA3030F</td>
<td>Statistical Inference &amp; Modelling</td>
<td>36</td>
<td>7</td>
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## Major in Archaeology  
### [AGE01]

### First Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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<tbody>
<tr>
<td>GEO1009F</td>
<td>Intro to Earth and Environmental Sciences</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>AGE1002S</td>
<td>The Human Planet: Prehistory to Present</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Either</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1000W</td>
<td>Mathematics 1000</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1004F</td>
<td>Mathematics 1004</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>and one of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STA1000F/S</td>
<td>Introductory Statistics</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>STA1007S</td>
<td>Introductory Statistics for Scientists</td>
<td>18</td>
<td>5</td>
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### Second Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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</thead>
<tbody>
<tr>
<td>AGE2011S</td>
<td>Human Evolution</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>AGE2012F</td>
<td>The First People</td>
<td>24</td>
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### Third Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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</thead>
<tbody>
<tr>
<td>AGE3013H</td>
<td>Archaeology in Practice</td>
<td>36</td>
<td>7</td>
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<td>One of:</td>
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<tr>
<td>AGE3011F</td>
<td>The Roots of Recent African Identities</td>
<td>36</td>
<td>7</td>
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<tr>
<td>AGE3012S</td>
<td>Global Diasporas &amp; the Archaeology of the Historical Past</td>
<td>36</td>
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## Major in Astrophysics  
### [AST02]

### First Year Core Courses

<table>
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<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
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<tbody>
<tr>
<td>MAM1000W</td>
<td>Mathematics 1000</td>
<td>36</td>
<td>5</td>
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<tr>
<td>PHY1004W</td>
<td>Matter &amp; Interactions</td>
<td>36</td>
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<td>Recommended:</td>
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<td></td>
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<tr>
<td>AST1000F/S</td>
<td>Introduction to Astronomy</td>
<td>18</td>
<td>5</td>
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### Second Year Core Courses

<table>
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<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
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<tbody>
<tr>
<td>AST2002H</td>
<td>Astrophysics</td>
<td>24</td>
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<tr>
<td>AST2003H</td>
<td>Astronomical Techniques</td>
<td>24</td>
<td>6</td>
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<tr>
<td>MAM2000W</td>
<td>Mathematics 2000</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
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<tr>
<td>MAM2004H</td>
<td>Mathematics 2004</td>
<td>24</td>
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<td>and</td>
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<tr>
<td>MAM2047H</td>
<td>Applied Mathematics 2047</td>
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<td>PHY2004W</td>
<td>Intermediate Physics</td>
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### Third Year Core Courses

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<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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<tbody>
<tr>
<td>AST3002F</td>
<td>Stellar Astrophysics</td>
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<tr>
<td>AST3003S</td>
<td>Galactic &amp; Extragalactic Astrophysics</td>
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</table>
### Major in Biochemistry

**[MCB01]**

*This major has limits on the number of students accepted into second year level courses*

#### First Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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<tbody>
<tr>
<td>BIO1000F</td>
<td>Cell Biology...........................................</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>BIO1004S</td>
<td>Biological Diversity...............................</td>
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<td>CEM1000W</td>
<td>Chemistry 1000........................................</td>
<td>36</td>
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<td>MAM1004F</td>
<td>Mathematics 1004.......................................</td>
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<td>MAM1000W</td>
<td>Mathematics 1000........................................</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>STA1007S</td>
<td>Introductory Statistics for Scientists........................</td>
<td>18</td>
<td>5</td>
</tr>
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<td>or</td>
<td>........................................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STA1000F/S</td>
<td>Introductory Statistics..................................</td>
<td>18</td>
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#### Second Year Core Courses

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<tbody>
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<td>MCB2020F</td>
<td>Biological Information Transfer........................</td>
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<td>MCB2021F</td>
<td>Molecular Bioscience..............................</td>
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<td>MCB2022S</td>
<td>Metabolism and Bioengineering..................</td>
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#### Third Year Core Courses

<table>
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<td>MCB3024S</td>
<td>Defence &amp; Disease...............................</td>
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<td>MCB3025F</td>
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### Major in Biology (for students registered from 2019 only)

**[BIO12]**

*Students who major in Biology and wish to progress to Biological Sciences or Marine Biology Honours must complete STA2007*

#### First Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
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#### Second Year Core Courses

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### Major in Business Computing

**[CSC02]**

*Must be taken concurrently with a Computer Science major*

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### Major in Chemistry

**[CEM01]**

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**Major in Computer Engineering**

[CSC03]

*Must be taken concurrently with a Computer Science major.*

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Note: *Physics is not a requirement of the major but is a pre-requisite of EEE2049W*

**Second Year Core Courses**

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**Major in Computer Science**

[CSC05]

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Major in Ecology & Evolution (for students registered before 2019 only)  
[BIO04]

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Major in Environmental & Geographical Science  
[EGS02]

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### Major in Genetics

**[MCB04]**

*This major has limits on the number of students accepted into second year level courses*

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### Major in Geology

**[GEO02]**

*This major has limits on the number of students accepted into second year level courses*

#### First Year Core Courses

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<td>Intro to Minerals, Rocks &amp; Structure ...............</td>
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# Second Year Core Courses

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<td>Physical Geology</td>
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<td>GEO2005X</td>
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# Third Year Core Courses

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* fieldwork half-course to be taken over second and third years of study

# Major in Human Anatomy & Physiology

[HUB17]

*This major has limits on the number of students accepted into second year level courses*

## First Year Core Courses

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<td>Chemistry 1000</td>
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Either

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or

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Recommended: 1000-level Physics

## Second Year Core Courses

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# Major in Marine Biology (for students registered before 2019 only)

[BIO05]

## First Year Core Courses

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Either

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or

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## DEGREES OFFERED IN THE FACULTY

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### Second Year Core Courses

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<td>BIO2010F</td>
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### Recommended:

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### Third Year Core Courses

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<td>BIO3017S</td>
<td>Marine Resources</td>
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### Major in Marine Biology (for students registered from 2019 only)

**[BIO05]**

*Students who major in Marine Biology and wish to progress to Biology or Marine Biology Honours must complete STA2007S*

### First Year Core Courses

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<td>Cell Biology</td>
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<td>36</td>
<td>5</td>
</tr>
<tr>
<td>STA1007S</td>
<td>Introductory Statistics for Scientists</td>
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### Second Year Core Courses

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<td>BIO2015F</td>
<td>Vertebrate Diversity &amp; Functional Biology</td>
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<td>BIO2016S</td>
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<td>BIO2017S</td>
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### Third Year Core Courses

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<td>BIO3017S</td>
<td>Marine Resources</td>
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</table>
Major in Mathematical Statistics

[STA02]

Students who major in Mathematical Statistics and wish to progress to Statistics Honours must complete one semester of Computer Science 1

First Year Core Courses

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Second Year Core Courses

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<td>Linear Models</td>
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Third Year Core Courses

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<td>Statistical Modelling, Machine Learning and Bayesian Analysis</td>
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Major in Mathematics

[MAM02]

Students who major in Mathematics and wish to progress to Mathematics Honours are strongly recommended to complete the project course MAM3006Z: Project in Mathematics

First Year Core Courses

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Second Year Core Courses

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Third Year Core Courses

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Major in Ocean & Atmosphere Science

[SEA03]

First Year Core Courses

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**Major in Physics**

[PHY01]

**First Year Core Courses**

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**Major in Quantitative Biology (for students registered from 2019 only)**

[BIO13]

**First Year Core Courses**

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<td>BIO1004S</td>
<td>Biological Diversity</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>STA100xF/S</td>
<td>Any 1000-level Science STA course</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Either</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1004F</td>
<td>Mathematics 1004</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1008S</td>
<td>Introduction to Discrete Mathematics</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAM1000W</td>
<td>Mathematics 1000</td>
<td>36</td>
<td>5</td>
</tr>
</tbody>
</table>
Second Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO2014F</td>
<td>Principles of Ecology &amp; Evolution</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>BIO2015F</td>
<td>Vertebrate Diversity &amp; Functional Biology</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>BIO2016S</td>
<td>Invertebrate Diversity &amp; Functional Biology</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>BIO2017S</td>
<td>Plant Diversity &amp; Functional Biology</td>
<td>24</td>
<td>6</td>
</tr>
</tbody>
</table>

One of:

* MAM2046W | Applied Mathematics 2046                      | 48          | 6         |

or

* STA20xxF/S | Any 2000-level Science STA course | 24          | 6         |

Third Year Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO3019S</td>
<td>Quantitative Biology</td>
<td>36</td>
<td>7</td>
</tr>
</tbody>
</table>

Either:

* MAM3040W | Applied Mathematics 3040                      | 72          | 7         |

or

* STA30xxF/S | Any 3000-level Science STA course | 36          | 7         |

* Note: Registration for these courses is conditional on pre-requisites having been met, and this should be checked.

Distinction

The Bachelor of Science (BSc) degree may be awarded with distinction, and with distinction in one or more majors.

Changes to distinction rules where curricula contain 2020 PA/F course results

For the purposes of awarding a distinction in a major where a student has PA for a required 2000-level course, an appropriate 1000-level course/s listed below may be substituted. Note: where marks do exist for the 2000-level courses, these will take precedence over 1000-level courses in awarding the distinction.

Rules for distinction in a major

FB8.1 (a) In order to obtain a distinction in a major, a student will be required to obtain first class passes in the courses listed below, except as specified in (b) and (c):

- Applied Mathematics: MAM1043H and MAM1044H (MAM2046W (or two of MAM2047H, MAM2048H and MAM2043S)) and MAM3040W
- Archaeology: AG1002S and one of GEO1009F or AG1004S. Two Four senior half-courses in Archaeology
- Astrophysics: MAM1000W or PHY1004W, (AST2002H, AST2003H,) AST3002F, AST3003S
- Biochemistry: (BIO1000F and BIO1004S) or CEM1000W;
<table>
<thead>
<tr>
<th>Degree</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology:</td>
<td>BIO1000F and BIO1004S (BIO2014F, any one of BIO2015F, BIO2016S and BIO2017S); any two of</td>
</tr>
<tr>
<td></td>
<td>BIO3013F, BIO3014S, BIO3018F and BIO3019S</td>
</tr>
<tr>
<td>Business Computing:</td>
<td>CSC1015F, CSC1016S (INF2009F, INF2011S); any two of INF3011F, INF3012S and INF3014F</td>
</tr>
<tr>
<td>Ecology &amp; Evolution:</td>
<td>BIO1000F and BIO1004S (BIO2014F, any one of BIO2015F, BIO2016S and BIO2017S) plus BIO3015F,</td>
</tr>
<tr>
<td></td>
<td>BIO3016S</td>
</tr>
<tr>
<td>Chemistry:</td>
<td>CEM1000W, (CEM2005W), CEM3005W</td>
</tr>
<tr>
<td>Computer Engineering:</td>
<td>CSC1015F, CSC1016S, (EEE2049W, EEE2050F), EEE3095S, CSC3022F</td>
</tr>
<tr>
<td>Ecology &amp; Geographical Science:</td>
<td>EGS1003S, GEO1009F, (EGS2013F and EGS2015S); any two of EGS3012S, EGS3020F, EGS3021F, EGS3022S,</td>
</tr>
<tr>
<td></td>
<td>EGS3023F</td>
</tr>
<tr>
<td>Genetics:</td>
<td>(BIO1000F and BIO1004S) or CEM1000W (MCB2020F, MCB2023S), MCB3023S, MCB3026F</td>
</tr>
<tr>
<td>Human Anatomy &amp; Physiology:</td>
<td>(BIO100F and BIO1004S) or CEM1000W (HUB2019F, HUB2021S), HUB3006F, HUB3007S</td>
</tr>
<tr>
<td></td>
<td>BIO3002F, BIO3017S</td>
</tr>
<tr>
<td>Mathematics:</td>
<td>(MAM1000W, MAM1019H, MAM2000W), MAM3000W</td>
</tr>
<tr>
<td>Ocean &amp; Atmosphere Science:</td>
<td>Two of (GEO1009F, BIO1004S and PHY1031F) or CEM1000W, (SEA2004F, SEA2005S), SEA3004F,</td>
</tr>
<tr>
<td></td>
<td>EGS3012S</td>
</tr>
<tr>
<td>Physics:</td>
<td>PHY1004W, (PHY2004W), PHY3004W</td>
</tr>
<tr>
<td>Quantitative Biology:</td>
<td>BIO1000F or BIO1004S and one of required 1000-level STA or MAM courses (Any one of BIO2014F,</td>
</tr>
<tr>
<td></td>
<td>BIO2015F, BIO2016S and BIO2017S; STAxxxF/S or MAM2046W) BIO3019S; STA30xxF/S or MAM3040W</td>
</tr>
</tbody>
</table>

(b) If a student obtains a first and an upper second class in two half-courses at first-year level listed in (a) above, the marks obtained in these half-courses shall be averaged. If this average is 75% or more the student will be regarded, for this purpose only, as having obtained first class passes in both these half-courses. The same applies at the third-year level.

(c) In special cases the Board of the Faculty may replace a first class in one of the courses listed above by a first class pass in a cognate course (which has not been used for distinction in that cognate subject).
Rules for distinction in the BSc degree as a whole

FB8.2 To obtain a distinction in the degree as a whole, a student must

(a) obtain a distinction in at least one major (rule FB8.1); and

(b) For 2021 (i.e. students with 2nd year PA/F results in 2020:
obtain first class passes in at least four courses (or the equivalent in
half-courses), including at least 2 senior courses, or obtain first
class passes in at least two first-year courses and an aggregate of at
least 75% for two third-year courses obtained in a minimum
period. (The minimum period will usually be three years).

For 2022 (i.e. students with 2nd year PA/F results in 2020:
obtain first class passes in at least four senior courses (or the
equivalent in half-courses), or obtain an aggregate of at least 75%
for two second-year courses, and two third-year courses obtained
in a minimum period. (The minimum period will usually be three
years).

Rules for distinction in a major (prior to 2020)

FB8.1 (a) In order to obtain a distinction in a major, a student will be required to
obtain first class passes in the courses listed below, except as specified in
(b) and (c):

<table>
<thead>
<tr>
<th>Major</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology:</td>
<td>BIO2013F, plus BIO3013F, BIO3014S</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>MAM2046W (or two of MAM2047H, MAM2044H and MAM3040W)</td>
</tr>
<tr>
<td>Statistics:</td>
<td>STA3030F, STA3022F/STA3036S</td>
</tr>
<tr>
<td>Archaeology:</td>
<td>Four senior half-courses in Archaeology</td>
</tr>
<tr>
<td>Astrophysics:</td>
<td>AST2002H, AST2003H, AST3002F, AST3003S</td>
</tr>
<tr>
<td>Biochemistry:</td>
<td>MCB2021F, MCB2022S, MCB3024S, MCB3025F</td>
</tr>
<tr>
<td>Business:</td>
<td>INF2009F, INF2011S; any two of INF3011F, INF3012S and INF3014F</td>
</tr>
<tr>
<td>Computing:</td>
<td>EEC2049W, EEE2050F, EEE3095S, CSC3022F</td>
</tr>
<tr>
<td>Chemistry:</td>
<td>CEM2005W, CEM3005W</td>
</tr>
<tr>
<td>Computer Science:</td>
<td>CSC2001F, CSC2002S, CSC3002F, CSC3003S</td>
</tr>
<tr>
<td>Environmental &amp; Geographical Science:</td>
<td>EGS2013F and EGS2015S; any two of EGS3012S, EGS3020F, EGS3021F, EGS3022S, EGS3023F</td>
</tr>
<tr>
<td>Genetics:</td>
<td>MCB2020F, MCB2023S, MCB3023S, MCB3026F</td>
</tr>
<tr>
<td>Geology:</td>
<td>GEO2001F, GEO2004S, GEO3005S, GEO3001S</td>
</tr>
<tr>
<td>Human Anatomy &amp; Physiology:</td>
<td>HUB2019F, HUB2021S, HUB3006F, HUB3007S</td>
</tr>
<tr>
<td>Mathematics:</td>
<td>MAM2000W, MAM3000W</td>
</tr>
</tbody>
</table>
Ocean & Atmosphere Science: SEA2004F, SEA2005S, SEA3004F, EGS3012S
Physics: PHY2004W, PHY3004W
Quantitative Biology: Any one of BIO2014F, BIO2015F, BIO2016S and BIO2017S; STA20xxF/S or MAM2046W; BIO3019S; STA30xxF/S or MAM3040W

(b) If a student obtains a first and an upper second class in two half-courses at second-year level listed in (a) above, the marks obtained in these half-courses shall be averaged. If this average is 75% or more the student will be regarded, for this purpose only, as having obtained first class passes in both these half-courses. The same applies at the third-year level.

(c) In special cases the Board of the Faculty may replace a first class in one of the courses listed above by a first class pass in a cognate course (which has not been used for distinction in that cognate subject).

**Rules for distinction in the BSc degree as a whole**

FB8.2 To obtain a distinction in the degree as a whole, a student must

(a) obtain a distinction in at least one major (rule FB8.1); and
(b) obtain first class passes in at least six courses (or the equivalent in half-courses), including at least four senior courses or obtain an aggregate of at least 75% for each of four first-year courses, three second-year courses and two third-year courses obtained in a minimum period. (The minimum period will usually be three years).

In applying the rules above, only passes at the first attempt are taken into account, i.e. ordinary examinations in June or December and/or deferred examinations will be taken into account, but not any supplementary examinations.

**Rules for the degree of Bachelor of Science Honours (BSc Hons)**

**Admission**

FH1 A person shall not be admitted as a candidate for the degree unless they

(a) are a graduate of the Faculty of Science who has been awarded a Bachelor’s degree in the discipline in which they propose to proceed to Honours, or have subsequently met the conditions which would have enabled them to be awarded the degree in the Faculty with that subject as a discipline; or
(b) are a graduate of any other faculty in the University who has completed courses and fulfilled conditions accepted by Senate as equivalent to those required under (a) above; or
(c) are a graduate of any other university recognised by Senate for such purposes who has completed courses and has fulfilled conditions accepted by Senate as equivalent to those required under (a) above.


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Duration

FH2.1 Subject to the provisions of rule GH3 the BSc Hons is offered over a period of not less than one academic year. Normally, candidates are required to complete the programme within one academic year.

FH2.2 In exceptional circumstances, where an application for the BSc Hons degree does not have an adequate undergraduate academic background, they may, with permission of the Head of Department, register as an occasional student to complete preparatory courses. On satisfactory completion of such courses, a candidate may be permitted to enrol on the Honours course.

NOTE: Students following rule FH2.2 are required to apply for admission to the Honours programme for the following year.

FH2.3 In exceptional circumstances, the Senate may admit a suitably qualified student as a part-time candidate for the Honours degree. Any such candidate shall be required to complete the programme within two academic years.

The Bachelor of Science Honours degree (BSc Hons) has a total NQF credit value of 160 at HEQSF level 8.

This degree may be conferred in any one of the following specialisations:

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Degree and Plan Code</th>
<th>Specialisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSc Hons</td>
<td>SH001MAM01</td>
<td>Applied Mathematics</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001AGE01</td>
<td>Archaeology</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001AGE02</td>
<td>Archaeology &amp; Environmental Science</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001AST03</td>
<td>Astrophysics &amp; Space Science</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001EGS07</td>
<td>Atmospheric Science</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001BIO07</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001CEM01</td>
<td>Chemistry</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001CSC05</td>
<td>Computer Science</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001EGS02</td>
<td>Environmental &amp; Geographical Science</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001GEO01</td>
<td>Geochemistry</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001GEO02</td>
<td>Geology</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001CSC06</td>
<td>Information Technology</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001BIO05</td>
<td>Marine Biology</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001MAM02</td>
<td>Mathematics</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001MCB02</td>
<td>Molecular &amp; Cell Biology</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001SEA03</td>
<td>Ocean &amp; Atmosphere Science</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001PHY01</td>
<td>Physics</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001STA04</td>
<td>Statistical Sciences</td>
</tr>
<tr>
<td>BSc Hons</td>
<td>SH001BUS01</td>
<td>Statistical Sciences for Actuaries</td>
</tr>
</tbody>
</table>

Refer to the appropriate Department sections in this handbook for detailed course outlines.

Restriction on registration

FH4 A student may not take any course(s) other than those prescribed by the Honours programme for which they are registered.
Award of the degree

FH5 The degree of BSc Hons may be conferred
(a) after the successful completion of a programme of formal training and
supervised research, the latter comprising a minimum of 30 NQF
credits out of a total of 160 credits; and
(b) subject to both the research project and the balance of the course (class
work plus examination) being passed separately with a minimum of
50%.

Curriculum structure for the Bachelor of Science Honours, specialising in Computer
Science and the Bachelor of Science Honours, specialising in Information
Technology
[CSC05 & CSC06]

Prescribed curriculum
The curriculum comprises three compulsory core courses, at least five elective courses and a
research project.

Compulsory (core) courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC4019Z</td>
<td>Research and Innovation</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>CSC4020Z</td>
<td>Functional Programming</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4021Z</td>
<td>Compilers 1</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4002W</td>
<td>Computer Science Honours Project</td>
<td>60</td>
<td>8</td>
</tr>
</tbody>
</table>

Students must choose 48 credits of elective courses from the remaining Computer Science courses at
the Honours level; or electives from other departments (with prior approval of the Honours
convener).

Elective courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC4007Z</td>
<td>Selected Honours module in Computer Science</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4010Z</td>
<td>Advanced Topics in Computer Science Honours 2</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4022Z</td>
<td>Compilers 2</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4023Z</td>
<td>Big Data Management and Analysis</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4024Z</td>
<td>Human Computer Interaction</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4025Z</td>
<td>Artificial Intelligence</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4026Z</td>
<td>Network and Internetwork Security</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4027Z</td>
<td>Computer Game Design</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4028Z</td>
<td>High Performance Computing</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>CSC4029Z</td>
<td>Introduction to Computer Graphics</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>STA4026S</td>
<td>Analytics</td>
<td>18</td>
<td>8</td>
</tr>
</tbody>
</table>

The handbook outlining the current year’s Honours programme is available from the Department
(http://www.cs.uct.ac.za).
Rules for the degree of Master of Philosophy/Science

(To be read with General Rules on Master Degrees (G and GM) in Book 3 of this series).

Master of Philosophy (MPhil)
The degree will normally be awarded for work on inter-faculty topics or where a student holds an undergraduate or Honours degree other than in Science.

Admission

FM1 A person shall not be admitted as a candidate for the degree unless they
(a) hold an Honours degree or four year equivalent of the University or of any other university recognised by Senate for the purpose; or
(b) are a graduate of the University or of any other university recognised by Senate for the purpose, who has shown by examination or publication or a record of appropriate training that they have reached the current level in the subject or discipline equivalent to an Honours degree; or
(c) have in any other manner attained a level of competence which in the opinion of Senate is adequate for the purpose of admission to the degree.

Master of Science (MSc)

Admission

FM2 A person shall not be admitted as a candidate for the degree unless they are
(a) an Honours graduate in the Faculty of Science, or a graduate of another faculty or another university who holds a degree recognised by the Senate as being equivalent to an Honours degree in the Faculty of Science; or
(b) a graduate of the University, or of any other institution recognised by the Senate for the purpose, who has shown by examination or publication or a record of appropriate training, that they have reached a level in the subject or cognate subject equivalent to an Honours degree in Science.

Guidelines for applicants
Prospective candidates should contact a member of the academic staff under whose supervision they would like to pursue a dissertation. Alternatively, applicants could approach the Head of Department that best suits their research interests and request contact with prospective supervisors. The Dean (through the Head) is responsible for the final acceptance of the candidate, and appointment or approval of the supervisor(s). The candidate will then be required to complete a memorandum of understanding (MoU), between them and their supervisor(s) for approval by the Dean (through the Head). Candidates may be required, after consultation with the prospective supervisor(s), to draw up a more detailed project proposal. This may then be inspected by a departmental board or panel appointed by the Head, before the candidate may proceed with their research.

FM3 The Master of Philosophy degree (MPhil) has a total NQF credit value of 180 at HEQSF level 9. This degree may be offered as a full research dissertation of 180 NQF credits; or as a coursework and minor dissertation of 90 NQF credits each; or as a coursework and minor dissertation of 120 NQF credits coursework and 60 NQF credits minor dissertation.

The Master of Science degree (MSc) has a total NQF credit value of 180 at HEQSF level 9. This degree may be offered as a full research dissertation of 180 NQF
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credits, or as a coursework and minor dissertation of 90 NQF credits each; or as a coursework and minor dissertation of 120 NQF credits coursework and 60 NQF credits minor dissertation.

The degree may be conferred in any one of the following specialisations:

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Degree and Plan Code</th>
<th>Specialisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 MAM01</td>
<td>Applied Mathematics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 AEO01</td>
<td>Archaeology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 AST01</td>
<td>Astronomy</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 BIO07</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 CEM01</td>
<td>Chemistry</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 CEM03</td>
<td>Computational Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 BIO09</td>
<td>Conservation Biology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 EG002</td>
<td>Environmental &amp; Geographical Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 GEO01</td>
<td>Geochemistry</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 GEO02</td>
<td>Geology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 STA02</td>
<td>Mathematical Statistics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 MAM02</td>
<td>Mathematics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 MCB02</td>
<td>Molecular &amp; Cell Biology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 SEA03</td>
<td>Ocean &amp; Atmosphere Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 STA03</td>
<td>Operational Research</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 SEA05</td>
<td>Physical Oceanography</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 PHY01</td>
<td>Physics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 STA09</td>
<td>Statistical Ecology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 PHY02</td>
<td>Theoretical Physics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 CEM02</td>
<td>Tertiary Chemistry Education</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM001/2 PHY03</td>
<td>Tertiary Physics Education</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 STA08</td>
<td>Advanced Analytics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 BIO11</td>
<td>Applied Ocean Sciences (Marine Biology)</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 SEA07</td>
<td>Applied Ocean Sciences (Operational Oceanography)</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 CSC08</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 AST03</td>
<td>Astrophysics &amp; Space Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 STA10</td>
<td>Biostatistics</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 EGS06</td>
<td>Climate Change &amp; Sustainable Development</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 CSC05</td>
<td>Computer Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 BIO09</td>
<td>Conservation Biology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 STA11</td>
<td>Data Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 EGS05</td>
<td>Environment, Society &amp; Sustainability</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 CSC06</td>
<td>Information Technology</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM004/5 SEA06</td>
<td>Ocean &amp; Climate Science</td>
</tr>
<tr>
<td>MPhil</td>
<td>SM005/EG008</td>
<td>Urban Studies</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM007/8 STA11</td>
<td>Data Science</td>
</tr>
<tr>
<td>MSc/MPhil</td>
<td>SM009/MAM06</td>
<td>Mathematical Sciences</td>
</tr>
</tbody>
</table>

Refer to the appropriate Department sections in this handbook for detailed course outlines.
NOTE: SM001/SM002 refers to the MSc/MPhil by full research dissertation (180 NQF credit dissertation).
SM004/SM005 refers to the MSc/MPhil by coursework and minor dissertation (90 NQF credit coursework, 90 NQF credit dissertation).
SM007/SM008/SM009 refers to the MSc/MPhil by coursework and minor dissertation (120 NQF credit coursework, 60 NQF credit dissertation).

Students undertaking any Master’s degree by coursework and minor dissertation will register for a 90 NQF credit coursework component followed by a 90 NQF credit minor dissertation component; or a 120 NQF credit coursework component followed by a 60 NQF credit dissertation component.

NOTE: For the coursework component of the Master’s degree, where the same course is offered for both the Honours (HEQSF level 8, 4000 level) and Master’s (HEQSF level 9, 5000 level) degrees, students must register for the course appropriate to their current qualification level. Students who have completed the 4000-level version of a course are excluded from enrolling on the 5000-level version of the same course and vice versa.

Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Computer Science
[CSC05]

Prescribed curriculum
The curriculum comprises one compulsory course, at least six elective courses and a minor dissertation.

Compulsory courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC5020Z</td>
<td>Research Methods in Computer Science</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>CSC5002W</td>
<td>Computer Science Minor Dissertation</td>
<td>90</td>
<td>9</td>
</tr>
</tbody>
</table>

Students must choose 72 credits of elective courses from the remaining Computer Science courses at the Master's level; or electives from other departments (with prior approval of the convener).

Elective courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC5021Z</td>
<td>Computational Geometry for 3D Printing</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5022Z</td>
<td>Distributed Scientific Computing</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5023Z</td>
<td>Evolutionary Computation</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5024Z</td>
<td>Information Retrieval</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5025Z</td>
<td>Intelligent Systems</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5026Z</td>
<td>Introduction to ICT for Development</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5027Z</td>
<td>Logics for Artificial Intelligence</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5028Z</td>
<td>Ontology Engineering</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5029Z</td>
<td>Introduction to image processing and computer vision</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5030Z</td>
<td>Advanced Topics in Computer Science Masters 1</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5031Z</td>
<td>Advanced Topics in Computer Science Masters 2</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5032Z</td>
<td>Network and Internet Systems</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5033Z</td>
<td>Human Computer Interaction</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5034Z</td>
<td>Machine Learning</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5035Z</td>
<td>Natural Language Processing</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5036Z</td>
<td>Virtual Reality</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>
With prior approval of the course convenor, students may also take: CSC5007Z Database Systems (12 credits); and/or CSC5008Z Data Visualization (12 credits).

The handbook outlining the current year’s Master’s programme is available from the Department (http://www.cs.uct.ac.za).

Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Information Technology [CSC06]

Prescribed curriculum
The curriculum comprises eight compulsory courses and a minor dissertation.

The coursework component (CSC5007Z–CSC5017Z) covers the basic information technology curriculum and is offered online, with no lectures, although students will be required to be in Cape Town for exams. Normally these are completed in one year (four per semester), but students working full-time are advised to take only four modules per year.

### Compulsory courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC5007Z</td>
<td>Database Systems</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5010Z</td>
<td>MIT: Computer Networks</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5011Z</td>
<td>MIT: Object-Orientated Programming in Python</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5012Z</td>
<td>MIT: Human Computer Interaction</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5015Z</td>
<td>MIT: Software Engineering</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5016Z</td>
<td>MIT: Web Programming</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5017Z</td>
<td>MIT: Research Methods</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5004W</td>
<td>Information Technology Minor Dissertation</td>
<td>90</td>
<td>9</td>
</tr>
</tbody>
</table>

The handbook outlining the current year’s Master’s programme is available from the Department (http://www.cs.uct.ac.za).

Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Advanced Analytics [STA08]

Entry Requirements: A honours degree in Statistics or a four-year Bachelor’s degree that includes a substantial research component equivalent to the UCT honours degree in Statistical Sciences with a mark of at least 65% in the 4th year of study at first attempt.

Prescribed curriculum
The curriculum comprises three compulsory core courses, elective courses and a minor dissertation.

### Compulsory courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA5071Z</td>
<td>Simulation and Optimisation</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5090Z</td>
<td>Advanced Topics Regression</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5069Z</td>
<td>Multivariate Statistics</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

Students will choose elective courses to bring the total number of coursework credits to a minimum of 90 NQF credits. Students may choose to take electives from other departments with prior approval of the Programme Convenor.
Elective courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA5086Z</td>
<td>Advanced Portfolio Theory</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5068Z</td>
<td>Machine Learning</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5061Z</td>
<td>Bayesian Decision Modelling</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5063Z</td>
<td>Design of Clinical Trials</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5064Z</td>
<td>Ecological Statistics</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5066Z</td>
<td>Mathematical Modelling for Infectious Diseases</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5067Z</td>
<td>Longitudinal Data Analysis</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5064Z</td>
<td>Ecological Statistics</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5066Z</td>
<td>Mathematical Modelling for Infectious Diseases</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5067Z</td>
<td>Longitudinal Data Analysis</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5064Z</td>
<td>Ecological Statistics</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5072Z</td>
<td>Survival Analysis</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5091Z</td>
<td>Data Analysis for High Frequency Trading</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>CSC5007Z</td>
<td>Database Systems</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5008Z</td>
<td>Visualization</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>IBS5004Z</td>
<td>Bioinformatics for high-throughput biology</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

The minor dissertation component (90 NQF credits) is a research project based on a selected research topic.

Minor dissertation

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA5004W</td>
<td>Advanced Analytics Minor dissertation</td>
<td>90</td>
<td>9</td>
</tr>
</tbody>
</table>

Progression Rules:
Students are required to pass modules adding up to 90 credits to qualify for the course work component of the degree.
All core courses must be passed.
Students are allowed to repeat a failed module once.
Students should pass at least 3 modules in their first year of registration to be allowed to continue with the degree.
Students may not progress to elective modules unless they have passed at least 3 core modules.
By the end of their second year of registration, students should have passed at least 4 modules to be allowed to continue with the degree.
Students may take a maximum of three years to complete their coursework requirement.
Students may register for the dissertation components of the degree if they have passed 3 modules. They may, however, not submit their dissertations for examination before they have passed all required modules.

Distinction Rules:
Unless otherwise specified, the degree will be awarded with distinction if the candidate obtains:
75% or higher in the credit-weighted average of coursework marks; marks of 75% or higher for at least 4 modules taken in Statistical Sciences; and a mark of 75% or higher in the dissertation.
Curriculum structure for the Master of Science by coursework and minor dissertation, specialising in Artificial Intelligence (AI) [CSC08]

Prescribed curriculum
The curriculum comprises one compulsory course, at least six elective courses and an AI dissertation (minor dissertation in a research area broadly related to AI).

Compulsory courses:
<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC5020Z</td>
<td>Research Methods in Computer Science ..................</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>CSC5037W</td>
<td>Artificial Intelligence Minor Dissertation .................</td>
<td>90</td>
<td>9</td>
</tr>
</tbody>
</table>

Students must choose 72 credits of elective courses from the remaining Computer Science courses at the Master's level; or other electives from Computer Science and other departments (with prior approval of the course convener).

Elective courses:
<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC5023Z</td>
<td>Evolutionary Computation ....................................</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5025Z</td>
<td>Intelligent Systems ...........................................</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5027Z</td>
<td>Logics for Artificial Intelligence ........................</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5028Z</td>
<td>Ontology Engineering .........................................</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5029Z</td>
<td>Introduction to image processing and computer vision ........</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5030Z</td>
<td>Advanced Topics in Computer Science Masters 1 .........</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5031Z</td>
<td>Advanced Topics in Computer Science Masters 2 ..........</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5034Z</td>
<td>Machine Learning ...............................................</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5035Z</td>
<td>Natural Language Processing ..................................</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5036Z</td>
<td>Virtual Reality ..................................................</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>

CSC5034Z is a first semester module that is offered as an introductory Machine Learning module and will be recommended for those who have not done CSC3022F or equivalent.

The handbook outlining the current year’s Master's programme is available from the Department (http://www.cs.uct.ac.za).

Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Biostatistics [STA10]

The Biostatistics specialization trains students in the more advanced statistical methodology needed for the analysis of data from the Health and Biological Sciences.

Entry Requirements: A mark of at least 65% for an honours degree in Statistics equivalent to the UCT honours degree in Statistical Sciences or a mark of at least 65% for an honours degree in a Biological or Medical discipline that involved a substantial component of quantitative training, as assessed by Head of Statistical Sciences Department, plus successful completion of pre-courses including, introductory calculus, linear algebra and statistical inference, and R programming, as deemed necessary.

Prescribed curriculum
The curriculum comprises four compulsory core courses, elective courses and a minor dissertation.
### Compulsory courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA5063Z</td>
<td>Design of Clinical Trials</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5067Z</td>
<td>Longitudinal Data Analysis</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5069Z</td>
<td>Multivariate Statistics</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5072Z</td>
<td>Survival Analysis</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

Students will choose elective courses to bring the total number of coursework credits to a minimum of 90 NQF credits. Students may choose to take electives from other departments with prior approval of the Programme Convener.

### Elective courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA5061Z</td>
<td>Bayesian Decision Modelling</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5064Z</td>
<td>Ecological Statistics</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5066Z</td>
<td>Mathematical Modelling for Infectious Diseases</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5068Z</td>
<td>Machine Learning</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5071Z</td>
<td>Simulation and Optimisation</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5090Z</td>
<td>Advanced Topics in Regression</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>IBS5004Z</td>
<td>Bioinformatics for high-throughput biology</td>
<td>15</td>
<td>9</td>
</tr>
</tbody>
</table>

Students who do not hold a qualification in Statistics at the Honours level will be required to take pre-courses (STA5014Z) before being allowed to register for the degree. These could include Introductory Calculus, Matrix Methods, Introductory Inference and R-programming. They will also be allowed to take honours level courses up to 30 credits.

The minor dissertation component (90 NQF credits) is a research project based on a selected research topic.

### Minor dissertation

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA5058W</td>
<td>Biostatistics Minor dissertation</td>
<td>90</td>
<td>9</td>
</tr>
</tbody>
</table>

### Progression Rules:

Students are required to pass modules adding up to 90 credits to qualify for the coursework component of the degree.

- All core courses must be passed.
- Students are allowed to repeat a failed module once.
- Students should pass at least 3 modules in their first year of registration to be allowed to continue with the degree.
- Students may not progress to elective modules unless they have passed at least 3 core modules.
- By the end of their second year of registration, students should have passed at least 4 modules to be allowed to continue with the degree.
- Students may take a maximum of three years to complete their coursework requirement.
- Students may register for the dissertation components of the degree if they have passed 3 modules. They may, however, not submit their dissertations for examination before they have passed all required modules.

### Distinction Rules:

Unless otherwise specified, the degree will be awarded with distinction if the candidate obtains:

- 75% or higher in the credit-weighted average of coursework marks;
- marks of 75% or higher for at least 4 modules taken in Statistical Sciences;
- a mark of 75% or higher in the dissertation.
Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Data Science
[STA11]
Refer to page 45 for the details of this course, which are included under the section of interdisciplinary programmes.

The Faculty offers the following interdisciplinary Master’s programmes. The details of the structure of these curricula are given below.

Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Climate Change & Sustainable Development
[EGS06]

The interdisciplinary Master’s course with a specialisation in Climate Change & Sustainable Development, offered by the African Climate & Development Initiative (ACDI), has the following curriculum structure:

Prescribed curriculum
The curriculum comprises two compulsory core courses, at least two elective courses and a minor dissertation.

Compulsory courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGS5031F</td>
<td>Introduction to Climate Change &amp; Sustainable Development</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5032F/S</td>
<td>Climate Change Adaptation &amp; Mitigation</td>
<td>23</td>
<td>9</td>
</tr>
</tbody>
</table>

(Refer to the Department of Environmental & Geographical Sciences section in this handbook for detailed course outlines).

Students will choose at least two elective courses, totalling a minimum of 45 NQF credits, chosen from a range of courses which offer the student the opportunity to explore new areas, or look at climate and development through existing disciplinary backgrounds.

Elective courses (A partial list includes):

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AXL5408F</td>
<td>Tradition, Science and Environment</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>BIO5003Z</td>
<td>Biodiversity and climate change</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>EGS5016F</td>
<td>Capital, Politics and Nature</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5023F</td>
<td>Research Methods for Natural Scientists</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5024F</td>
<td>Managing Complex Human Ecological Systems</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5030S</td>
<td>Climate Modelling</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5038F</td>
<td>Climate Change and Predictability</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5039F</td>
<td>Urban Food Security</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5040F</td>
<td>Topics in Human and Environment Interaction</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5043F</td>
<td>Living with Global Change</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5045F</td>
<td>Geomorphology</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5046F</td>
<td>Water Resource Management</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>MEC5075Z</td>
<td>New and Renewable Technologies</td>
<td>20</td>
<td>9</td>
</tr>
</tbody>
</table>
(Details of these courses are available from the ACDI handbook or the relevant Faculty handbook. Additional elective options exist and may be added or withdrawn according to circumstances each year).

**NOTE:** The code EGS5012W represents the overall coursework component; the overall coursework result will be reflected against this code.

The minor dissertation component (90 NQF credits) is based on a three- to six-month research project, to be submitted at the end of January, with the possibility of extension to June. The choice of project and electives will be determined by prior qualification. Students may register for a minor dissertation in a range of departments across the University, including Biological Sciences, Environmental & Geographical Science, Geological Sciences, Oceanography, Chemical Engineering, Mechanical Engineering, Economics, Sociology, Law [Refer to relevant Faculty Handbooks]. Students registering for the dissertation component in a Faculty other than the host Faculty (which administers the course) will be subject to the examination criteria of that Faculty.

**Minor dissertation options include:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGS5029H</td>
<td>Minor Dissertation (Science)</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>GEO5005H</td>
<td>Minor Dissertation (Science)</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>END5069W</td>
<td>Minor Dissertation (Engineering &amp; Built Environment)</td>
<td>90</td>
<td>9</td>
</tr>
</tbody>
</table>

**Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Urban Studies [EGS08]**

The interdisciplinary Master’s course with a specialisation in Urban Studies - Southern Urbanism, offered by the African Centre for Cities (ACC), has the following curriculum structure:

**Prescribed curriculum**

The curriculum comprises one compulsory course, at least two core courses and one elective course, or three core courses without an elective, and a minor dissertation.

**Compulsory course:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGS5065W</td>
<td>City Research Studio: Research Practice &amp; Methods</td>
<td>23</td>
<td>9</td>
</tr>
</tbody>
</table>

**Core courses:** Students will choose at least two core courses, totalling a minimum of 46 NQF credits.

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGS5063F</td>
<td>Urban Theory</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>EGS5062F</td>
<td>The Urban Everyday</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>APG5089S</td>
<td>Curating Urban Regulation</td>
<td>23</td>
<td>9</td>
</tr>
</tbody>
</table>

(Refer to the Department of Environmental & Geographical Sciences section in this handbook for detailed course outlines).
Elective courses: Electives include modules with disciplinary and thematic focus on urban issues offered in various departments across the University, subject to approval by the course convenor. Students will choose at least one elective course, totalling a minimum of 23 NQF credits.

NOTE: The code EGS5060W represents the overall coursework component: the overall coursework result will be reflected against this code.

The minor dissertation component (90 NQF credits) is based on a three- to six-month research project, to be submitted in the second year. Students may register for a minor dissertation in the Faculty of Science (Department of Environmental & Geographical Science), the Faculty of Humanities or the Faculty of Engineering and the Built Environment. [Refer to relevant Faculty Handbooks]. Students registering for the dissertation component in a Faculty other than the host Faculty (which administers the course) will be subject to the examination criteria of that Faculty.

Minor dissertation options:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGS5061W</td>
<td>Urban Studies Minor Dissertation (Science)........</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>END5128W</td>
<td>Urban Studies Minor Dissertation (EBE)...............</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Urban Studies Minor Dissertation in the Humanities Faculty</td>
<td>96</td>
<td>9</td>
</tr>
</tbody>
</table>

(The code for minor dissertations completed in the Humanities Faculty will depend on the Humanities discipline in which the student chooses to complete the minor dissertation.)

Curriculum structure for the Master of Science/Master of Philosophy by coursework and minor dissertation, specialising in Data Science [STA11]

The interdisciplinary Master’s course with a specialisation in Data Science, is offered in collaboration with the Departments of Statistical Sciences, Computer Science, Astronomy, the Computation Biology Group (Faculty of Health Sciences) and the departments of Finance and Tax, Information Systems, Economics and AIFMRM (Commerce Faculty).

Entry requirements: A mark of at least 65% for a HEQSF level 8 qualification (equivalent in standard to that of a UCT degree) in any discipline that included a substantial research component and at least a first year Statistics course and a first year Computing Course. Students may be required to register for and pass STA1000P (the summer term offering of STA1000) before being allowed to register for the degree. Academic transcripts of applicants will be assessed by a selection committee made up of representatives from the participating departments. Applicants may be called for an interview to assess whether they meet entrance requirements.

Prescribed curriculum

The degree has two structures. Student can elect to register for core courses adding to 66 credits, and either elective courses adding to at least 24 credits and a minor dissertation counting 90 credits, or elective courses adding to at least 66 credits and a minor dissertation counting 60 credits.

Compulsory courses:
List from which core courses should be selected subject to meeting entrance requirements and consent of Program convenor:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC5007Z</td>
<td>Databases for Data Scientists</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5008Z</td>
<td>Visualization</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>CSC5011Z</td>
<td>MIT: Programming in Python</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>STA5075Z</td>
<td>Statistical and High Performance Computing</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>STA5076Z</td>
<td>Supervised Learning</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>STA5077Z</td>
<td>Unsupervised Learning</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>STA5092Z</td>
<td>Exploratory Data Analysis</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>
### Elective courses:

Students will choose a minimum of 4 elective courses to bring the total number of elective coursework credits to a minimum of 54 NQF credits. Available electives will depend on staff availability and not all electives will be offered each year. Students may choose to take electives from the list of core courses above, or from the list of elective courses below subject to satisfying the entrance requirements for the chosen courses and consent of course and program convenor, or from courses from other departments subject to consent of the programme and course conveners.

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST5004Z</td>
<td>Data Science for Astronomy</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>PHY5007Z</td>
<td>Data Science for Particle Physics</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>IBS5004Z</td>
<td>Bioinformatics for high-throughput biology</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5061Z</td>
<td>Bayesian Decision Modelling</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5073Z</td>
<td>Data Science for Industry</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5074Z</td>
<td>Decision Modelling for Prescriptive Analytics</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>STA5091Z</td>
<td>Data Analysis for High Frequency Trading</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5090Z</td>
<td>Advanced Regression</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5068Z</td>
<td>Machine Learning</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5066Z</td>
<td>Advanced Portfolio Theory</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5061Z</td>
<td>Bayesian Decision Modelling</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5071Z</td>
<td>Simulation &amp; Optimization</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5067Z</td>
<td>Longitudinal Data Analysis</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>STA5072Z</td>
<td>Survival Analysis</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>FTX5040F</td>
<td>South African Financial Markets</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>FTX5051S</td>
<td>Risk Management of Financial Instruments</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>FTX5028W</td>
<td>Topics in Financial Management</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>FTX5043F</td>
<td>Capital Markets and Financial Instruments</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>FTX5044H</td>
<td>Empirical Finance</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>ECOS5037S</td>
<td>Fintech and Cryptocurrencies</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>INF5006S</td>
<td>Financial Systems Design</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>ECOS5069S</td>
<td>Applied Time Series Analysis</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>ECOS5070S</td>
<td>Microeconomics</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>ECOS5046F</td>
<td>Advanced Econometrics</td>
<td>30</td>
<td>9</td>
</tr>
</tbody>
</table>

The minor dissertation component (90 or 60 NQF credits) is a research project based on a selected research topic. Students may register for a minor dissertation from the available options listed below. Students registering for the dissertation component in a Faculty other than the host Faculty (which administers the course) will be subject to the examination criteria of that Faculty.

### Minor dissertation options include:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course</th>
<th>NQF Credits</th>
<th>NQF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST5005W</td>
<td>Data Science in Astronomy</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>IBS5005W</td>
<td>Data Science in Bioinformatics</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>CSC5009W</td>
<td>Data Science in Computer Science</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>PHY5008W</td>
<td>Data Science in Physics</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>STA5079W</td>
<td>Data Science in Statistical Sciences</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>FTX5003W</td>
<td>Minor Dissertation in Finance</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>INF5005W</td>
<td>Minor Dissertation in IS</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>FTX5029W</td>
<td>Minor Dissertation in Financial Management</td>
<td>60</td>
<td>9</td>
</tr>
<tr>
<td>ECOS5023W</td>
<td>Minor Dissertation</td>
<td>60</td>
<td>9</td>
</tr>
</tbody>
</table>
Progression Rules:
Students are required to pass courses adding up to 90/120 credits to qualify for the course work component of the degree.
All core courses must be passed.
Students are allowed to repeat a failed course once.
Students should pass at least 3 courses in their first year of registration to be allowed to continue with the degree.
Students may not progress to elective courses unless they have passed at least 3 core courses.
By the end of their second year of registration, students should have passed at least 4 courses to be allowed to continue with the degree.
Students may take a maximum of three years to complete their coursework requirement.
Students may register for the dissertation components of the degree if they have passed 3 courses. They may, however, not submit their dissertations for examination before they have passed all required courses.

Distinction Rules:
Unless otherwise specified, the degree will be awarded with distinction if the candidate obtains:
75% or higher in the credit-weighted average of coursework marks; marks of 75% or higher for at least 4 modules in Statistical Sciences or Computer Science; and a mark of 75% or higher in the dissertation.

Rules for the degree of Master of Philosophy/Science continued

Registration and candidacy

FM4 A candidate for the degree shall register for not less than one academic year. Except by permission of Senate, full-time students are required to complete the requirements for the degree within two years. In exercising its discretion, Senate may take into account the nature of the research project undertaken.

Part-time studies

FM5 On the recommendation of the Head of Department, Senate may permit a candidate who is unable to complete the course within the minimum period, to complete the course part-time over a period of at least two years or more.

NOTE: No reduction in fees is made for part-time Master’s degree students.

Recognition of attendance at another institution

FM6 The Senate may accept, in lieu of, part or all of the required periods of attendance at other approved laboratories or institutions with facilities for the purpose of the proposed study, provided that supervision of the candidate by an approved officer of the University of Cape Town is assured.

Guidelines for candidates
Prior to registration the candidate must complete the Memorandum of Understanding (MoU) to be agreed in the first year of registration by both supervisor(s) and candidate, clarifying issues relating to respective roles and responsibilities, frequency of access to supervisor, sabbatical leave planned by supervisor, timing of annual leave by supervisor and student, expected working hours for student, timeframes, funding (if appropriate) and intellectual property. It is essential that students and
supervisors apply their minds carefully to proposed timelines, skills, equipment and resources required to achieve the goals stated in the research proposal. The MoU is subject to approval by the Head of Department and Dean. Before the start of the second and subsequent years of registration, a Progress & Planned Activity (PPA) form needs to be completed and agreed by both the candidate and supervisor(s). This process represents an annual review of progress and should be seen as an extension to the initial MoU. If in the opinion of the supervisor, adequate progress is not being made the PPA form should clearly lay down criteria (such as submission dates and milestones) against which further progress shall be measured.

In November of each year supervisors are required to provide the Faculty Examinations Committee (FEC) with a statement as to the progress (satisfactory or unsatisfactory) of their Master’s and PhD students. Progress is relative to the stated objectives within the MoU or PPA and takes into consideration factors that may have impeded progress that are not within the control of either the student or supervisor. In all cases where progress is considered to be unsatisfactory, despite mitigating factors, the student will be given a chance to respond and appeal against the supervisor’s statement. The FEC will deliberate on the report submitted by the supervisor together with the response from the student, as well as the MoU or PPA.

If the appeal is upheld, the student will be allowed to reregister and will be assigned a progress of ‘FEC concession to continue’. A new PPA form will be required to be completed with the supervisor, before registration, in which the objectives for the following year are clearly stipulated.

If the student’s ‘unsatisfactory’ progress is upheld by the FEC, the student will be coded ‘academically ineligible to continue’ and may not reregister. Appeals against this decision can be submitted to the Vice Chancellor’s nominee via the Deputy Registrar by research students, or to the Faculty Readmission Appeals Committee (RAC) by students registered for the coursework component of a Master’s degree.

The student may decide not to continue with their studies in which case they must complete a ‘Cancellation of Registration’ form and submit it to the Faculty Office for processing.

In select circumstances, the FEC may award a probation period to a student until reregistration commences. The student will be assigned a 'status pending final FEC decision'. The student will be informed of this decision in writing and will be required to immediately meet with the supervisor(s) and prepare a new PPA form within a specified period. Here the student and supervisor must devise a new work schedule for the stated period during which clear objectives must be agreed upon for reassessment of progress. At the end of this probation period the supervisor will again be required to provide the FEC with a statement as to the progress (satisfactory or unsatisfactory) of the student. Should the progress during this “pending” period be satisfactory, the student will be assigned the progress of ‘FEC concession to continue’ and will be allowed to reregister for that year. If progress is again considered to be unsatisfactory and the FEC supports this decision, then the student will be coded as ‘academically ineligible to continue’ and will not be permitted to register. Students have the right to appeal this decision if there are relevant extenuating circumstances that might have impeded progress. Appeals against this decision can be submitted to the Vice Chancellor’s nominee via the Deputy Registrar by research students, or to the Faculty Readmission Appeals Committee (RAC) by students registered for the coursework component of a Master’s degree.

In appropriate cases, the supervisor(s) and Head may propose to Faculty that a candidate’s registration be converted to a PhD. This should take place at the end of the first year/beginning of the second year of MSc/MPhil registration.
The dissertation

FM7.1 The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research project and an appropriate acquaintance with the relevant literature. It shall be clearly presented and conform to the standards laid down from time to time by the department and the Faculty (refer also to Faculty Postgraduate Student Information Handbook).

FM7.2 (a) The dissertation shall be accompanied by a written undertaking by the candidate, empowering the University to reproduce for the purpose of research the whole or any part of the dissertation.

(b) A publication may not, without the prior permission of the Senate, contain a statement that the published material was, or is to be, submitted in fulfilment or part fulfilment of a Master’s degree.

FM7.3 A candidate required to submit a dissertation shall:

(a) Inform the Head of Department and Faculty Office in writing of his or her intention to submit the dissertation for examination within two weeks of the intended submission date.

(b) Submit for examination a digital copy in the format specified. It is recommended that the dissertation be submitted for examination five months before the graduation ceremony to allow time for the examination process to run its course. The University does not however undertake to reach a decision on the award of the degree by any specific date. Should an examiner/s request a hard copy, the candidate will be asked to provide this to the Faculty Office.

(c) Submit a digital copy of the final corrected version of the dissertation in the format specified, for the Library.

Note: Depending on the date of submission, certain fee rebates may apply. See Book 12, Student Fees, for details.

Guidelines for candidates

The dissertation will usually consist of a detailed report on the conduct of, and analysis of the results of, a research project performed under the close guidance of a suitably qualified supervisor(s). It is not essential for the Master’s degree that the dissertation constitutes a distinct contribution to knowledge in the subject, nor that the research project(s) undertaken necessarily be original. The degree is usually regarded as a training course to equip the candidate with the skills necessary either for employment in a given field, or for further, independent research for the degree of PhD in the same or related subject area. The course of training provided, and the research project(s) undertaken, will usually be less rigorous, and require less independent thought, than would study for a PhD.

Length of Master’s dissertation

A Master’s dissertation, submitted in fulfilment of the degree, should not exceed 30,000 words (appendices excluded). Any request to deviate from these limits must be discussed with the supervisor and forwarded with the supervisor’s comments to the Dean for consideration and possible approval. Minor dissertations completed as part of a Master’s by coursework and minor dissertation should be shorter than full dissertations; on the order of 50 pages or 17,000 – 25,000 words. For further details, refer to the “Faculty Postgraduate Student Information Handbook”, section 12, Submission of a dissertation/thesis.
A candidate who contemplates including published papers in their dissertation must accept that approval to do so is not automatic. For further information, refer to the Guidelines for the inclusion of publications in the PhD thesis, available from the Faculty Office. The rules for publishing papers in a PhD thesis will also apply to all Master’s dissertations. If a candidate contemplates doing this, they must note this in their MoU with their supervisor each year. In addition, the candidate and supervisor are advised to seek the advice of the Faculty’s Higher Degrees Committee about their plan to do so at an early stage. A request to include publications in a dissertation should generally include the following:
1. Title of dissertation.
2. A brief overview of the dissertation structure (it must include a general introduction and a discussion chapter that pulls the various chapters in the dissertation together).
3. A list of publications that will be included as self-standing chapters, with the authors, title and journal information, together with a comment on the student’s contribution to each article.
4. Declaration from each co-author and supervisor(s) that they agree that the article may be included in the dissertation, and what their individual contributions were.
5. Declaration from any student co-author that the work will not be used for their higher degree purposes.

Award of the degree

FM8.1 The degree of MSc/MPhil may be conferred
(a) after acceptance by the Faculty of a dissertation constituting a detailed report on a research project performed under the guidance of an approved supervisor (Master’s by dissertation only). The dissertation must be presented for formal examination;
or
(b) after a programme of advanced formal training and supervised research, for which a minor dissertation would be a partial requirement (Master’s by coursework and minor dissertation). The coursework and minor dissertation must each be passed separately for the award of the degree. The minor dissertation must be presented for formal examination.

FM8.2 The degree may be awarded with distinction. In the case of a Master’s by coursework and minor dissertation, a distinction must be obtained in both components for the award of the degree with distinction. Where this is not achieved, a distinction may be awarded and recorded in one of the components. Where the coursework requires registration for individual courses, the following distinction rules apply: Unless otherwise specified, the Master’s degree will be awarded with distinction if the candidate obtains: 75% or higher in the credit-weighted average of coursework marks; marks of 75% or higher in at least 75% of the coursework credits; and a mark of 75% or higher in the dissertation.

FM8.3 Supplementary examinations are not awarded to candidates for the degree of Master.

Rules for the degree of Doctor of Philosophy (PhD)

Admission
The entrance requirement to the PhD is a Master’s degree or equivalent. Prospective candidates wishing to register for a PhD should have a discussion with a prospective supervisor and Head of Department in the appropriate field of study prior to applying formally to the University. It is sometimes possible to upgrade to a PhD after completing the first year of Master’s research.
The thesis
Where a candidate intends to submit their thesis for examination, they must inform the Doctoral Degrees Board (DDB) Office in writing of their intention to do so 6-8 weeks prior to the intended submission date. It is recommended that the thesis be submitted for examination five months before the graduation ceremony to allow time for the examination process to run its course. The University does not, however, undertake to reach a decision on the award of the degree by any specific date.

Length of the PhD thesis
The Senate has approved a recommendation from the DDB that a doctoral thesis should not exceed 80,000 words (rule GP6.8; this excludes appendices and illustrations). Any request to deviate from these limits must be discussed with the supervisor and forwarded with the supervisor's comments via the Dean to the DDB for approval. For further details, refer to the “Faculty Postgraduate Student Information Handbook”, section 12, Submission of a dissertation/thesis.

A candidate who contemplates including published papers in their thesis must accept that approval to do so is not automatic. For further information, refer to the Guidelines for the inclusion of publications in the PhD thesis, available from the DDB or Faculty Office. If a candidate contemplates doing this, they must note this in their MoU with their supervisor each year. In addition, the candidate and supervisor are advised to seek the advice of the Faculty’s Higher Degrees Committee about their plan to do so at an early stage. While the Faculty committee will not be able to give a binding answer, it will be able to indicate to the candidate and their supervisor whether:

- It is likely to support the proposal. Where published papers are included, the thesis must nonetheless show acceptable academic style, scholarly content and coherence as a connected account with a satisfactory introduction, statement of thesis and conclusion.
- It is unlikely to support submission according to the plan outlined. A binding decision can only be given by the DDB. It is accepted that this may not be possible until sometime into the work.

A request to include publications in a thesis should generally include the following:
1. Title of thesis.
2. A brief overview of the thesis structure (it must include a general introduction and a discussion chapter that pulls the various chapters in the thesis together).
3. A list of publications that will be included as self-standing chapters, with the authors, title and journal information, together with a comment on the student’s contribution to each article.
4. Declaration from each co-author and supervisor(s) that they agree that the article may be included in the thesis, and what their individual contributions were.
5. Declaration from any student co-author that the work will not be used for their higher degree purposes.

Rules for the degree of Doctor of Science

FD1 The degree of Doctor of Science is a senior degree and is awarded for substantial and original contributions to knowledge in a field of scientific endeavour. Such contribution will normally be the result of work carried out and published over a period of years and will be such as to have established the candidate's position as a leading authority in the field(s) in which they have worked. Candidates will ordinarily be senior scientists with a PhD, post-doctoral experience, and a track record of at least ten years as a leading researcher.

FD2 A candidate for the degree must be a graduate of:
(a) the University (only in exceptional cases will candidates who do not have a PhD be considered); or
(b) a university recognised by the Senate for the purpose (only in exceptional cases will candidates who do not have a PhD be considered) who has or has had established research or teaching associations with the University.

FD3

A candidate for the degree of Doctor of Science
(a) must submit published work, which must constitute a substantial, original and important contribution to learning in some branch of science;
(b) may submit other published or unpublished work as collateral testimony of their fitness for the degree;
(c) must submit a formal application and register for the degree, should the Faculty Committee of Assessors accept the nomination.

FD4

(a) The examination will consist primarily of an assessment of the work submitted by the candidate, but a candidate shall, if required by Senate, present themself for an oral examination on the subject of the work presented.
(b) No work will be accepted which has already been accepted by another university for the purpose of obtaining a degree.

FD5

A candidate must submit the publications they wish to be assessed for examination or as collateral testimony. If, at the date of its presentation, any portion of the work submitted has not been published, or is not being published, in a manner satisfactory to the University, the candidate must grant the University in writing a free licence to reproduce the work in whole or in part for the purpose of research. The University may waive the right so granted if the candidate subsequently makes arrangements for publication in a manner satisfactory to the University.

NOTES:
1. The DSc is the highest and most prestigious degree awarded in the Faculty of Science; it is of higher status than the Doctor of Philosophy (PhD) degree and is awarded very rarely. In these respects, the DSc at UCT is based on the DSc tradition followed by many universities in the United Kingdom. (Some universities confer the DSc degree for a thesis on research done under supervision; such a DSc is the equivalent of a PhD. UCT does not.)
2. The DSc at UCT is awarded on the basis of published research work in a specific scientific field in which the supplicant has been active and productive for at least ten years.
3. Examiners for the DSc will be asked to consider whether the work submitted for the DSc constitutes a substantial, original and important contribution to learning in some branch of science in the sense that
   (a) it is likely to be regarded as 'benchmark' research in the relevant field now and in years to come, and
   (b) it demonstrates that the candidate has achieved a leadership role (internationally) in that field of scientific research and will be reminded that the emphasis in assessing the work of a DSc candidate must be on originality, substance and excellence.
DEPARTMENT OF ARCHAEOLOGY

The Department is housed in the Beattie Building, 5 University Avenue
Telephone (021) 650-2353 Fax (021) 650-2352
The Departmental abbreviation for Archaeology is AGE.

Associate Professor and Head of Department:
D D Stynder, MA PhD Cape Town

Professor and South African Research Chair in Stable Isotopes in Archaeology and Paleo-environmental Studies:
J C Sealy, MSc PhD Cape Town

Senior Scholars:
S L Hall, MA Witwatersrand DPhil Stell
J E Parkington, MA PhD Cantab

Emeritus Professor:
N J van der Merwe, MA PhD Yale

Professors:
R R Ackermann, MA Arizona PhD Wash U St Louis
S Chirikure, MA PhD UCL

Emeritus Associate Professor:
A B Smith, PhD Berkeley

Senior Lecturer:
Y Sahle, MA Addis Ababa PhD Cape Town

Lecturers:
V Hare, MSc PhD Oxford
V Lupuwana, MA PhD Cape Town

Research Officer:
J Luyt, MSc PhD Cape Town

Chief Scientific Officer:
L Hutten, BSc Hons MSc Pret

Administrative Officer:
L J Cable

Laboratory Assistant:
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Departmental Assistant:
M Kanye

RESEARCH IN ARCHAEOLOGY
The Department of Archaeology investigates how people have changed through time, in order to gain insight into why we are the way we are today. We study the cultural and biological records of the past and present in order to do this. South Africa is endowed with a rich and unique archaeological, fossil and ethnographic record, giving us considerable advantage in this respect. Within this broad theme, our researchers are especially interested in the dynamics of human change over the Quaternary Period, and indeed change, process, innovation, complexity, and adaptation are core ideas that thread throughout all of our work. This time period spans a large part of our evolutionary history, and incorporates the record of early ape-like hominins, the first members of our genus Homo, modern human origins, hunter-gatherer societies, farming communities, and colonists. Our specific areas of focus include but are not limited to: technological change and innovation; study of past diets and environments; understanding and reconstructing palaeocology, the dynamics of complex social landscapes; evolutionary process and the shaping of diversity.
Undergraduate Courses

Lectures are usually held four times a week, but the fifth day may also be used and should therefore be kept free.

First-Year Courses

AGE1002S  THE HUMAN PLANET: PREHISTORY TO PRESENT
18 NQF credits at NQF level 5
Convener: Dr V Hare
Course entry requirements: None
Course outline:
This aim of this course is to introduce the study of archaeology, and the study of human origins. Archaeology is defined as the study of the human past through material culture. Over the second semester, this course presents an overview of prehistory leading up to the modern day, as well as the broader climatic, geographic, ecological, social, and cultural contexts which made modern humans. In particular, it looks at the past through the lens of what people leave behind - the archaeological record.
What you can expect to take away from this course:
• A broad understanding of the timescales of human prehistory, and our interactions with the Earth System, from the Early Pleistocene through to the Historical period, and the emergence of present day societies (the "Anthropocene").
• An understanding of current concepts in archaeological thought, and the complexities of relationships between archaeologists, science, and society today.
• Familiarity with the foundational skills and terminology necessary for present-day archaeological research and investigation.
This broad course is suitable for all undergraduate students in the sciences and humanities; but particularly for those wishing to major in Archaeology, Environmental & Geographical Science, or cognate subjects.
Lecture times: Monday - Thursday, 5th period
DP requirements: Attendance at lectures and tutorials and completion of assignments.
Assessment:
Assignments and class tests count 50% towards the final mark and one 3-hour examination written in November counts 50%. A sub-minimum of 40% is required for the examination.

AGE1005L  TOWARDS A DECOLONISED SCIENCE IN SOUTH AFRICA
(offered during winter term)
18 NQF credits at NQF level 5
Convener: Professor R Ackermann
Course outline:
This course addresses some key topics relevant to the decolonization of science in South Africa. Course objectives are as follows: (1) to contrast the science behind human diversity (e.g. skin colour variation, sex) with socially-constructed categories (e.g. race, gender binary); (2) to demonstrate how the history of racism and gender bias has limited the focus of scientific enquiry; (3) to highlight the importance of diversity and diverse voices in the production of scientific knowledge, (4) to show how African voices in particular have shaped and are continuing to shape the trajectory of science.
The approach is a blended learning environment which combines online lectures, tutorials, tasks, and assessments. Guests both within UCT and from further afield will be brought in to supplement material through lectures, interviews and/or short case studies.
Assessment:
Class participation (workshops/tutorials and online discussions) 20%, online tests 20%, final exam 30%, final project 30%. NOTE: The allocation of 30% to the final exam breaks with the traditional 50% threshold. Given the format and intense interactive nature of the courses, the decision has been made that a large component of student assessment should be a course project.
which allows them to engage with and reflect on their changing understanding of decolonisation and race in the course. This project will be equal weight to the exam, and will be externally examined.

Second-Year Courses

**AGE2011S**  HUMAN EVOLUTION  
24 NQF credits at NQF level 6  
**Convener:** Professor R Ackermann  
**Course entry requirements:** Any first-year Science course, or any first-year Humanities course from a related discipline such as Social Anthropology, Historical Studies, Sociology, etc or by permission of the Head of Department.  
**Course outline:**  
In AGE2011S we examine the record of primate and human evolution, showing how fossil skeletons and artefacts are interpreted in terms of human behaviour and evolutionary processes. We also consider genetic and other comparative evidence that are increasingly providing insight into the origin of our lineage. We answer questions such as: Why did our ancestors evolve in Africa? How did we evolve such large and complex brains? What advantage does bipedalism provide? When do humans begin to make tools? Why is human skin colour so variable? What makes humans unique?  
The syllabus for AGE2011S includes practical sessions for the study of primate and human, fossil and recent skeletal material and the artefacts associated with our ancestors.  
**Lecture times:** Monday - Thursday, 2nd period, Practicals: One 2-hour practical per week, at times to be arranged  
**DP requirements:** Attendance at lectures and practicals and completion of assignments.  
**Assessment:** Essays and tests count 50%; one 3-hour examination in October/November counts 50%. A sub-minimum of 40% is required for the examination.

**AGE2012F**  THE FIRST PEOPLE  
24 NQF credits at NQF level 6  
**Convener:** Dr Y Sahle  
**Course entry requirements:** Any first-year Science course; or any one of AXL1400F (was SAN1015F,) or AGE1002S or equivalent first-year semesters; or AGE2011S; or any first-year Humanities course from cognate disciplines such as Anthropology, Historical Studies, Sociology; or by permission of the Head of Department.  
**Course outline:**  
All humans living today have a common African origin. The first humans were hunter-gatherers, as were their descendants. Indeed, our ancestors were hunter-gatherers for at least 99% of our evolutionary history, which means that our physical, psychological and social selves have been shaped by this way of life. We learn about the origin and evolution of our hunter-gatherer ancestors from genetic, fossil, archaeological and ethnographic evidence. Studies of Khoesan peoples of southern Africa have contributed significantly to our understanding of such societies. In this course we focus on the hunter-gatherer way of life over the past few hundreds of thousands of years. Specific topics covered include modern human origins, the Middle and Later Stone Age, ethnographic studies of Khoesan, the origins of pastoralism, coastal vs. arid environment adaptations, rock art and symbolic interpretation, genetics and biology, revisionism, and contemporary socio-politics and identity. In the weekly practical sessions, students will conduct hands-on, problem-solving exercises with archaeological materials.  
**Lecture times:** Monday - Thursday, 2nd period, Practicals: One 2-hour practical per week, at times to be arranged  
**DP requirements:** Attendance at lectures and practicals, completion of assignments and participation in a one-day fieldtrip.  
**Assessment:** Assignments and class tests count 50% towards the final mark and one 3-hour examination written in June counts 50%. A sub-minimum of 40% is required for the examination.
Third-Year Courses

AGE3006H  DIRECTED READING & RESEARCH
36 NQF credits at NQF level 7
Course entry requirements: Only for students specialising in Archaeology, with permission of the Head of Department.
Course outline: A flexible intensive study course in a specific area customised to the needs of individual students.
Lecture times: By arrangement
DP requirements: Completion of assignments.
Assessment: Essays and tests count 20%; a long paper counts 40%; one 3-hour examination in November counts 40%.

AGE3011F  THE ROOTS OF RECENT AFRICAN IDENTITIES
36 NQF credits at NQF level 7
Convener: To be advised
Course entry requirements: AGE2011S or AGE2012F, or by permission of the Head of Department.
Course outline: In this course we explore the history of Africa’s people over the past 2000 years with special reference to southern Africa. Why are southern African populations so diverse? What lies behind the linguistic map that we see today? What social, technological and palaeoenvironmental systems shaped the evolution of societies? Did Africa have any civilisations? Who did Africa interact with? We discuss the archaeological record of artefacts, settlement systems, food waste, environmental contexts and human skeletons. We deploy historical, material science, molecular science, anthropological and palaeoclimatic techniques to explore this rich and diverse heritage of the last two thousand years.
Lecture times: Monday - Thursday, 4th period, Practicals: One 2-hour practical per week, at times to be arranged
DP requirements: Attendance at lectures and practicals, completion of assignments.
Assessment: Assignments and class tests count 50% towards the final mark and one 3-hour examination written in June counts 50%. A sub-minimum of 40% is required for the examination.

AGE3012S  GLOBAL DIASPORAS & THE ARCHAEOLOGY OF THE HISTORICAL PAST
36 NQF credits at NQF level 7
Convener: Dr V Lupuwana
Course entry requirements: AGE2011S or AGE2012F, or by permission of the Head of Department.
Course outline: Over the last thousand years, southern Africa has been connected to the world in a number of ways. From the 16th century the European push to open trade routes to the east increasingly disrupted earlier interactions between the southern African interior and the wider Indian Ocean region that had been in place from the 1st millennium AD. The European diaspora into southern Africa created new orders of power, control and trade that had massive impacts on indigenous societies who were subjected to slavery, genocide and eventually apartheid. In this course we look at these interactions and transformations from both foreign and local viewpoints, in which the idea of frontier is a central theme. The focus is on archaeological evidence and the contribution it makes to understanding the texture of life on frontiers and the new identities that frontiers created. In doing this the relationship between archaeological evidence, written sources and oral history is critically addressed, particularly in the search for perspectives that address cultural change and continuity at the local scale.
Lecture times: Monday - Thursday, 4th period, Practicals: One 2-hour practical per week, at times to be arranged
DP requirements: Attendance at lectures and practicals, completion of assignments.
Assessment: Assignments and class tests count 50% towards the final mark and one 3-hour exam written in November counts 50%. A sub-minimum of 40% is required for the examination.

AGE3013H  ARCHAEOLGY IN PRACTICE
Please note that this course requires you to make yourselves available for field excursions during the first (March/April) and second (June/July) vacations of the academic year. While the majority of field excursions are likely to be day trips, there will be a four-week residential field-school during the second vacation. It is mandatory to participate fully in all field excursions.

36 NQF credits at NQF level 7
Convener: Associate Professor D Stynder
Course entry requirements: AGE2011S and AGE2012F, or by permission of the Head of Department.
Course outline:
The course will run throughout the academic year. The lecture programme (campus and field) will be flexible and a schedule will be decided upon in consultation with participating students. The curriculum covers training in site location, excavation, field note taking, stratigraphic observation, site survey, use of GPS and total station, photography, rock art recording, processing of field observations, spread sheet use, preliminary conservation and accessioning of materials, preliminary analyses and report writing.
DP requirements: Participation in all field excursions and completion of all assignments.
Assessment: A class test counts 30%; a group project counts 20%; the final examination counts 50%.

Postgraduate Courses

AGE4000W  ARCHAEOLGY HONOURS
Since the code AGE4000W will not carry a NQF credit value, students will be concurrently registered for AGE4003W (coursework component of 112 NQF credits) and AGE4004W (research project of 48 NQF credits).
160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: Dr V Hare
Course entry requirements: A BSc degree majoring in Archaeology and an acceptable academic record. Students applying for admission to the Honours programme in Archaeology must satisfy the Head of Department that they have adequate fieldwork experience.
Course outline:
The purpose of the Honours programme in Archaeology is to look in depth at current issues in the discipline, both internationally and in southern Africa. Those taking part are expected to become fully involved in the academic life of the Department, attending such seminars as may be given by staff members, research students and visitors. In addition, they must participate in the structured programme of lectures and tutorials, and write a research dissertation. The dissertation is a central part of the Honours programme. Each student must prepare a project proposal, worked out with a supervisor and approved by the Head of Department. In addition, students must take part in one open seminar, where they present their project to the Department. All students are required to participate in two weeks of fieldwork.
Assessment: On average the course work component counts 70% (this includes 50% from final examinations) and the research project counts 30%. A sub-minimum of 50% is required for the research project. These component parts of the course will be combined in a final overall mark which will be reflected against the course code AGE4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.
AGE4001W  ARCHAEOLOGY & ENVIRONMENTAL SCIENCE HONOURS

*Since the code AGE4001W will not carry a NQF credit value, students will be concurrently registered for AGE4003W (coursework component of 112 NQF credits) and AGE4006W (research project of 48 NQF credits).*

160 NQF credits at NQF level 8; the combined credit value of both components.

**Convener:** Dr V Hare

**Course entry requirements:** A BSc degree with majors in both Archaeology and Environmental & Geographical Science. Acceptance will be at the discretion of the Head of Department.

**Course outline:**
Using the resources of both the Departments of Archaeology and Environmental & Geographical Science, this Honours programme focuses on the palaeoenvironmental context in which humans lived during the long course of the Quaternary. Course requirements include modules from both Archaeology and from Environmental & Geographical Science and a research project (48 credits).

**Assessment:** On average the coursework component counts 70% (this includes 50% from final examinations) and the research project counts 30%. A sub-minimum of 50% is required for the research project. These component parts of the course will be combined in a final overall mark which will be reflected against the course code AGE4001W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

AGE5000W  ARCHAEOLOGY DISSERTATION

180 NQF credits at NQF level 9

**Course outline:**
See also AGE5006W, Faculty of Humanities Handbook.

This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material.

AGE6000W  ARCHAEOLOGY THESIS

360 NQF credits at NQF level 10

**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF ASTRONOMY

The Department is housed in the RW James Building, 9 University Avenue
Telephone (021) 650-5830; website http://www.ast.uct.ac.za
The Departmental abbreviation for Astronomy is AST.

Professor and Head of Department:
P A Woudt, MSc Groningen PhD Cape Town

South African Research Chair in Astrophysics & Space Science:
T H Jarrett, PhD Amherst

SKA South African Research Chair in Multi-wavelength Extragalactic Astronomy:
D J Pisano, MSc PhD Madison

SALT South African Research Chair in Fast Transients and Gravitational Wave Counterparts:
P J Groot, MSc PhD Amsterdam

UCT-UWC-SKA Chair in Radio Astronomy:
R Taylor, MSc PhD Vancouver

Adjunct Professor and SAAO National Facilities South African Research Chair:
M Bershady, MSc PhD Chicago

Emeritus Distinguished Professor of Natural Philosophy:
B Warner, BSc Hons PhD DSc London MA DSc Oxon DSc (h.c) Cape Town Hon FRSSAf Hon Fell UCL

Emeritus Professor:
R C Kraan-Korteweg, Diplom (MSc) Basle PhD Phil II Basle FRSSAf, MASSAf

Honorary Professors:
W J G de Blok, MSc PhD Groningen
P Väisänen, MSc PhD Helsinki
P A Whitelock, DIC PhD London Hon FRAS FRSSAf MASSAf

SKA Visiting Professor:
R Fender, PhD OU Milton Keynes

Associate Professor:
S-L Blyth, MSc PhD Cape Town

Adjunct Associate Professors:
V McBride, MSc Cape Town PhD Soton
S Mohamed, DPhil Oxon

Senior Lecturers:
L Marchetti, MSc PhD Padova
K J van der Heyden, BSc Hons MSc Cape Town PhD Utrecht

Lecturers:
J Delhaize, PhD Perth
I Monageng, MSc PhD Cape Town

Adjunct Lecturer:
B Frank, PhD Cape Town

Honorary Research Associate:
D A H Buckley, MSc Canterbury PhD Canberra

Computer System Manager:
S Funani

Administrative Officer:
C Marsh

NASSP Administrator:
R Fagodien

Administrative Assistant:
R Daniels
INTER-UNIVERSITY INSTITUTE FOR DATA INTENSIVE ASTRONOMY (IDIA)
The Institute, hosted in the Department of Astronomy, is a partnership between the University of Cape Town, the University of the Western Cape, the University of Pretoria and the South African Radio Astronomy Observatory (SARAO). It involves researchers in astronomy, physics, statistics and computer science at the four partner institutes and the UCT eResearch Centre. The Institute also houses the UCT-IDIA Visualisation Lab.

Director:
R Taylor (UCT/UWC), MSc PhD Vancouver

Associate Directors:
B Frank (SARAO/UCT), PhD Cape Town
C Odman (UWC), PhD Cantab
R Simmonds (UCT CSC), PhD Bath

Operations Manager:
J Smith, MSc Cape Town

Project Manager:
K Kirkham, MSc York MPhil Cape Town

Senior Visualisation Developer:
A Comrie, PhD Cape Town

Visualisation Developer:
A Pinska, MSc Cape Town

Senior Data Scientists:
D Aikema, PhD Calgary
J Bochenek, PhD Tallahassee

Senior Technical Specialists:
J-E Avenant
M Currin

Senior Technical Specialist Bioinformatics Support:
D Kennedy

Astronomy Support:
J Collier, PhD Sydney

Junior Astronomy Support:
O H Moloko

Senior Systems Administrator:
R Hall (UWC), MSc Cape Town

Administrative Manager:
N Walker

Development and Outreach Administrator:
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Big scientific data changes the way we do science. Scientists themselves have to change their habits and approaches when data have to live in the cloud. Platforms like IDIA’s research cloud also need to enable scientists to keep applying the scientific method; visualising their data, reprocessing it, testing hypotheses on it, etc. without having to wait for weeks for results because the data sets are so big.

The overarching goal of IDIA is to build within the South African university research community the capacity and expertise in data intensive research to enable global leadership on MeerKAT large survey science projects and large projects on other SKA pathfinder telescopes, leading to leadership on SKA phase 1 Key Science programs. One of the first elements to reach this goal was for IDIA to set up a data-intensive research cloud facility to service its scientific community. Currently, IDIA is the primary platform to service five out of eight MeerKAT large survey projects.

For more information on IDIA and its activities, see https://www.idia.ac.za
RESEARCH IN ASTRONOMY
Research at the Astronomy Department covers a number of distinct themes, ranging from *Galactic Composition and Stellar Evolution* (Professor Whitelock and Adjunct Associate Professor Mohamed) and *Accretion Physics in Compact Stellar Binaries* (Professors Woudt, Groot, Warner and Fender, Adjunct Associate Professor McBride and Dr Monageng) to *Neutral Hydrogen and Dark Matter Content of Nearby Galaxies* (Professors Jarrett, de Blok, Pisano and Associate Professor Blyth), *Star Formation and Galaxy Evolution* (Professors Kraan-Korteweg, Bershady, Pisano, Vaisanen, Associate Professor Blyth and Drs Delhaize, Marchetti and van der Heyden), *Large-Scale Structures of Galaxies and the Zone of Avoidance* (Professors Kraan-Korteweg and Jarrett and Associate Professor Blyth), and *Cosmic Magnetism* (Professor Taylor). The department hosts numerous postdoctoral fellows working in these research themes: Drs Cavallaro, Chen, Macfarlane, Nyamai, Sekhar, Karupati and Titus.

In each of these thematic areas, expertise exists in the department across a range of ground- and space-based observational techniques in X-ray, optical, infrared and radio astronomy, with the additional expertise in developing optical astronomical instrumentation. Besides leading many research projects on SALT, members of the Department of Astronomy lead four of the eight MeerKAT Large Survey Projects.

**Undergraduate Courses**

**First-Year Courses**

**AST1000S**  **INTRODUCTION TO ASTRONOMY**

*Two sessions are held in the Planetarium of Iziko Museums of Cape Town, plus six tutorial sessions and four practical sessions.*

18 NQF credits at NQF level 5

*Convener:* Associate Professor S L Blyth

*Course entry requirements:* None

*Course outline:* The course introduces students to the subject of Astronomy and our place in the universe from the small scales of the Earth-Sun-Moon system to the large scales of distant galaxies. It aims to provide insight into how we study astrophysical objects via EM radiation and telescopes (theory) as well as providing a high-level overview of objects in the universe, moving outwards from our solar system, to stars and stellar remnants, our galaxy and others, dark matter and cosmology, and the study of the universe at the largest scales. The course is open to all interested students as well as providing a solid introduction to those wishing to continue in astrophysics.

*Lecture times:* Monday - Friday, 5th period

*DP requirements:* Satisfactory attendance at lectures and compulsory attendance at Wednesday afternoon sessions and submission of bi-weekly problem sets; class record of at least 35%.

*Assessment:* Class record: 50%, June examination 2 hours: 50%. Sub-minimum: 40% for final examination.

**Second-Year Courses**

**AST2002H**  **ASTROPHYSICS**

*One fieldtrip to the South African Astronomical Observatory, Sutherland.*

24 NQF credits at NQF level 6

*Convener:* Dr L Marchetti

*Course entry requirements:* PHY1004W, MAM1000W
Course outline:
This course presents an introduction to the theoretical aspects of modern astrophysics. The key objective is to illustrate the application of physical laws in an astronomical context and to explain how we know what we do about the universe and its constituents. Subject matter broached includes: Celestial mechanics; radiation laws; blackbody radiation, Planck function and approximations; magnitudes; the hydrogen atom; stellar spectroscopy; stellar evolution and remnants; special relativity; the Earth-Moon system; the Solar system; extrasolar planets; stellar motions; the Milky Way and other galaxies; the extragalactic distance scale; large scale structure; Newtonian cosmology.

Lecture times: Monday - Friday, 2nd period, Term 2 and 4, Tutorials: 10 Compulsory tutorial/practical sessions over the year, Wednesday, 14h00 -16h30.

DP requirements: Satisfactory attendance at lectures and tutorials; class mark of at least 35%.

Assessment: Three class tests count 25%; 6 compulsory tutorials/practicals including a virtual observatory project, an essay and one presentation count 20%. Regular quizzes count 5%. One 2-hour final examination in November counts for 50%; subminimum requirement of 40% for final examination.

AST2003H ASTRONOMICAL TECHNIQUES
One observational radio astronomy project and one observational optical astronomy project, by arrangement. One fieldtrip to South African Astronomical Observatory, Sutherland.
24 NQF credits at NQF level 6
Convener: Professor P A Woudt

Course entry requirements: PHY1004W and MAM1000W (pre-requisites), or PHY1023H and MAM1005H (pre-requisites) and PHY1004W and MAM1006H (co-requisites)

Course outline:
This course combines a large practical component (radio and optical astronomy practicals) with theoretical background in astronomical techniques, instrumentation and data analysis. The techniques, instrumentation and data analysis section includes: Positional astronomy: time systems, spherical astronomy, co-ordinate systems and conversions, astrometry; Detection systems: interaction of radiation and matter, ultraviolet and optical detectors; Optics and telescope design; Multi-wavelength astronomy: infrared, ultraviolet, x-ray and gamma–ray astronomy, fundamentals of radio astronomy; Observational techniques: photometry and spectroscopy; Orthodox statistics: probability distributions, Chi-squared distribution, propagation of errors; Stochastic processes and noise: photon noise.

Lecture times: Monday, Tuesday and Thursday, 2nd period, Term 1 and 3, Tutorials: Five over the year, Wednesday, 14h00 - 16h30, by arrangement.

DP requirements: Satisfactory attendance at lectures and tutorials. Attendance at all fieldwork practicals. Class record of at least 35%.

Assessment: Two class tests 15%; 5 tutorials over the year in which students will learn astronomical data analysis and statistical techniques count 10%. One 2-hour theoretical examination counts 25%; two projects count 40% and presentation counts 10%

Third-Year Courses

AST3002F STELLAR ASTROPHYSICS
Two evening observing sessions at the UCT teaching observatory, by prior arrangement.
36 NQF credits at NQF level 7
Convener: Dr I Monageng


Course outline:
This course introduces fundamental concepts such as radiative transfer and opacity to explain the observed spectroscopic and photometric signatures of stars. Students will interpret the observed
intrinsic properties of stars through a theoretical understanding of the energy production inside stars and the propagation of the electromagnetic radiation from the stellar core through its interior to the stellar surface, from where the radiation escapes unhindered. The life cycle of stars is considered in great detail, from the collapse of an interstellar gas cloud to the end products of stellar evolution: white dwarfs, neutron stars and black holes. This course includes an observational component in which the students use the modern teaching observatory on campus to derive fundamental properties of stars and stellar systems.

**Lecture times:** Monday - Friday, 2nd period, Practicals: One practical or tutorial per week, Wednesday, 14h00 - 16h30.

**DP requirements:** Satisfactory attendance at lectures and tutorials; class record of at least 35%.

**Assessment:** Class record 50% (this includes two class tests, tutorials, and practicals); one 2-hour final examination 50%; subminimum requirement of 40% for final examination.

### AST3003S GALACTIC & EXTRAGALACTIC ASTROPHYSICS

*One observing trip to Sutherland in the semester break is compulsory.*

36 NQF credits at NQF level 7

**Convener:** Dr J Delhaize

**Course entry requirements:** AST2002H and AST2003H (or AST2002S), PHY2004W, MAM2000W (or MAM2004H and MAM2047H).

**Course outline:**

The aim of this course is to provide a broad introduction to galactic & extragalactic astrophysics and cosmology. Topics will include the Milky Way and normal galaxies, supermassive black holes, active galaxies, clusters of galaxies, and cosmology and the origin of structure in the universe. Current hot topics in the area are also discussed in lectures from time to time and students are encouraged to keep abreast of the latest developments. A further aim is to develop observing data reduction skills. Students will therefore participate in a fieldtrip to the South African Astronomical Observatory in Sutherland, where they will obtain their own spectroscopic data and will be taught how to do the data reduction and analysis.

**Lecture times:** Monday - Friday, 2nd period, Practicals: One practical or tutorial per week, Wednesday, 14h00 - 16h30.

**DP requirements:** Satisfactory attendance at lectures and tutorials; class record of at least 35%.

**Assessment:** Class record 50% (this includes two class tests, tutorials, and practicals); one 2-hour final examination 50%; subminimum requirement of 40% for final examination.

### Postgraduate Courses

**AST4007W ASTROPHYSICS & SPACE SCIENCE HONOURS**

*Since the code AST4007W will not carry a NQF credit value, students will be concurrently registered for AST4008W (coursework component of 128 NQF credits) and AST4009W (research project of 32 NQF credits).*

160 NQF credits at NQF level 8; the combined credit value of both components.

**Convener:** To be advised

**Course entry requirements:** AST3002F and AST3003S or PHY3004W or MAM3040W or equivalent. Candidates with an Engineering background will also be considered. Enrollments are limited to 20 students. Candidates must satisfy the Steering Committee that they have sufficient background in Mathematics and Physics. Admission is subject to the approval of the Steering Committee and an application must be made before 30th September of the preceding year. Late applications will also be considered.

**Course outline:**

The Honours course in Astrophysics & Space Science consists of courses presented by distinguished South African researchers from research institutions participating in NASSP. There is a theory component which includes courses in spectroscopy, electrodynamics, general relativity, general astrophysics, galaxies, computational physics, astrophysical fluid dynamics and computational
methods, as well as an observational techniques component which includes optical and infrared astronomy and radio astronomy. In addition students will complete a mini research project as well as a main research project and go on a number of fieldtrips to the national facilities.

**DP requirements:** Satisfactory lecture attendance (minimum 50%); class record of at least 40%.

**Assessment:** The assessment of the coursework is based on the class records and examinations for each of the modules. In general they are made up from tests, oral presentations, projects and a final examination. Examinations count 40%, class record 40% and research project 20% of the final result. The project component must be passed at 50%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code AST4007W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

**AST5000W  ASTRONOMY DISSERTATION**
180 NQF credits at NQF level 9

**Course outline:**
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of the handbook.

**AST5001W  ASTROPHYSICS & SPACE SCIENCE MINOR DISSERTATION**
(National Astrophysics & Space Science Programme (NASSP))
90 NQF credits at NQF level 9

**Course entry requirements:** AST5003F

**Course outline:**
This course consists of an investigation of an approved research topic on which a minor dissertation must be presented for formal assessment. The minor dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

**AST5003F  ASTROPHYSICS & SPACE SCIENCE COURSEWORK**
(National Astrophysics & Space Science Programme (NASSP). All students on the National Astrophysics & Space Science Programme (NASSP) will enrol (and pay fees) for the coursework component (AST5003F) at the start of their first year of registration. Those who choose to remain at UCT to complete the minor dissertation component (AST5001W, MAM5005W or PHY5003W) will be required to enrol (and pay fees) for the minor dissertation component in July. Where the minor dissertation is not submitted by the February deadline of the subsequent year, the student will be required to enrol (and pay fees) for the minor dissertation component in the subsequent year/s.

90 NQF credits at NQF level 9

**Convener:** To be advised
Course entry requirements: This course is open to Honours graduates in Astronomy and Space Science (AST4007W), Physics (PHY4000W, PHY4001W, PHY4002W) or equivalent, and Engineering. Entrance is subject to a minimum pass mark of 60% in the Honours degree.

Course outline:
This course consists of a selection of advanced topics presented by distinguished South African researchers from research institutions participating in NASSP. The courses vary from year to year but usually include cataclysmic variables, extragalactic astronomy, space technology, hot topics in cosmology, advanced general relativity, high energy astrophysics, observational cosmology, geomagnetism and aeronomy, plasma physics and magnetohydrodynamics.

Assessment: On average, examinations of individual modules count 60% of the final result, and marked practical work counts 40%.

AST5004Z   DATA SCIENCE FOR ASTRONOMY
12 NQF credits at NQF level 9
Convener: Dr J Collier
Course entry requirements: Core modules of the Master's in Data Science course.
Course outline:
This course introduces students to various aspects of data intensive astrophysics, ranging from data visualisation and complex databases, to advanced statistical tools for astronomical data analysis and computational astrophysics. At the core of this module are examples in modern data-intensive astrophysics derived from the global data challenges around MeerKAT, the Square Kilometre Array (SKA), associated projects in radio astronomy, and other large multi-wavelength surveys. Students will be introduced to the use of Bayesian statistics in astronomy, the complexity of visualising large data cubes, optimising database operations in the presence of multi-dimensional data, data mining and discovery tools, and the role of large-scale simulations to interpret the significance of astronomical observations.

DP requirements: 50% average for the two projects.
Assessment: Two projects: 25% each. Practical 'take-home' data science examination: 50%. A sub-minimum of 50% for each of the projects, and examination component will be required.

AST5005W   DATA SCIENCE MINOR DISSERTATION
90 NQF credits at NQF level 9
Convener: Dr S Er
Course entry requirements: Successful completion of the coursework component of the Masters course in Data Science.
Course outline:
The research component of the degree is based on a 90 credit dissertation. The topic of the research will be based on an analysis of large data sets from Astronomy.
Assessment: The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

AST6000W   ASTRONOMY THESIS
360 NQF credits at NQF level 10
Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant
field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF BIOLOGICAL SCIENCES

The Department is housed in the John Day Building, 20 University Avenue
Telephone (021) 650-3603/4 Fax (021) 650-3301 and the H W Pearson Building, 8 University
Avenue.
The FitzPatrick Institute of African Ornithology may be reached on telephone (021) 650-3291/2896
The Plant Conservation Unit may be reached on telephone (021) 650-2440
The Departmental abbreviation for Biological Sciences is BIO.

Associate Professor and Head of Department:
G A Verboom, BSc Hons PhD Cape Town

Leslie Hill Professor of Plant Conservation:
M T Hoffman, BSc Hons PhD Cape Town

Pola Pasvolsky Chair of Conservation Biology:
C Spottiswoode, BSc Hons Cape Town PhD Cantab

H W Pearson Honorary Professor of Botany:
J S Donaldson, MSc Rhodes PhD Cape Town

Professors:
A Chinsamy-Turan, BSc Hons PhD Witwatersrand
M D Cramer, MSc Witwatersrand PhD Cape Town
L Gillson, MSc Imperial DPhil Oxon
T A Hedderson, MSc Memorial PhD Reading
A M Muasya, MPhil Moi PhD Reading
M J O’Riaain, BSc Hons PhD Cape Town
P G Ryan, MSc PhD Cape Town
A G West, MSc Cape Town PhD Utah

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L Shannon, BSc Hons MSc PhD Cape Town

Senior Scholars:
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G M Branch, BSc Hons PhD Cape Town FRSSAf
G Gäde, MSc PhD rer nat. Habil Münster Germany
C L Griffiths, BSc Hons Soton PhD Cape Town
L G Underhill, MSc PhD Cape Town

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T M Crowe, MSc Chicago PhD Cape Town
J Midgley, BSc Hons PhD Cape Town
W R Siegfried, PhD Cape Town

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D H M Cumming, BSc Hons PhD Rhodes

Associate Professors:
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C Attwood, BSc Hons PhD Cape Town
S B M Chimphango, MSc Malawi PhD Cape Town
D S Jacobs, BSc Hons Cape Town PhD Hawaii
C L Moloney, BSc Hons PhD Cape Town
D Pillay, BSc Hons PhD UKZN
R L Thomson, MSc PhD Oulu

South African Research Chair in Marine Ecology & Fisheries:
A Jarre, MSc Kiel PhD Bremen

Emeritus Associate Professors:
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E C February, BA Hons PhD Cape Town
J H Hoffmann, MSc PhD Rhodes
J U M Jarvis, MSc Cape Town PhD East Africa FRSSAf
M D Picker, BSc Hons PhD Witwatersrand

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S E Kerwath, MSc Erlangen PhD Rhodes
A G Rebelo, PhD Cape Town

Senior Lecturers:
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G N Bronner, MSc PhD Natal
S J Cunningham, BSc Victoria PhD Massey
C C Reed, MSc PhD UFS
J A Slingsby, BSc Hons PhD Cape Town

Lecturers:
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N Karenyi, MSc Cape Town PhD NMU
C A Ngamphalala, MSc PhD Pret

Honorary Research Associates:
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P J Carrick, PhD Cantab
M Cyrus, PhD Cape Town
H Dallas, PhD Cape Town
R Goversker, PhD Witwatersrand
H J Hawkins, BSc Hons MSc Cape Town PhD Germany
J A Huggett, PhD Cape Town
K Hutchings, PhD Cape Town
K Klaka, BSc Hons PhD Cape Town
K Ludymia, PhD Germany
C L Lyons, PhD Stellenbosch
B M Macey, PhD Cape Town
H G Marico, PhD Cape Town
L Mattio, BSc Hons Napier MSc PhD Marseille
J M Oifers, PhD Cape Town
H D Oschadleus, PhD Cape Town
D Parker, PhD Rhodes
M Pfaff, PhD Cape Town
G C Pitcher, PhD Cape Town
M D Rothman, PhD Cape Town
T Samaai, PhD UWC
C Savage, BSc Hons Cape Town PhD Stockholm
A L Skowno, PhD Rhodes
C H Stirton, PhD Cape Town
C D van der Lingen, PhD Cape Town
H Van der Merwe, PhD Pret
S van Noort, PhD Rhodes
H M S M Verheye, PhD Cape Town

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M Brink-Hull, PhD Stell
E D Krupandan, PhD Cape Town
D MacAlister, PhD Cape Town
K L Morrissey, PhD Ghent Uni
V N Naude, PhD Cape Town
S Prader, PhD Hamburg
E R Razanatsoa, PhD Cape Town
K P Smit, PhD NMMU
J E M van der Wal, PhD St Andrews
D A Zhigila, PhD Cape Town

**Director: Organisation for Tropical Studies South Africa Programmes**
L Kruger, MSc PhD Cape Town

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**Principal Technical Officers:**
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P Müller
A Plos, BSc Cape Town

**Chief Scientific Officer:**
L V Phigeland, BSc Cape Town

**Chief Technical Officer:**
D I Barnes, BA Cape Town BPhil Stell

**Departmental Administrative Manager:**
C Khai

**Administrative Assistants:**
S Abrahams
N Jodamus

**Procurement Officer:**
A Stain

**Senior Secretary:**
R Rayner

**Lab Assistant:**
B Tom

**Departmental Assistant:**
B Marope, BSc Hons North West

**Assistant Technical Officer:**
C Hartnick

**BOLUS HERBARIUM**

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G A Verboom, BSc Hons PhD Cape Town

**Keeper:**
A M Muasya, MPhil Moi PhD Reading

**Curator/Principal Scientific Officer:**
C Klak, BSc Hons PhD Cape Town

**Scientific Officer:**
D Philips, MSc UKZN

**Principal Library Assistant:**
J Lucas

**Herbarium Operations Assistant:**
C J Christians

**THE FITZPATRICK INSTITUTE OF AFRICAN ORNITHOLOGY**

**Professor and Director:**
P G Ryan, MSc PhD Cape Town

**Pola Pasvolsky Chair of Conservation Biology:**
C Spottiswoode, BSc Hons Cape Town PhD Cantab
Emeritus Professors:
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W R Siegfried, PhD *Cape Town*

Honorary Professor:
D H M Cumming, BSc Hons PhD *Rhodes*

Associate Professors:
A D Amar, BSc Hons *Newcastle* PhD *Aberdeen*
R L Thomson, MSc PhD *Oulu*

Senior Lecturer:
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R Covas, MSc *Lisbon* PhD *Cape Town*
G S Cumming, PhD *Oxford*
T Flower, PhD *Cantab*
W Foden, PhD *Witwatersrand*
D Grémillet, PhD *Kiel*
P O Farrell, PhD *Cape Town*
A R Ridley, PhD *Cantab*
A Santangeli, PhD *Helsinki*
C L Seymour, PhD *Cape Town*
R Simmons, MSc *Acadia* PhD *Witwatersrand*
R Wanless, PhD *Cape Town*

Honorary Research Affiliates:
D Bolopo, PhD *Valladolid* Spain
A Makhado, PhD *Cape Town*
A McInnes, PhD *Cape Town*
M Murgatroyd, PhD *Cape Town*

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R C K Bowie, MSc PhD *Cape Town*
R S Boyes, PhD *UKZN*
C Cohen, PhD *Cape Town*
T Cook, PhD *La Rochelle*
W R J Dean, MSc *Natal* PhD *Cape Town*
C Doutrelant, PhD *Montpellier*
R Flood, PhD *London*
A Jenkins, PhD *Cape Town*
M G W Jones, PhD *Cape Town*
G Joseph, PhD *Cape Town*
A T K Lee, PhD *Manchester*
I T Little, PhD *Cape Town*
K Maciejewski, PhD *NMU*
R O Martin, PhD *Sheffield*
A McKechnie, PhD *Natal*
M Melo, MSc *Cape Town* PhD *Edinburgh*
A Milewski, MSc *Cape Town* PhD *Murdoch*
M S L Mills, MSc *Cape Town*
S J Milton, PhD *Cape Town*
R Navarro, PhD, *Cape Town*
S T Osinubi, PhD *Christchurch*
L Pichegru, PhD *Strasbourg*
P Pistorius, PhD *NMMU*
S Rahlao, PhD *Stell*
C Reynolds, PhD *Cape Town*
Y Ropert-Coudert, PhD *Tokyo*
C Seymour, PhD *Cape Town*
J M Shaw, PhD *Cape Town*
R Sherley, PhD *Cape Town*
A Steinfurth, MSc *Goettingen* PhD *Kiel*
P Sumasgutner, PhD *Vienna*
G Tate, PhD *Cape Town*
J K Turpie, PhD *Cape Town*
J Walton

**Principal Technical Officer:**
G A Aguilar, MSc *Chile*

**Senior Scientific Officer:**
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**Librarian:**
J Dunlop, Hons LibSci *Cape Town* MInfoTech *Pret*

**Administrative Assistants:**
H Buchanan, BA HDip Lib *Cape Town*
A Links

**PLANT CONSERVATION UNIT**

**Professor and Director and Leslie Hill Chair of Plant Conservation:**
M T Hoffman, BSc Hons PhD *Cape Town*

**Professor and Deputy Director:**
L Gillson, BA *Oxon* MSc *Imperial* DPhil *Oxon*

**INSTITUTE FOR COMMUNITIES AND WILDLIFE IN AFRICA**

**Professor and Director:**
M J O’Riain, PhD *Cape Town*

**Professor and Co-Director:**
N Nattrass, PhD *Oxford*

**Senior Lecturers:**
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G Bronner, MSc PhD *Natal*

**Honorary Research Associates:**
G Balme, PhD *UKZN*
A Kock, PhD *Cape Town*
P Richardson, PhD *Oxford*

**Honorary Research Affiliates:**
N Le Roex, PhD *Stell*
N C Okes, PhD *Cape Towne*

**SEAWEED RESEARCH UNIT**

**DEPARTMENT OF FORESTRY, FISHERIES AND THE ENVIRONMENT (DFFE)**

**Oceanographic Researcher and Head:**
M D Rothman, BSc Hons *UWC* MSc PhD *Cape Town*

**Principal Oceanographic Research Assistants:**
C J T Boothroyd
F A Kemp

**WEED BIOLOGICAL CONTROL UNIT**

**Emeritus Associate Professor:**
J H Hoffmann, MSc PhD *Rhodes*
Scientific Officers:
F A C Impson, BSc Hons *Rhodes* MSc *Cape Town*
C A Kleinjan, MSc *Cape Town*
V C Moran, MSc PhD *Rhodes* FRES FLS FRSSAf

RESEARCH IN THE BIOLOGICAL SCIENCES
The mission of the Department of Biological Sciences is to conduct high quality teaching and research in the biodiversity, conservation, ecology, ecophysiology, evolution, and systematics of terrestrial and aquatic life. Courses offered are designed to reflect these research interests and train students in the major areas of ecology and evolution, applied biology and marine biology.

**Ecophysiology**: Associate Professor SBM Chimphango (nitrogen fixation and agriculture), Professor MD Cramer (carbon-nitrogen interactions, nutritional physiology), Emeritus Associate Professor EC February (plant water relations, anthropogenic impacts), Dr HG Marco (invertebrate neuroendocrinology, comparative endocrinology, animal physiology) Professor AG West (impacts of climate change, drought), Emeritus Professor G Gäde (invertebrates, neuropeptides), Dr C Janion-Scheepers (invertebrate thermal physiology).

**Evolution and Systematics**: Dr JM Bishop (conservation genetics, evolutionary genetics, phylogeography), Dr G Bronner (micromammal systematics, conservation biology), Professor A Chinsamy-Turan (palaeobiology, vertebrate bone & teeth histology), Associate Professor D Jacobs (animal evolution and systematics, biology & behaviour of bats), Professor TA Hedderon (molecular ecology, bryophytes), Professor AM Muasya (wetlands and Cyperaceae, Fabaceae, rhizobia) and Associate Professor GA Verboom (evolutionary ecology, speciation, Cape flora), Dr C Janion-Scheepers (invertebrate systematics).

**Ecology and Behaviour**: Emeritus Associate Professor JA Day (fresh water ecology & conservation), Emeritus Associate Professor EC February (savannas, Cape flora), Professor L Gillson (long-term ecology, conservation), Emeritus Associate Professor JH Hoffmann (bio-control, plant-insect interactions), Professor MT Hoffman (historical ecology, rangelands), Emeritus Professor JJ Midgley (ecosystem dynamics, plant-animal interactions), Professor MJ O’Riain (behavioural ecology, human-wildlife conflict solutions), Emeritus Professor LG Underhill (applications of statistics in the biological sciences, particularly ornithology and ecology), Emeritus Associate Professor JUM Jarvis (small mammal biology, mole-rats), Dr C Janion-Scheepers (invertebrates, bio-indicators).

**Marine Biology**: Associate Professor CG Attwood (marine protected areas, line fish population biology), Emeritus Professor CL Griffiths (coastal ecology, taxonomy), Associate Professor A Jarre (SARChI Chair; ecosystem modelling, ecosystem approach to fisheries management), Associate Professor CL Moloney (ecological modelling, marine ecosystems), Associate Professor D Pillay (estuarine and intertidal ecology), Dr CC Reed (parasitology, aquatic ecology), Emeritus Professor GM Branch (rocky shore & coastal ecology).

**Ornithology**: Associate Professor AD Amar (conservation and raptor biology), Dr SJ Cunningham (ecophysiology, climate change, chemo-tactile reception), Professor PG Ryan (seabirds, island conservation, plastic pollution), Professor C Spottiswoode (evolution, ecology and conservation), Associate Professor RL Thomson (behavioural ecology).

The department is also home to the following research entities:
The Bolus Herbarium: Taxonomy of the Cape Flora (Curator: Dr C Klak)
The Institute for Communities and Wildlife in Africa (Director: Professor MJ O’Riain)
The FitzPatrick Institute of African Ornithology and the associated Centre of Excellence in Birds as Keys to Biodiversity Conservation (Director: Professor PG Ryan)
Marine and Antarctic Research centre for Innovation and Sustainability (Director: Professor M Vichi)
The Plant Conservation Unit: Plant conservation, palaeoecology and historical ecology (Director: Professor MT Hoffman, Leslie Hill Chair of Plant Conservation)
The Seaweed Research Unit of the Department of Agriculture, Forestry & Fisheries (Head: Dr MD Rothman)
**Undergraduate Courses**

**First-Year Courses**

**BIO1000F  CELL BIOLOGY**
18 NQF credits at NQF level 5  
**Convener:** Dr J M Bishop  
**Course entry requirements:** Admission will be restricted to students who have passed either NSC Physical Science or Life Science with at least 60%. _NOTE:_ Preference will be given to students registered in the Science Faculty. Students registered for this course will be assessed in week 5; if it is judged that they are not coping with the level and pace of the course, and would benefit from an opportunity to strengthen foundational concepts and learn new material at a slower pace, they will be required to transfer to BIO1000H from week 7.  
**Course outline:**  
Basic biological principles and processes at a cellular level provide an essential grounding for future study in the life sciences. The structure and function of cell components is introduced, followed by an introduction to chemistry, including the structure and functions of biological macro-molecules. Cell division and the role of genetics in inheritance and the control of biological systems is then considered. This leads into an introduction to membrane physiology, metabolism and its regulation. Cellular processes that are considered in detail include the functioning of photosynthesis and cellular respiration, and how these relate to organismal physiology. Cellular communication and the immune system of animals complete the organismal physiology.  
**Lecture times:** Monday - Friday, 5th period,  
**Tutorials:** One per week, by arrangement,  
**Practicals:** One afternoon per week, Monday, Tuesday, Wednesday or Thursday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.  
**DP requirements:** Attendance of at least 80% of practicals; completion of at least 80% of deliverables (including class tests); minimum of 40% for the class record.  
**Assessment:** Class record counts 40% (three class tests count 27%; two practical tests count 5%; and a practical book mark counts 8%). One 2-hour examination paper (Theory) written in June counts 40%; a subminimum of 40% is required for this paper. One 1.5-hour examination paper (Practical) in June counts 20%.  

**BIO1000H  CELL BIOLOGY**  
18 NQF credits at NQF level 5  
**Convener:** To be advised  
**Course entry requirements:** Admission will be restricted to students who have passed either NSC Physical Science or Life Science with at least 60%. The permission of the Dean or Head of Department is required prior to registration for this course. _NOTES:_ 1) Preference will be given to students registered in the Science Faculty. 2) This course only begins in week 7 and is intended for students who have been advised to transfer to this course after initially registering for BIO1000F (see entry for BIO1000F). 3) The course places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. 4) BIO1000H is equivalent to BIO1000F in level, credit value towards the degree and as prerequisite for certain other courses.  
**Course outline:**  
Basic biological principles and processes at a cellular level provide an essential grounding for future study in the life sciences. The structure and function of cell components is introduced, followed by an introduction to chemistry, including the structure and functions of biological macro-molecules. Cell division and the role of genetics in inheritance and the control of biological systems is then considered. This leads into an introduction to membrane physiology, metabolism and its regulation. Cellular processes that are considered in detail include the functioning of photosynthesis and cellular respiration, and how these relate to organismal physiology. Cellular communication and the immune system of animals complete the organismal physiology.
Lecture times: Monday - Friday, 2nd period, Tutorials: One per week, by arrangement, Practicals: One afternoon per week, Friday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.

DP requirements: Attendance of at least 80% of practicals; completion of at least 80% of deliverables (including class tests); minimum of 40% for the class record.

Assessment: Class record counts 40% (three class tests count 27%; two practical tests count 5%; and a practical book mark counts 8%). One 2-hour examination paper (Theory) written in November counts 40%; a subminimum of 40% is required for this paper. One 1.5-hour examination paper (Practical) in November counts 20%.

BIO1004S BIOLOGICAL DIVERSITY
Preference will be given to students registered in the Science Faculty. Fieldwork: A compulsory one-day excursion will be held over a weekend.
18 NQF credits at NQF level 5
Convener: Professor A Chinsamy-Turan
Course entry requirements: BIO1000F/H, or a pass at 60% in NSC Life Sciences or by permission of the Head of Department.
Course outline:
This course aims to illustrate the diversity and complexity of living organisms, from viruses to humans. Topics include: evolution as a means of interpreting change with time; modern theories on the mechanisms of evolution; the origin of species, including humans; structure and functioning of the simplest microbial life forms; structure and life cycles of fungi; the evolution of aquatic and terrestrial plants; the diversity and adaptations of invertebrate animals; the development and adaptations of chordate groups; primate diversity and evolution; conservation and biodiversity issues in relation to South African biomes and global change. The course includes a strong practical component which further examines biodiversity and related concepts.

Lecture times: Monday - Friday, 5th period, Tutorials: One per week, by arrangement, Practicals: one practical per week, Monday, Tuesday, Wednesday, Thursday, or Friday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.

DP requirements: Attendance of at least 80% of the lectures and practicals (including the field trip), completion of at least 80% of deliverables (including class tests), an average of more than 50% for the practical record, a minimum of 40% for the class record.

Assessment: Coursework 40%. Theory test 1 (4%), theory test 2 (10%), practical test (10%), field trip report (group mark, 6%). Examinations 60%. One 2-hour theory examination written in November counts 40% (subminimum of 40% applies); one 1.5-hour practical examination written in November counts 20%.

Second-Year Courses

BIO2014F PRINCIPLES OF ECOLOGY & EVOLUTION
Includes a compulsory weekend field camp.
24 NQF credits at NQF level 6
Convener: Dr C Janion-Scheepers
Course entry requirements: BIO1000F/H, BIO1004F/S, DP in STA1007S
Course outline:
This course begins with an exploration of the mechanisms by which populations evolve and ultimately give rise to the entities that we term species. Building on this, it then explores the nature of the genealogical relationships between species (phylogeny), and the manner in which these are estimated in practice. The focus then shifts to abiotic and biotic controls on the distribution of species and higher taxa in nature, as viewed through the lens of niche theory, as well as constraints on the adaptability of populations or species to changing selective conditions. Finally, the course explores life history variation amongst organisms, including the factors that regulate its evolution and its demographic consequences. The latter provides context for a brief introduction to population ecology. Lectures provide theoretical background, while practicals and the compulsory field trip
provide hands-on experience of material taught in lectures, as well as training in basic research techniques.

**Lecture times:** Monday-Friday, 2nd period, Practicals: One per week, Monday, 14h00-17h00. Attendance is compulsory for all lectures and practicals.

**DP requirements:** Completion of at least 70% of deliverables (including class tests), 40% for the class record, attendance of all practicals, submission of all assignments on schedule and attendance of a weekend field camp.

**Assessment:** A 3-hour examination, written in June, with a subminimum of 40%, counts 40% of the course mark. The class record, which counts for the balance, is made up as follows: practicals count 20%, the field camp report counts 20% and two class tests count 20%.

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**BIO2015F  VERTEBRATE DIVERSITY & FUNCTIONAL BIOLOGY**  
Includes a compulsory field camp.

**24 NQF credits at NQF level 6**

**Convener:** Associate Professor R L Thomson

**Course entry requirements:** BIO1000F/H, BIO1004F/S

**Course outline:**

This course begins with an overview of the evolution, characteristics, diversity, morphology, and life histories of the different cranial classes, paying particular attention to adaptations underlying the success of the vertebrates. Distinctive or advanced biological features of each group are highlighted and their ecological/economic importance briefly considered. The rest of the course comprises integrative, cross-taxonomic modules on the functional biology of vertebrates, notably locomotion, sensory systems, metabolism, homeostasis and behaviour. The course includes a strong practical component to demonstrate the links between form and function; as well as a compulsory 4-day field camp during which students will be trained in methods for studying the diversity, ecology and behaviour of selected vertebrate groups.

**Lecture times:** Monday – Friday, 3rd period, Practicals: One per week, Wednesday, 14h00-17h00. Attendance is compulsory for all lectures and practicals.

**DP requirements:** Completion of at least 70% of deliverables (including class tests), 40% for class record, attendance of all practicals, submission of assignments on schedule and attendance of the field camp.

**Assessment:** A 3-hour theory examination written in June, with subminimum of 40%, will count 50% of the course mark. Coursework marks will be allocated as follows: practical classes (eight deliverables) count 15%, project report based on field camp data counts 15%, two class tests together count 20%.

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**BIO2016S  INVERTEBRATE DIVERSITY & FUNCTIONAL BIOLOGY**  
Includes a compulsory five-day field camp.

**24 NQF credits at NQF level 6**

**Convener:** Associate Professor D Pillay

**Course entry requirements:** BIO1000F/H, BIO1004F/S

**Course outline:**

The course exposes students to the diversity of invertebrates and their functional biologies. Topics will be presented within an evolutionary framework to emphasise past and contemporary selective pressures driving diversification. Students will be exposed to key topics in functional biology across the major invertebrate groups and will include cellular to organism level processes. The course begins with an introduction to the evolution of the invertebrates and the major phyla. This leads to an exploration of invertebrate functional biology, with an emphasis on key adaptations across the aquatic–terrestrial gradient. Lectures, practicals and field trips will expose students to contemporary philosophical, methodological and conceptual approaches used in the field of invertebrate functional biology and diversity.

**Lecture times:** Monday – Friday, 3rd period, Practicals: One per week, Wednesdays, 14h00-17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: Completion of at least 70% of deliverables (including class tests), 40% for the class record, attendance of all practicals, submission of all assignments on time and attendance for the full duration of a five-day field camp.

Assessment: A 3-hour examination, written in November, with a subminimum of 40%, counts for 50% of the course mark. Coursework marks will be allocated as follows: practicals count 15%, the field camp report counts 15% and two class tests count 20%.

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**BIO2017S  PLANT DIVERSITY AND FUNCTIONAL BIOLOGY**  
*Includes a compulsory four-day field camp.*  
24 NQF credits at NQF level 6  
**Convener:** Associate Professor S B M Chimphango  
**Course entry requirements:** BIO1000F/H, BIO1004F/S  
**Course outline:**  
The course begins with a discussion on the nature and origin of plants that includes an overview of major autotrophic eukaryote lineages. The benefits and challenges of life in water and on land are also presented. Diversity and evolution of life histories and reproductive systems in plants and consequences of the diversity of major plant lineages are studied. The functional biology of the major organs of the plant including roots, stems and leaves in relation to strategies for resource acquisition and utilisation, mineral nutrition, plant water relations and carbon metabolism are considered. This entails studying variations in root, stem and leaf morphologies in various plant lineages and unique terrestrial and aquatic environments and their function in water, nutrients and carbon metabolism. There is a strong focus on African plants, and a particular emphasis on the Cape Floristic region. The course practicals are compulsory and complements the theory with hands-on experience on working with different lineages of plants, data collection and analysis from scientific studies and experiments, and scientific writing. A compulsory 4-day field camp is undertaken for students to study the relationship between ecology and plant morphology, function and diversity.  
**Lecture times:** Monday – Friday, 2nd period, Practicals: One per week, Thursdays, 14h00-17h00. Attendance is compulsory for all lectures and practicals.  
**DP requirements:** Completion of at least 70% of deliverables (including class tests), 40% for class record, attendance at practicals, submission of all assignments on time and attendance of a four-day field camp.  
**Assessment:** A 3 hour examination written in November, with a subminimum of 40%, counts 50% of the course. Coursework marks will be allocated as follows: Practical classes count 20%, project based on field camp counts 10%, two class tests count 20%.

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**Third-Year Courses**

**BIO3002F  MARINE ECOSYSTEMS**  
*Includes a compulsory three-day field camp during first semester*  
36 NQF credits at NQF level 7  
**Convener:** Dr N Karenyi  
**Course entry requirements:** BIO2014F, SEA2004F (or concurrent registration for SEA2004F)  
**Course outline:**  
The course aims to develop and promote skills in the marine sciences in South Africa, making students familiar with global marine ecosystem structure and functioning, but with an emphasis on South African systems. Lectures, tutorials and practicals will be aimed at developing interpretative and integrative skills built during previous courses (e.g. SEA2004F; BIO2014F; BIO1004S; BIO1000F), which cover large amounts of more basic information. A further important aim will be to develop numerical and written skills, as well as introducing students to modern research techniques and approaches.  
**Lecture times:** Monday - Friday, 1st period, Practicals: One per week, Wednesday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
**DP requirements:** Completion of at least 70% of deliverables (including class tests); minimum of 40% for class record; submission of all assignments on time; attendance at practicals and the field camp.

**Assessment:** A 3-hour examination written in June, with a sub-minimum of 40% will count for 50% of the course. The class record will count 50% of the course mark, allocated as follows: practical classes (assessed weekly) count 15%; assignments count 20%; class tests count 15%.

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**BIO3013F GLOBAL CHANGE ECOLOGY**
36 NQF credits at NQF level 7

**Convener:** Professor M T Hoffman

**Course entry requirements:** BIO1000F/H, BIO1004F/S; approved 2000-level semester Science course.

**Course outline:**
How are organisms and ecosystems affected by the drivers of global environmental change? In this course we briefly explore the drivers of global change, both natural (e.g. Milankovitch cycles, tectonic drift) and anthropogenic (e.g. greenhouse gas emissions, pollution, land-use change), and then examine how these drivers influence (and are influenced by) terrestrial and marine biological systems. We cover a variety of topics, ranging from organismal and physiological responses to global change, biodiversity, global biogeochemical cycles, ecological function and ecosystem services. While the majority of the class is focussed on contemporary global change, this is contextualized relative to palaeohistorical environmental change. The course provides an integrated knowledge of contemporary environmental issues related to global change (e.g. carbon sequestration, climate change mitigation, land-use change) and its implications for biodiversity, ecosystem services and human wellbeing.

**Lecture times:** Monday - Friday, 2nd period, Practicals: One per week, Monday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.

**DP requirements:** Completion of at least 70% of deliverables (including class tests), minimum of 40% for class record.

**Assessment:** A 3-hour examination written in June, with a sub-minimum of 40%, will count for 50% of the course. Coursework marks will be allocated as follows: Practical classes (assessed weekly) count 15%; research project counts 20%; class tests count 15%.

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**BIO3014S CONSERVATION: GENES, POPULATION & BIODIVERSITY**
36 NQF credits at NQF level 7

**Convener:** Professor L Gillson

**Course entry requirements:** BIO2014F

**Course outline:**
This course introduces students to the science and practice of conservation biology, beginning with an overview of conservation issues, the value of biodiversity, extinction risks and the history and philosophy of conservation. The conservation of biodiversity is explored at multiple levels, including the diversity of genes, species, populations and ecosystems. At the species and population levels, we consider the role of life history and behaviour in the management of populations in the real world. The conservation and management of ecosystems is considered in terms of important processes, such as disturbance, re-wilding and threats by alien species. This course includes consideration of conservation, society, landscapes and ecosystem services. Issues to be considered here include: incentives, access, who benefits from conservation, legal aspects and management policies.

**Lecture times:** Monday - Friday, 2nd period, Tutorials, by arrangement, Practicals: One per week, Monday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.

**DP requirements:** Completion of at least 70% of deliverables (including class tests), submission of assignments by due date and 40% subminimum for the class record.

**Assessment:** A 3-hour examination written in November, with a sub-minimum of 40%, will count for 50% of the course. Coursework marks will be allocated as follows: Practical classes (assessed weekly) count 20%; project work counts 15%; two class tests count 15%.
BIO3017S  MARINE RESOURCES
36 NQF credits at NQF level 7
Convener: Associate Professor C G Attwood
Course entry requirements: BIO2014F; BIO3002F is recommended.
Course outline:
This course covers the science that supports renewable marine resource management. Topics include the diversity and life-history strategies of living marine resources, the diversity of fish and fisheries, surplus production, ecological responses to exploitation, monitoring and assessment techniques, regulatory strategies, resource economics, diversity and principles of marine aquaculture, and marine conservation.
Lecture times: Monday - Friday, 3rd period, Tutorials: By arrangement, Practicals: One per week, Thursday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: Completion of at least 70% of deliverables (including class tests); 40% for class record; attendance of all practicals; submission of assignments on schedule.
Assessment: A 3-hour examination written in November, with a sub-minimum of 40%, will count for 50% of the course. Coursework marks will be allocated as follows: Practical classes count 10%; project work counts 20%; two essays count 20%.

BIO3018F  ECOLOGY & EVOLUTION
This course is a residential two-week field course, occurring before term starts. During term time tutorials and various assignments need to be completed.
36 NQF credits at NQF level 7
Convener: Professor M D Cramer
Course entry requirements: BIO2014F
Course outline:
Ecological and evolutionary processes together determine patterns of biodiversity. This African-centric ecology and evolution course utilises regional examples within the global context to illustrate plant and animal ecology and evolution. The course starts with community assembly and the mechanisms (e.g. functional traits) that contribute to species coexistence (e.g. niche construction) and turnover (competition/facilitation for resources) between communities and the results of this (e.g. succession and alternate states). The role of disturbance (e.g. fire, herbivory, predation) in structuring communities and the roles of adaptation versus exaptation are then considered. Alien invasions are considered in the context of the supposed “empty niche” and as current examples of dispersalism and mechanisms (e.g. traits) of coexistence and competition. This is followed by behavioural ecology, focusing on how competition and cooperation between and within species affects evolutionary fitness. This leads into analytical biogeography, considering the distribution of species and how this was established (i.e. vicariance versus dispersalism) before discussing the evolution and coexistence of species regionally and globally. The course is based on a two-week field-trip before the semester starts, with assignment hand-ins and tutorials during the semester.
Lecture times: Monday - Friday, 5th period, -Tutorials: By arrangement in 5th period, Practicals: One per week, Tuesday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: Completion of at least 70% of deliverables (including class tests), minimum of 40% for class record and attendance of two week field-camp.
Assessment: An examination, written in June, with a subminimum of 40%, counts for 50% of the course mark. The class record, which counts for the balance, is made up as follows: practicals 30%, field-camp seminar 10%, class test 10%. 
BIO3019S QUANTITATIVE BIOLOGY
36 NQF credits at NQF level 7
Convener: Professor T A Hedderson
Course entry requirements: BIO2014F, approved 2000-level Science STA or MAM course.
Course outline: In an era of "big data", the ability to work with large amounts of numerical data is an important skill. Biological systems are notoriously complex across all levels of organisation, and are often difficult to manipulate experimentally on meaningful temporal and spatial scales. Mathematical models provide a means of gaining insight into such systems, allowing us to disentangle complicated processes, focus on variables of interest to a particular research question, test alternative hypotheses, make predictions, and help present ideas in an unambiguous fashion. This course deals with the use, interpretation, and limits of modelling approaches in biology. In a series of modules exploring processes ranging from the behaviour of genes to understanding global scale distributions of species and communities, students will gain experience in question formulation, model development and parameterisation, interpretation of results, and model critique.
Lecture times: Monday - Friday, 5th period, Tutorials: By arrangement, Practicals: One per week, Tuesday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: Completion of at least 70% of deliverables (including class tests), minimum of 40% for class record and attendance at practicals.
Assessment: A 3-hour examination written in November, with a sub-minimum of 40%, will count 50% of the course. The class record, which counts for the balance, is made up as follows: practicals and project work count 35%, two class tests count 15%.

Postgraduate Courses

BIO4000W BIOLOGICAL SCIENCES HONOURS
Since the code BIO4000W will not carry a NQF credit value, students will be concurrently registered for BIO4002W (coursework component of 88 NQF credits) and BIO4003W (research project of 72 NQF credits).
160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: Professor A M Muasya
Course entry requirements: A BSc degree in Biology. Acceptance will be at the discretion of the Head of Department who will consider quality of final year results, material covered in the undergraduate curriculum, and also possibly referees’ reports.
Course outline: The Honours course is designed to enrich the student's appreciation of theory through advanced coursework, essay writing, seminars, discussion groups and fieldwork. In addition to compulsory coursework modules, students are required to choose eight elective modules and complete an original research project.
DP requirements: Attendance of field camp and all lectures are required for the DP. The non-project component of the course carries a sub-minimum of 50% and the project component a sub-minimum of 50%.
Assessment: Two 3-hour examinations written in November count 20%; project and research seminar count 40%; compulsory coursework counts 20%; elective coursework counts 20%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code BIO4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

BIO4001W MARINE BIOLOGY HONOURS
Since the code BIO4001W will not carry a NQF credit value, students will be concurrently registered for BIO4004W (coursework component of 88 NQF credits) and BIO4005W (research project of 72 NQF credits).
160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: Professor A M Muasya

Course entry requirements: BSc degree in Marine Biology. Enrolments are limited to 10. Acceptance will be at the discretion of the Head of Department who will consider quality of final year results, material covered in the undergraduate curriculum, and also possibly referees' reports.

Course outline:
The Honours course is designed to enrich the student’s appreciation of theory through advanced coursework, essay writing, seminars, discussion groups and fieldwork. In addition to compulsory coursework modules, students are required to choose eight elective modules, at least four of which must be marine topics, and complete an original research project.

DP requirements: Attendance of field camp and all lectures are required for the DP. The non-project component of the course carries a sub-minimum of 50% and the project component a sub-minimum of 50%.

Assessment: Two 3-hour examinations written in November count 20%; project and research seminar count 40%; compulsory coursework counts 20%; elective coursework counts 20%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code BIO4001W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

BIO5007H    CONSERVATION BIOLOGY COURSEWORK
Students will enrol (and pay fees) for both courses BIO5007H and BIO5008W in their first year of registration; where the minor dissertation is not submitted by the February deadline of the subsequent year; the student will be required to enrol (and pay fees) for the minor dissertation component in the subsequent year/s. A handbook of postgraduate studies is available from the Percy Fitzpatrick Institute's website: www.fitzpatrick.uct.ac.za.
90 NQF credits at NQF level 9
Convener: Dr S J Cunningham

Course entry requirements: A relevant honours degree or equivalent: students with an honours degree from another discipline may be required to register for an MPhil in Conservation Biology.

Course outline:
This course deals with the conservation and biologically sustainable use of biodiversity. It provides the education and training necessary to identify threatened species, ecosystems and ecological processes, and to develop appropriate measures to reduce the effects of threats to biodiversity. This course is intended for students concerned with both the theory and practise of conservation. The coursework consists of a series of compulsory modules that run from January to August and cover a range of fields of conservation biology: biodiversity basics, philosophy of science and conservation ethics, population ecology and viability analysis, conservation genetics, community ecology, ecosystem/aquatic ecology, invasive species, landscape ecology, GIS and conservation planning, climate change and conservation, resource economics, societies and natural resources, conservation leadership.

Assessment: Each student receives a mark for each of the modules, and the modules are examined in groups during 'open-book' examinations.

BIO5008W    CONSERVATION BIOLOGY MINOR DISSERTATION
Students will enrol (and pay fees) for both courses BIO5007H and BIO5008W in their first year of registration; where the minor dissertation is not submitted by the February deadline of the subsequent year, the student will be required to enrol (and pay fees) for the minor dissertation component in the subsequent year/s. Those students already in possession of a Master's degree, or in exceptional cases those who wish to upgrade to a PhD, may expand a project in accordance with the normal pursuit of that degree at UCT.
90 NQF credits at NQF level 9
Convener: Dr S J Cunningham

Course entry requirements: BIO5007H
Course outline:
The research component must be submitted as a minor dissertation for formal examination. It should be completed by mid-February following first registration.

Assessment: The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

BIO5009W  CONSERVATION BIOLOGY DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of this handbook.

BIO5010W  BIOLOGICAL SCIENCES DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of the handbook.

BIO5012W  APPLIED OCEAN SCIENCES COURSEWORK

Students will enrol (and pay fees) for the coursework codes BIO5012W, BIO5013F, BIO5014F/SEA5011F as well as the minor dissertation course BIO5015W in their first year of registration; where the minor dissertation is not submitted by the February deadline of the subsequent year, the student will be required to enrol (and pay fees) for the minor dissertation component in the subsequent year/s.

0 NQF credits at NQF level 9

Convener: Professor M Vichi and Dr C Reed

Course entry requirements: A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.

Co-requisites: The relevant dissertation code from those proposed in the handbook.

Course outline:
This course is convened between the Departments of Biological Sciences and Oceanography. The code BIO5012W represents the overall coursework component and will reflect the overall coursework result. This full time taught master’s course is offered over 13 months, beginning in January each year. It provides interdisciplinary vocational training in applied aspects of
oceanography and marine biology for future ocean professionals. The course is designed for both recent graduates as well as those with several years’ work experience and who wish to gain skills to operate in the ocean services sector, focussing on operational and conservational activities, food, water quality and recreation preservation and other aspects of the Blue Economy. The curriculum offers a choice of two streams: Applied Marine Biology (BIO5014F) and Operational Oceanography (SEA5011F), with a common course in Foundations of Applied Ocean Sciences (BIO5013F). In addition, students will choose at least two elective courses, chosen from a range of modules offered in both disciplinary streams. The list and details of the offered courses will be available at registration. Students can choose to register for the minor dissertation in a number of disciplines. Assesement: Students must pass all coursework components with a subminimum of 40% for the fundamental course BIO5013F and the disciplinary courses (BIO5014F and SEA5011F); an aggregate coursework mark of 50% is required. A composite grade of the performance on the coursework component as a whole will be reflected against the assessment course code BIO5012W. The minor dissertation component is 50% of the degree. The choice of project for the minor dissertation will be determined by prior qualification with the course conveners and supervisors from other Departments. Students may register for a minor dissertation in a range of Departments across the University.

BIO5013F  FUNDAMENTALS OF APPLIED OCEAN SCIENCES
40 NQF credits at NQF level 9
Convener: Dr C Reed
Course entry requirements: A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.
Co-requisites: BIO5014F or SEA5011F depending on the chosen stream. A minor dissertation code chosen from the ones described in the handbook.
Course outline:
The course is composed of 5 separate modules covering the foundational aspects of applied ocean sciences. The first 3 modules provide an intermediate introduction to numerical skills and statistics, scientific computing and data management as well as scientific writing and project management. The last 2 modules give an introduction to descriptive oceanography and marine ecology, including a presentation of marine sampling techniques and data processing in conjunction with a field trip. Assessment: Every module is assessed independently either with a class test or individual project assignments. The syllabus and the relative weight for each module are described in a handbook that will be made available on the BIO5012W website (hosted by the Marine and Antarctic Research Centre for Innovation and Sustainability).

BIO5014F  APPLIED MARINE BIOLOGY
50 NQF credits at NQF level 9
Convener: Dr C Reed
Course entry requirements: A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.
Co-requisites: BIO5013F and minor dissertation code chosen from the ones listed in the handbook. Changes in the dissertation code are allowed according to the student background and prior to consultation with the course conveners.
Course outline:
The course in Applied Marine Biology focuses on conservation, ecosystem-based management, sustainable utilization and alternative livelihoods such as aquaculture. Assessment: Every module is assessed independently either with a class test or individual project assignments. The syllabus and the relative weight for each module are described in a handbook that will be made available on the BIO5012W website (hosted by the Marine and Antarctic Research Centre for Innovation and Sustainability).
BIO5015W  APPLIED OCEAN SCIENCES MINOR DISSERTATION

Students will enrol (and pay fees) for both courses BIO5012W and BIO5015W in their first year of registration; where the minor dissertation is not submitted by the February deadline of the subsequent year, the student will be required to enrol (and pay fees) for the minor dissertation component in the subsequent year/s.

90 NQF credits at NQF level 9

Convener: Professor M Vichi and Dr C Reed

Course entry requirements: A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.

Co-requisites: BIO5012W, BIO5013F, BIO5014F/SEA5011F

Course outline:
The minor dissertation, which forms 50% of the overall degree, is based on a six-month supervised research project. The choice of project will be determined by the student's prior qualification and in agreement with the course conveners and supervisors. The dissertation should be submitted by mid-February of the following year.

Assessment: The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

BIO6002W  CONSERVATION BIOLOGY THESIS

360 NQF credits at NQF level 10

Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.

BIO6003W  BIOLOGICAL SCIENCES THESIS

360 NQF credits at NQF level 10

Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF CHEMISTRY

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Telephone (021) 650-2324
The Departmental abbreviation for Chemistry is CEM.

Associate Professor and Head of Department:
M A Jardine, MSc PhD Cape Town

Mally Professor of Organic Chemistry:
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Jamison Professor of Inorganic Chemistry:
T J Egan, BSc Hons PhD Witwatersrand MSACI

Professor of Physical Chemistry:
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Professor and South African Research Chair in Drug Discovery:
K Chibale, BScEd Zambia PhD Cantab FRSC FRSSAf

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G S Smith, BSc Natal MSc PhD UWC MSACI MRSC

Emeritus Associate Professors:
B Davidowitz, MSc PhD Cape Town MSACI
D W Gammon, BSc Hons PhD HDE Cape Town MSACI
A T Hutton, MSc PhD Cape Town CChem MRSC MSACI

Senior Lecturers:
S Ngubane, BSc Hons Cape Town PhD Houston
C L Oliver, BSc Hons PhD Cape Town MSACI
G A Venter, MSc PhD Stell MSACI
S Wilson, BSc Hons PhD Cape Town

Lecturers:
C Edmonds-Smith, BSc Hons Cape Town MSc ARU PhD Cape Town
M W Mogodi, BSc Hons PhD Witwatersrand
W Petersen, BSc Hons PhD Cape Town

Chemical Safety Officer:
M Muller, MBA UFS

Principal Scientific Officers:
D Jappie-Mohamed, BSc Hons PhD Cape Town MSACI
C Lawrence-Naidoo, MSc Cape Town

Chief Scientific Officers:
A Gamieldien, BSc Hons HDE UWC
M Rylands, BSc Hons PhD Cape Town
H Su, MSc PhD Cape Town

Senior Scientific Officer:
Scientific Officer:

Principal Technical Officer:
P D de Kock, BEng MEng Stell

Chief Technical Officer:

Senior Technical Officer:
Y Ely

Assistant Technical Officer:
F Majola, NDipl ElectEng CPUT

Departmental Administrative Manager:
D C Brooks

Administrative Assistants:
C Losper
M Mayiya
J Polzin

Senior Secretary:
L Lalbahadur, BPaed UDW BEd Hons Unisa

Departmental Assistants:
F Esau
A Jooste
N Ngqanya
K M Sigam
C M Stanley

Workshop Assistant:
T Kamaldien

DRUG DISCOVERY & DEVELOPMENT CENTRE (H3D)

Director:
K Chibale, BScEd Zambia PhD Cantab FRSC FRSSAf

Principal Research Officer:
G S Basarab, BSc Penn State PhD MIT

Chief Research Officer:
S R Ghorpade, MPharm Mumbai PhD NCL

Senior Research Officer:
V Singh, MSc CSIMU India PhD CSIR-CDRI/Lucknow India

Researchers:
L B Arendse, BSc Hons PhD Cape Town
K Wicht, MSc PhD Cape Town

Junior Research Officer:
J Woodland, MSc PhD Cape Town

Chief Investigators:
D Taylor, BSc(Med) Hons PhD(Med) Cape Town
R van der Westhuyzen, MSc PhD Stell

Senior Investigators:
G A Boyle, BSc BSc Hons Natal MSc PhD UKZN
R K Gessner, BSc Hons PhD Cape Town
L Gibhard, MSc PhD North West
P Govender, MSc PhD Cape Town
A Horatscheck, Dipl Humboldt PhD Freie Berlin
A Nchinda, MSc Yaounde I PhD Rhodes
M Njoroge, PhD Cape Town
C Soares de Melo, BSc Cape Town BSc Hons Stell MSc Cape Town PhD Nijmegan

Investigators:
N Cardoso, PhD *Witwatersrand*
J Dam, PhD *Witwatersrand*
L P Khonde, MSc PhD *Cape Town*
L Lubbe, BSc *Pret* BSc Hons PhD *Cape Town*
C Oosthuizen, BSc Hons MSc PhD *Pret*
N Peton, BSc Hons *UWC* PhD *Cape Town*
L Taleli, BSc *Lesotho* MSc PhD *Stell*

**Senior Research Scientists:**
N N Barnes, Nat. Dipl Anal Chem *CPUT*
Z Ngqumba, MSc *CPUT*
T Ntsabo, BTech: Biotech BTech Quality *CPUT*
R Ockers, MSc *Stell*
W Olifant, BSc *UWC* BSc Hons *Stell*
A Sayed, MSc *CPUT*

**Research Scientists:**
J Akester, BSc Hons MSc *Cape Town*
R Cozett, PhD *Cape Town*
J Ferreira, MSc *Cape Town*
A Mulelu, MSc PhD *Cape Town*
S Salie
V Verhoog

**Senior Laboratory Administrator:**
D van Rooyen, BSc Hons *UWC*

**Laboratory Assistant:**
V Stuurman

**Head of Research Operations and Business Development:**
S Winks, BSc Hons *Cape Town* PhD *Witwatersrand* MBA *MANCOSA*

**Senior Finance Officer:**
A Bandeker, BCom *Cape Town* BCom Hons *UKZN* CA(SA)

**Project & Research Operations Manager:**
A Armstrong, MSc *UWC* MSc *Pret*

**Administrative Officer:**
E Rutherfoord-Jones, BSocSc *Cape Town*

**Administrative Assistant:**
S Naicker

**SCIENTIFIC COMPUTING RESEARCH UNIT (SCRU)**

**Director:**
K J Naidoo, MSc *Cape Town* PhD *Michigan*

**Academic Staff:**
G A Venter, MSc PhD *Stell* MSACI
S Winberg, MSc *UTK* PhD *Cape Town*

**Administrative Officer:**
L A Dreyer

**CENTRE FOR SUPRAMOLECULAR CHEMISTRY RESEARCH (CSCR)**

**Director:**
S A Bourne, BSc Hons PhD *Cape Town* CChem FRSC MSACI

**Academic Staff:**
M W Mogodi, BSc Hons PhD *Witwatersrand*
C L Oliver, BSc Hons PhD *Cape Town* MSACI

**Senior Research Scholars:**
M R Caira, MSc PhD *Cape Town* Dr Hons Causa Univ Med Pharm ‘Iuliu Hatieganu’ *Romania*
L R Nassimbeni, MSc *Rhodes* PhD *Cape Town* CChem FRSC FRSSAfMSACI
RESEARCH IN CHEMISTRY

The research activities of the Department reflect the wide range and scope of the traditional sub-disciplines of inorganic, organic and physical chemistry, sustained by analytical, spectroscopic and computational methodology. The Department has active research groups with strengths in catalysis, bioinorganic, biophysical and bioanalytical chemistry, synthetic chemistry, medicinal chemistry, supramolecular chemistry, scientific computing and chemical glyco-biology. Programmes are devoted to fundamental and applied chemical research, and to interdisciplinary studies in which chemistry plays a key role. Synthetic studies are carried out in organic, organometallic and coordination chemistry, in order to develop and apply new methodology, and to prepare biologically active compounds, novel catalysts and components of new materials. These studies also provide tools for analytical and separation science, and models for advanced structural and conformational work. Molecular structure determination with the aid of spectroscopic and X-ray diffraction techniques are two areas of specialisation in the Department. Computational chemistry is a leading area of specialisation supported by several state of the art clusters. Computer code development and modelling applications of biological and industrial problems play a key role in many of the Department’s research programmes. There is also an active research thrust in the area of chemistry education, with a particular focus on student learning in tertiary level chemistry courses.

The Department of Chemistry is home to four UCT-accredited research units:

The Centre for Supramolecular Chemistry Research, CSCR (Dir. Professor Mino Caira) studies the physical chemistry of supramolecular systems. Research projects include the synthesis and characterization of metal organic frameworks (MOFs) and large metal-containing supramolecular assemblies with the potential for guest uptake (gas storage, molecular sensing), the study of selectivity in organic host-guest systems, and the beneficiation of pharmaceutically relevant materials through the investigation of their polymorphs, solvates, cyclodextrin inclusion complexes and cocrys-tals. Solid phases are studied using powder and single crystal X-ray diffraction, thermal analysis (including TGA and DSC) and spectroscopy (FTIR and solid-state NMR techniques). The thermodynamics of inclusion and complexation processes in solution are investigated by high-resolution NMR spectroscopy and isothermal titration calorimetry.

The MRC/UCT Drug Discovery & Development Research Unit (Dir. Professor Kelly Chibale). The mandate of this unit includes the development of infrastructural and operational systems for new drug discovery and development, with special reference to natural product-guided medicinal chemistry, as well as biological screening platforms against communicable and non-communicable diseases.

H3D Drug Discovery and Development Centre (Dir. Professor Kelly Chibale) aims to bridge the gap between basic and clinical studies, training a new generation of African scientists with key skills required for drug discovery and development – integrating medicinal chemistry, biology, pharmacology as well as drug metabolism and pharmacokinetics (DMPK) studies as reflected in the processes of Absorption, Distribution, Metabolism and Excretion (ADME). H3D also focuses on beneficiation of clinically used drugs, including generic medicines. Drug beneficiation, amongst other things, involves selection of the optimum form of a solid drug candidate for pharmaceutical development and (re)formulation.

The Scientific Computing Research Unit, SCRU (Dir. Professor Kevin J. Naidoo) develops state-of-the-art high performance computing (HPC) software as well as providing a modelling and informatics platform for applications in chemistry and chemical biology. SCRU’s research activities include the development of software acceleration for life science applications. This aspect of the research is supported by hardware giant Nvidia Corporation. SCRU’s specialised HPC facility houses South Africa’s most sophisticated scientific computing servers and GPU clusters designed for chemical and chemical biology applications. The specific objectives of the unit are to trace gene-to-glycan biochemical schemes important in glyco-biology as well as model enzyme-catalysed chemical reactions and ionic liquids.
The research enterprise of the Department of Chemistry is significantly enhanced by the appointment of two of its permanent staff members to DST/NRF South African National Research Chairs - Professor Kevin Naidoo in Scientific Computing and Professor Kelly Chibale in Drug Discovery. These highly prestigious appointments have raised the Department’s international research profile significantly and contribute substantially to its research outputs.

Further information may be found on the Department’s website at http://www.chemistry.uct.ac.za

Undergraduate Courses

Supplementary examinations:
For all undergraduate Chemistry courses, borderline candidates may not necessarily be awarded a supplementary examination to be written in January/February of the following year. As an alternative, the Department reserves the right to apply rule G21 which implies that a further test, which may be oral or written, may take place before the date of the Faculty Examinations Committee. Students are accordingly warned that they may be expected to make themselves available for such further testing.

First-Year Courses
CEM1000W is the first-year full qualifying course for entrance to second-year courses in the Faculty of Science and in Chemical Engineering in the Faculty of Engineering & the Built Environment. CEM1009H and CEM1010H are half courses taken by students who transfer to the Extended Degree Programme, and completion of both courses is equivalent to the full course CEM1000W. The Department also offers CEM1008F: Chemistry for Engineers and CEM1011F: Chemistry for Medical Students, which is repeated as CEM1111S and CEM1011X as part of the Faculty of Health Sciences Intervention Programme. Details of these courses can be found in the relevant faculty student handbooks.

Undergraduate Courses

First-Year Courses

CEM1000W  CHEMISTRY 1000
NOTES: Preference will be given to students registered in the Science Faculty. Students registered for this course will be assessed in week 5; if it is judged that they are not coping with the level and pace of the course, and would benefit from an opportunity to strengthen foundational concepts and learn new material at a slower pace, they will be required to transfer to CEM1009H from week 7.
36 NQF credits at NQF level 5
Convener: Associate Professor G S Smith
Course entry requirements: Students wishing to register for CEM1000W will normally be expected to have passed NSC Physical Science with at least 60% and NSC Mathematics with at least 70%.
Course outline: This course lays the foundation of chemistry in its context as a central science for scientists and engineers working in the chemical, biological or earth sciences or in chemical engineering. Fundamental concepts in chemistry are covered to illustrate their application to understanding the molecular nature of the world around us. Topics include microscopic and macroscopic concepts, atomic structure, chemical bonding and molecular structure, the chemistry of the elements and inorganic chemistry, chemical equilibrium, acids and bases, solubility, phases of matter, thermochemistry and thermodynamics, colligative properties, oxidation and reduction, electrochemistry and chemical kinetics. The course continues with an introduction to the language of organic chemistry, including structure and reactivity in organic chemistry, describing and predicting organic reactivity and the properties and reactivity of biologically important molecules. Practicals
aim to develop essential manipulative and technical laboratory skills, as well as to draw links to interpreting the physical world in terms of its molecular nature. A blended approach to learning may be used where academic activities will be delivered online and face-to-face, if feasible. This will be at the discretion of the course convener.

**Lecture times:** Monday to Wednesday and Friday, 2nd or 4th period. Tutorials: Thursday 2nd or 4th period. Practicals: Tuesday, Thursday or Friday, 14h00 - 17h00.

**DP requirements:** Attendance and completion of practicals, tests and tutorial exercises, and at least 35% for the class record.

**Assessment:** Class record (comprising tests, tutorials and practicals) counts 50%; one 3-hour examination written in November counts 50%. A subminimum of 40% is required in the final examination.

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**CEM1009H  CHEMISTRY 1009**

**NOTES:** 1) Preference will be given to students registered in the Science Faculty. 2) This course only begins in week 7 and is intended for students who have been advised to transfer to this course after initially registering for CEM1000W (see entry for CEM1000W). 3) The course places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. 4) CEM1009H + CEM1010H is equivalent to CEM1000W in level, credit value towards the degree and as prerequisite for certain other courses.

18 NQF credits at NQF level 5

**Convener:** Dr C Edmonds-Smith

**Course entry requirements:** Admission will be restricted to students who have passed NSC Physical Science with at least 60%. The permission of the Dean or Head of Department is required prior to registration for this course.

**Course outline:** This course lays the foundation of chemistry in its context as a central science for scientists working in the chemical, biological or earth sciences. Fundamental concepts in chemistry are covered to illustrate their application to understanding the molecular nature of the world around us. Topics include microscopic and macroscopic concepts, atomic structure, chemical bonding and molecular structure, chemical equilibrium, acids and bases, solubility, phases of matter, thermochemistry, osmosis and chemical kinetics. The course continues with an introduction to the language of organic chemistry, including naming of compounds, identification of functional groups and isomers. Practicals are designed to develop essential manipulative and technical laboratory skills, to take measurements and handle data, as well as to draw links to interpreting the physical world in terms of its molecular nature.

**Lecture times:** Wednesday - Friday, 4th period. Tutorials: Monday and Tuesday, 4th period. Practicals: Wednesday, 14h00 - 17h00.

**DP requirements:** Attendance and completion of practicals, tests and tutorial exercises and at least 35% for the class record.

**Assessment:** Class record (comprising tests, tutorials and practicals) counts 50%; one 2-hour examination written in November counts 50%. A subminimum of 50% is required in the final examination.

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**CEM1010H  CHEMISTRY 1010**

**NOTES:** 1) This course follows on from CEM1009H and also places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. 2) CEM1009H + CEM1010H is equivalent to CEM1000W in level, credit value towards the degree and as prerequisite for certain other courses.

18 NQF credits at NQF level 5

**Convener:** Associate Professor M A Jardine

**Course entry requirements:** CEM1009H
Course outline:
Topics covered at a more advanced level include microscopic and macroscopic concepts, atomic structure, chemical bonding and molecular structure, the chemistry of the elements and inorganic chemistry, chemical equilibrium, acids and bases, solubility, vapour pressure and phase diagrams, thermodynamics, colligative properties, oxidation and reduction, electrochemistry and chemical kinetics. The course includes an introduction to the language of organic chemistry, structure and reactivity in organic chemistry, describing and predicting organic reactivity and the properties and reactivity of biologically important molecules. Practicals aim to develop essential manipulative and technical laboratory skills, as well as to draw links to interpreting the physical world in terms of its molecular nature.

Lecture times: Monday - Wednesday and Friday, 5th period, Terms 1 - 3, 4th period, Term 4. Tutorials: Thursday, 5th period, Terms 1 - 3, 4th period, Term 4. Practicals: Tuesday, 14h00 - 17h00.

DP requirements: Attendance and completion of practicals, tests and tutorial exercises and at least 35% for the class record.
Assessment: Class record (comprising tests, tutorials and practicals) counts 50%; one 2-hour examination written in November counts 50%. A subminimum of 40% is required in the final examination.

Second-Year Courses
CEM2005W is required for students proceeding to a major in Chemistry.

CEM2005W  INTERMEDIATE CHEMISTRY
48 NQF credits at NQF level 6
Convener: Dr G A Venter

Course entry requirements: For Science students: CEM1000W (or equivalent), 1000-level full course in Physics, 1000-level full or semester course in Mathematics. Concurrent registration for STA1000F/S (or equivalent) is highly recommended. For Chemical Engineering students: CEM1000W (or equivalent), PHY1012F/S, MAM1020F/S, CHE1005W

Course outline:
This course develops the foundations of a major in Chemistry at an intermediate level and allows continuation to third-year Chemistry for the completion of a major in Chemistry. The theory component features a set of intermediate topics, and the laboratory component develops both experimental and interpretative skills. The course includes the following topics: spectroscopy and modern analytical tools, introduction to inorganic chemistry, organic structure and reactivity, thermodynamics, thermodynamics of solutions, phase equilibria, chemical reaction kinetics and equilibria, reactions of organic molecules (patterns, predictions and preparation of new products), introduction to coordination chemistry, structures and energetics of inorganic solids and electrochemistry. The practical course covers the same topics and aims to develop manipulative and technical laboratory skills including the application of modern analytical methods to the elucidation of chemical structures.

Lecture times: Monday - Friday, 3rd period. Tutorials by arrangement. Practicals, EBE: Tuesday, 14h00 - 17h00; Science: Thursday, 14h00 - 17h00.

DP requirements: Attendance and completion of practicals, tests and tutorial exercises; at least 40% average for practical exams.
Assessment: The class record (comprising tests and practicals) counts 50%; one 3-hour examination written in November counts 50%. The class record consists of class tests (25%), tutorials (5%) practical reports (10%) and practical exams (10%). A subminimum of 40% is required in the final examination.
Third-Year Courses

CEM3005W is the required course for students completing a major in Chemistry.

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**CEM3005W  CHEMISTRY 3005**

72 NQF credits at NQF level 7

**Convener:** Dr W Petersen

**Course entry requirements:** CEM2005W, 1000-level full course in Mathematics; completion of or concurrent registration for STA1000F/S is highly recommended.

**Course outline:**

This final course for the Chemistry major aims to develop understanding and integrated knowledge of the core disciplines in Chemistry. Lecture material includes topics in wave mechanics and spectroscopy, adsorption and heterogeneous catalysis, solid-state chemistry and X-ray crystallography, dynamics, inorganic reaction mechanisms, organometallic chemistry, further topics in organic structure and reactivity, organic synthesis and organic dynamic stereochemistry. The practical course covers the same topics and aims to develop integrative and interpretive skills. A further aim is to develop skills in writing within the discipline, as well as introducing students to modern research methods.

**Lecture times:** Monday - Friday, 3rd period. Practicals: Wednesday and Friday, 14h00 - 17h00.

**DP requirements:** Attendance and completion of practicals, tests and tutorial exercises, and at least 50% for the class record.

**Assessment:** Class record (comprising tests, writing project and practicals) counts 50% and two 3-hour examinations written in November count 50% towards the final mark. A subminimum aggregate of 40% for two papers is required in the final examination.

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Postgraduate Courses

**CEM4000W  CHEMISTRY HONOURS**

*Since the code CEM4000W will not carry a NQF credit value, students will be concurrently registered for CEM4001W (coursework component of 94 NQF credits) and CEM4002W (research project of 66 NQF credits). Entrance is limited to 16 students.*

160 NQF credits at NQF level 8; the combined credit value of both components.

**Convener:** Dr S Ngubane

**Course entry requirements:** A BSc degree (or equivalent) with a major in Chemistry at a sufficiently high standard to satisfy the Head of Department. Entrance to the Honours course is competitive and applications are considered individually, taking into consideration the entire academic record. Priority will be given to UCT graduates, who require 60% or higher in CEM3005W as the normal minimum prerequisite for admission. Applicants from other universities must satisfy the Honours steering committee that they have covered the same topics at the equivalent level.

**Course outline:**

The Honours course is designed to enrich understanding of chemical theory, while developing skills in the modern research techniques and approaches required of the professional chemist. The course has several components:

- **Modern instrumental methods and group theory** are taught through experiential workshops and lectures covering topics in NMR spectroscopy, X-ray methods of analysis, separation methods, electrochemical techniques, group theory and molecular modelling methods.

The **core lecture course** provides the conceptual tools required in modern inorganic, organic and physical chemistry. Topics covered include aqueous coordination chemistry, organometallic chemistry, bioinorganic chemistry and catalysis (inorganic chemistry), organic synthesis, the third dimension in organic reactions, asymmetric synthesis and advanced reagents (organic chemistry), as well as statistical thermodynamics, quantum chemistry, solid-state chemistry and the chemistry of liquids (physical chemistry).
A 14-week research project caps the course. After presentation of a research proposal, the student engages in 10 weeks of full-time research work which culminates in the presentation of a short dissertation, research poster and an oral presentation to the Department. Training in oral communication is provided during this period.

**Lecture times:** By arrangement. Lectures, tutorials and practicals start at the end of January. Lectures and tutorials are daily in the first four periods and at other times arranged. Practical work and other activities occupy three afternoons per week during the first semester and all day, all week during the second semester.

**Assessment:** Examinations count 33%, coursework 26% and the Honours research project 41%. To pass the Honours course candidates must obtain an overall average of 50%, an average of 45% for the Core Course written examinations with a subminimum of 33% on each individual paper of the Core Course examinations. In addition, candidates must attain at least 50% for the research project, 45% for the Modern Instrumental Methods and Group Theory module, complete all practical work, tutorial assignments, generic skills course and any other compulsory activities. These component parts of the course will be combined in a final overall mark which will be reflected against the course code CEM4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

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**CEM5000W  CHEMISTRY DISSERTATION**

180 NQF credits at NQF level 9

**Course outline:**
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of the handbook.

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**CEM5002W  COMPUTATIONAL SCIENCE DISSERTATION**

180 NQF credits at NQF level 9

**Course outline:**
The academic disciplines of chemistry, chemical biology and biophysics have a critical dependence on computer simulation and large scale data analysis to understand observed phenomena and advance the frontiers of disciplinary knowledge. This course aims to prepare students to undertake research in computational science as applied to chemistry, chemical biology, biophysics and chemical physics. The two streams of focus are computation and informatics. The course will commence with project assignment followed by a combination of in-house and online short training (non-credit) courses in: Scientific Computing, High Performance Computing, Computational Methods for Data Analysis, Data Management, R Programming, Quantum Mechanics and Statistical Mechanics. The above short training courses are designed to prepare students to successfully complete a computational science project and dissertation.

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**CEM5004W  TERTIARY CHEMISTRY EDUCATION DISSERTATION**

180 NQF credits at NQF level 9

**Course outline:**
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough
understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct and analysis of the results of research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of the handbook.

**CEM6000W CHEMISTRY THESIS**
360 NQF credits at NQF level 10

**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates for the PhD degree must submit a thesis on an approved research topic, and are referred to Book 3, General Rules and Policies, in which the rules for the degree are set out.

**CEM6001W TERTIARY CHEMISTRY EDUCATION THESIS**
360 NQF credits at NQF level 10

**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates for the PhD degree must submit a thesis on an approved research topic, and are referred to Book 3, General Rules and Policies, in which the rules for the degree are set out.

**CEM6002W COMPUTATIONAL SCIENCE THESIS**
360 NQF credits at NQF level 10

**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates for the PhD degree must submit a thesis on an approved research topic, and are referred to Book 3, General Rules and Policies, in which the rules for the degree are set out.
DEPARTMENT OF COMPUTER SCIENCE

The Department is housed in the Computer Science Building, 18 University Avenue
Telephone (021) 650-2663
The Departmental abbreviation for Computer Science is CSC.

The Department of Computer Science forms part of the School of IT.
The School focuses on leveraging the excellent research and teaching of both departments to provide
students with the relevant knowledge and skills to contribute to the international and South African
Information Technology Communities.

The capstone Honours degrees in the School are accredited by the British Computer Society,
providing students with an internationally recognized certification.

For further detail and degree options, see www.sit.uct.ac.za

Professor and Head of Department:
H Suleman, MSc UDW PhD Virginia Tech

Professors:
J E Gain, MSc Rhodes PhD Cantab
T A Meyer, MSc RAU PhD Unisa
R Simmonds, BSc PhD Bath

Adjunct Professor:
A C M Hutchison, MSc HDE (PG) See Cape Town PhD Zurich

Associate Professors:
S Berman, BSc Rhodes MSc PhD Cape Town
M Densmore, BA Cornell MSc UCL PhD Berkeley
M Keet, BSc Hons OU MSc Wageningen MA Limerick PhD Bozen-Bolzano
M Kuttel, MSc PhD Cape Town
P C Marais, MSc Cape Town DPhil Oxon
D Moodley, MSc UNP PhD UKZN
G Nitschke, BSc Hons Curtin PhD VU Amsterdam

Senior Lecturers:
A Safla, MSc UKZN
G Stewart, BSc Hons Cape Town

Adjunct Senior Lecturers:
B DeRenzi, BS UC Santa Barbara MSc PhD University of Washington
D Johnson, BEng Cape Town MEng Pret PhD Santa Barbara

Lecturers:
J M Buys, MSc Stell DPhil Oxon
J Chavula, MSc Lancaster PhD Cape Town

Adjunct Lecturer:
M Molapo, MSc PhD Cape Town

Computer System Managers:
C Balfour, BSc SocSc Cape Town BA (SS) Hons Unisa
S Chetty, IT Management Cert Cape Town

Chief Scientific Officer
S Jamieson, MSc London
Senior Scientific Officer:
L Poulo, MSc Cape Town

Administrative Officer:
T Jenneker

Administrative Assistant:
P Bikani
Senior Secretary:
J Christians

Departmental Assistant:
B J Sam

RESEARCH IN COMPUTER SCIENCE
Research in the Department is organised into well-equipped laboratories funded by international, governmental and industrial sponsors. More information can be obtained on the Departmental Web pages or by writing to the department.

CENTRE FOR ARTIFICIAL INTELLIGENCE RESEARCH (Co-Director: Professor T Meyer, Co-Director: Associate Professor Deshen Moodley). The Centre for Artificial Intelligence Research (CAIR) is a national centre, hosted by the CSIR, with nodes at a number of South African universities. CAIR conducts research related to foundational and applied aspects of Artificial Intelligence. The UCT node has a specific focus on Knowledge Representation and Reasoning, as well as Adaptive and Cognitive Systems, and explores applications of Artificial Intelligence for social and economic development in South Africa and Africa.

CENTRE IN ICT FOR DEVELOPMENT (Interim Director: Professor Wallace Chigona). The UCT Centre in ICT for Development seeks to create ICTs that are appropriate for developing nations. To date, most innovation in ICT has been driven by the developed world to meet challenges originating from that context. This centre designs, creates and evaluates technologies that address the needs of the developing world and the people who live there.

COLLABORATIVE VISUAL COMPUTING (Co-ordinator: Professor James Gain). Topics of research include: Collaborative Virtual Environments; Usability and Human-Computer Interaction; Computer Graphics; Image Analysis applied to Medical Images; and Virtual Reality. Special interests within the CVC lab include Virtual Environments, Modelling and Procedural Graphics.

DIGITAL LIBRARIES (Co-ordinator: Professor Hussein Suleman). Research areas covered within digital libraries include information retrieval; ontologies; natural language processing and generation; digital archives and repositories; interoperability and protocols and cultural heritage preservation.

EVOLUTIONARY MACHINE LEARNING (Co-ordinator: Associate Professor Geoff Nitschke). The main focus of the research group is to devise new methods using algorithmic techniques from a broad range of biologically inspired machine learning sub-fields such as evolutionary computation and artificial neural networks as well as statistical machine learning, and apply such methods to adapt artificial brains on various experimental platforms, including: evolutionary-robotic, artificial life and agent-based systems.

HIGH PERFORMANCE COMPUTING (Co-ordinator: Associate Professor Michelle Kuttel). This laboratory investigates aspects of high performance computing, including: parallel algorithms; multi-core and GPU programming; computational science; and scientific visualisation.

HUMAN-COMPUTER INTERACTION (Co-ordinator: Associate Professor Melissa Densmore). Affiliated with the Centre in ICT4D, this laboratory takes a human-centred approach to the design and deployment of systems. Domains of research include design for mothers, design for community-health workers, local content creation for communities, media-based peer health education, and co-design across borders, with a focus on the role of HCI in making effective, usable and sustainable systems to address problems of inequality and social justice.

KNOWLEDGE ENGINEERING (Co-ordinator: Associate Professor Maria Keet). The aim of the team's activities is to contribute computing theory, methods, and techniques to the knowledge society. The scope of the KEEN team is knowledge engineering in its broad sense. This includes ontology engineering, the Semantic Web, intelligent (logic-based, ontology-driven) conceptual modelling, and natural language generation.

NETWORK AND INFORMATION SECURITY (Co-ordinator: Professor Andrew Hutchison). This group aims to design and implement network security protocols to address problems of security in web services, cloud computing environments and enterprise environments; research includes goal-oriented protocol design and identity management.

NETWORKING FOR DEVELOPMENT (Co-ordinators: Dr Josiah Chavula and Dr David L Johnson). The Net4D laboratory focuses on the design and implementation of network infrastructure
suitable for developing regions, as well as methods for sharing information in resource-scarce areas using alternative technologies. Main areas of research include Network Measurements, Wireless Community Networks, Localised Cloud Services, Software Defined Networking (SDN), and AI-driven network engineering. Our work involves a mix of creating solutions using network theory and systems, combined with trial networks that provide tangible measurable results. Net4D laboratory is affiliated to the UCT Centre in ICT4D.

**Undergraduate Courses**

*Credit will not be given for CSC1015F/S and CSC1016S together with CSC1010H and CSC1011H.*

**First-Year Courses**

**CSC1010H COMPUTER SCIENCE 1010**

*NOTE: This course only begins in week 7 and is intended for students who have been advised to transfer to this course after initially registering for CSC1015F (see entry for CSC1015F). The course places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. CSC1010H is equivalent to CSC1015F in level, credit value towards the degree and as prerequisite for certain other courses.*

18 NQF credits at NQF level 5  
**Convener:** G Stewart  
**Course entry requirements:** The permission of the Dean or Head of Department is required prior to registration for this course.  
**Course outline:**  
This course is an introduction to problem solving, algorithm development and programming in the Python language. It includes fundamental programming constructs and abstractions, sorting and searching techniques, and machine representations of data. The practical component covers input/output, conditionals, loops, strings, functions, arrays, lists, dictionaries, recursion, text files and exceptions in Python. Students are taught testing and debugging, as well as sorting and searching algorithms, algorithm complexity and equivalence classes. Number systems, binary arithmetic, boolean algebra and logic gates are also introduced  
**Lecture times:** Monday - Friday, 5th period, Tutorials: One per week, replacing one lecture, Practical: One per week, Thursday, 14h00 - 17h30  
**DP requirements:** Minimum of 45% aggregate in practical work.  
**Assessment:** Theory tests count 15%; practical tests and practical assignments count 25%; one 3-hour examination written in November counts 60%. Subminima: 45% for practicals, 45% on weighted average of theory tests and examination.

**CSC1011H COMPUTER SCIENCE 1011**

*NOTE: 1) This course follows on from CSC1010H and also places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. 2) CSC1011H is equivalent to CSC1016S in level, credit value towards the degree and as prerequisite for certain other courses.*

18 NQF credits at NQF level 5  
**Convener:** G Stewart  
**Course entry requirements:** CSC1010H  
**Course outline:**  
The first half of the course aims to further develop problem solving and programming in Python. The second half focuses on object-oriented design and programming in Java, as well as introducing important considerations relating to ethical and professional issues. The latter introduces students to ethical issues such as property rights, freedom of expression and privacy, and concepts such as free and open source software, ICT for Development, and Professional Codes of Conduct. The Java
component of the course covers object-oriented design techniques and UML class diagrams, as well as elementary data structures such as lists, stacks and queues. The practical component includes use of inheritance, polymorphism, interfaces, generics and GUI programming in Java.

**Lecture times:** Monday - Thursday, 4th period, Tutorials: One per week, replacing one lecture, Practicals: One per week, Monday, 14h00 - 16h00

**DP requirements:** Minimum of 45% aggregate in practical work.

**Assessment:** Theory tests count 25%; practical tests and practical assignments count 25%; one 3-hour examination written in November counts 50%. Subminima: 45% for practicals, 45% on weighted average of theory tests and examination.

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**CSC1015F/S  COMPUTER SCIENCE 1015**
18 NQF credits at NQF level 5

**Convener:** A Safla

**Course entry requirements:** At least 70% for NSC Mathematics. Students registered for this course will be assessed in week 5; if it is judged that they are not coping with the level and pace of the course, and would benefit from an opportunity to strengthen foundational concepts and learn new material at a slower pace, they will be required to transfer to CSC1010H from week 7.

**Course outline:**
This course is an introduction to problem solving, algorithm development and programming in the Python language. It includes fundamental programming constructs and abstractions, sorting and searching techniques, and machine representations of data. The practical component covers input/output, conditionals, loops, strings, functions, arrays, lists, dictionaries, recursion, text files and exceptions in Python. Students are taught testing and debugging, as well as sorting and searching algorithms, algorithm complexity and equivalence classes. Number systems, binary arithmetic, Boolean algebra and logic gates are also introduced. The course is offered in a blended-learning format. Students are provided with a set of video lectures that they can watch multiple times. Student contact time is in a tutorial/practical format aimed at reinforcing the principles introduced in the online lectures and giving students time to do exercises under the supervision of tutors.

**Lecture times:** 4th or 5th period once per week, Tutorials: One per week, replacing one lecture, Practicals: One per week, Monday, Tuesday, Wednesday or Thursday 14h00 - 16h00 or 16h00 - 18h00

**DP requirements:** Minimum of 45% aggregate in practical work.

**Assessment:** Theory tests 15%; practical tests and practical assignments 25%; June examination 2 hours 60%. Subminima: 45% for practicals, 45% on weighted average of theory tests and examination.

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**CSC1016S  COMPUTER SCIENCE 1016**
18 NQF credits at NQF level 5

**Convener:** A Safla

**Course entry requirements:** CSC1015F (At least 45% for CSC1015F or at least 70% for CSC1017F)

**Course outline:**
This course builds on the foundation of CSC1015F/CSC1010H, with a focus on object-oriented design and programming in Java, as well as introducing important considerations relating to ethical and professional issues. The latter introduces students to ethical issues such as property rights, freedom of expression and privacy, and concepts such as free and open source software, ICT for Development, and Professional Codes of Conduct. The Java component of the course covers object-oriented design techniques and UML class diagrams, as well as elementary data structures such as lists, stacks and queues. The practical component includes use of inheritance, polymorphism, interfaces, generics and GUI programming in Java.

**Lecture times:** 4th or 5th period daily, Tutorials: One per week, replacing one lecture, Practicals: One per week, Monday, Tuesday or Wednesday, 14h00 - 16h00 or 16h00 - 18h00

**DP requirements:** Minimum of 45% aggregate in practical work.
Assessment: Theory tests count 15%; practical tests and practical assignments count 25%; one 2-hour exam written in November counts 60%. Subminima: 45% for practicals and 45% on weighted average of theory tests and examination.

Second-Year Courses

CSC2001F  COMPUTER SCIENCE 2001
Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.cs.uct.ac.za/teaching. (A tablet or “netbook” will not be suitable). The course convenor will provide details of additional software (open source) required.
24 NQF credits at NQF level 6
Convener: To be advised
Course entry requirements: (CSC1015F and CSC1016S) or (CSC1010H and CSC1011H)
Course outline:
This course builds on the first year Computer Science foundation with an emphasis on data storage and manipulation. The course covers abstract data types and assertions, recursive algorithms, tree structures such as AVL and B-trees, graph traversals, minimum spanning trees, sets, hashing and priority queues. An introduction to conceptual modelling, database design and relational database manipulation is included. Practical programming in Java in a Unix environment is an important part of the course.
Lecture times: Monday - Friday, 2nd period, Four or five lectures per week, Practicals: One 4-hour practical per week, Monday - Friday, 14h00 - 18h00
DP requirements: Minimum of 45% aggregate in practical work.
Assessment: Tests count for 16.7%; practicals count 33.3%; one 3-hour paper written in June counts 50%. Subminima: 45% on weighted average of theory tests and examination.

CSC2002S  COMPUTER SCIENCE 2002
Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.cs.uct.ac.za/teaching. (A tablet or “netbook” will not be suitable). The course convenor will provide details of additional software (open source) required.
24 NQF credits at NQF level 6
Convener: To be advised
Course entry requirements: CSC2001F (At least 45% for CSC2001F)
Course outline:
The goal of this course is to complete the basic education of a Computer Scientist. Topics include: mobile application development and interface design, an introduction to computer architecture and concurrent programming. Practical work in Java and in assembler programming are included.
Lecture times: Monday - Friday, 2nd period, Four lectures per week, Practicals: One 4-hour practical per week, Monday - Friday, 14h00 - 18h00
DP requirements: Minimum of 45% aggregate in practical work.
Assessment: Tests count for 16.7%; practicals and practical test count 33.3%; one 3-hour paper written in November counts 50%. Subminima: 45% on weighted average of theory tests and examination.

CSC2004Z  PROGRAMMING ASSESSMENT
This is a required course for all students majoring in Computer Science and/or who wish to continue to any third year courses in Computer Science. It should be taken in the second year of study and will demonstrate competency in programming, which is assumed in all third year courses. It is a compulsory course in the Computer Science major CSC05.
0 NQF credits at NQF level 6
Convener: To be advised
Course entry requirements: (CSC1015F and CSC1016S) or (CSC1010H and CSC1011H)

Course outline:
All students who take advanced courses in Computer Science need to build on a foundation of strong programming skills. The aim of this course is to assess and confirm mastery in fundamental programming skills before students can proceed to advanced courses.

Lecture times: None

DP requirements: None

Assessment: Practical programming examination counts for 100%

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CSC2005Z  INDEPENDENT RESEARCH IN COMPUTER SCIENCE
24 NQF credits at NQF level 7

Convener: To be advised

Course entry requirements: Academically strong students may apply for entrance. Selection will be made on the basis of marks for CSC1015F, CSC1016S and CSC2001F. The number of places will be limited depending on the availability of supervisors, and the final decision will be at the discretion of the Head of Department.

Course outline:
This course allows students to pursue a course of independent research in one of the areas of specialisation of the department, as listed on the department's website, under the direct supervision of one of the staff members. Students will learn research methods in Computer Science and apply these in a suitable project. They will also learn about research writing (proposal and report). Students will complete a research project and document this in a research report (mini-dissertation). An intermediate deliverable will be a project proposal and presentation to staff.

Lecture times: Meetings with supervisor, by arrangement

Assessment: Proposal 20%, Final research report 80%

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Third-Year Courses

CSC3002F  COMPUTER SCIENCE 3002
Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.cs.uct.ac.za/teaching. (A tablet or “netbook” will not be suitable). The course convenor will provide details of additional software (open source) required.

36 NQF credits at NQF level 7

Convener: Associate Professor P Marais

Course entry requirements: CSC2001F, CSC2002S and ((MAM1004F+MAM1008S) or MAM1000W). CSC2004Z is required if CSC2002S was passed after 2017.

Course outline:
The course provides an introduction to the two topics (1) structure and organization of operating systems and (2) a basic knowledge of computer networks that will take the student through the various logical layers of the ISO OSI layers, focusing on the Internet Protocol suite.

Lecture times: Monday - Friday, 2nd period, Practicals: Two 4-hour practicals per week, Monday - Friday, 14h00 - 18h00

DP requirements: Minimum of 45% aggregate in practical work.

Assessment: Tests count 15%; practical work counts 35%; one 3-hour paper written in June counts 50%. Subminima: 45% for practicals; 45% on weighted average of theory tests and examinations.

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CSC3003S  COMPUTER SCIENCE 3003
Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.cs.uct.ac.za/teaching. (A tablet or “netbook” will not be suitable). The course convenor will provide details of additional software (open source) required.

36 NQF credits at NQF level 7
Convener: Associate Professor P Marais

Course entry requirements: CSC2001F, CSC2002S and ((MAM1004F+MAM1008S) or MAM1000W), and either INF2009F or permission from the Head of Department to do compensation work to a satisfactory standard. CSC2004Z is required if CSC2002S was passed after 2017.

Course outline:
This is a course on two advanced topics: (1) advanced software design is about turning requirements into effective and efficient implementations in a systematic manner; and (2) the algorithms module expands on a topic central to computing. This module describes how algorithms are categorised, and shows interesting algorithms in each category and analyses their complexity. It also touches on Turing machines and the limits of computation.

Lecture times: Monday - Friday, 2nd period, Practicals: Two 4-hour practicals per week, Monday - Friday, 14h00 - 18h00

DP requirements: Minimum of 45% aggregate in practical work.

Assessment:
Tests count 15%; practical work counts 35%; one 3-hour paper written in November counts 50%. Subminima: 45% for practicals, 45% on weighted average of theory tests and 35% for the algorithms module (comprising Theory of Algorithms and Theory of Computation) in the final examination.

CSC3022F  C++ AND MACHINE LEARNING
36 NQF credits at NQF level 7
Convener: Associate Professor P Marais

Course entry requirements: CSC2001F, CSC2002S and ((MAM1004F+MAM1008S) or MAM1000W). CSC2004Z is required if CSC2002S was passed after 2017.

Course outline:
This course introduces the C++ programming language, followed by an exploration of topics in machine learning. Students are exposed to different aspects of C++ including templates and functional programming and an in-depth study of the C++ memory model. A basic introduction to a widely used Python ML framework is then provided. A number of machine learning algorithms are introduced and students implement a subset of these using the Python framework. By the end of the course, students should understand how to write efficient object-oriented programs in C++, and also be familiar with major categories of learning algorithms, and be able to select and implement the most appropriate algorithm for a given problem in Python.

Lecture times: Monday – Friday, 3rd period, Practicals: Two 4-hour practicals per week, by arrangement

DP requirements: Minimum of 45% aggregate in practical work.

Assessment:
Tests count 16.7%; practical work counts 33.3%; examinations count 50%. Subminima: 45% for practicals, 45% weighted average of theory tests and examinations.

Postgraduate Courses

Honours

The Department offers 2 Honours streams: BSc Hons specialising in Computer Science (CS) and BSc Hons specialising in Information Technology (IT).

Programme Convener: Dr J Buys

Entry requirements – BSc Hons (CS): A BSc degree majoring in Computer Science from UCT, with an average of at least 60% in both CSC3002F and CSC3003S, or permission from the Head of Department.

Entry requirements – BSc Hons (IT): A Bachelor’s degree from a recognised university with a major in Computer Science or related field. Students must have an average of at least 60% in the major. Acceptance will be at the discretion of the Head of Department, who will consider quality of final year results and material covered in the undergraduate curriculum.
### Degree Rules and Structure

See General Rules for Honours Degrees in the front section of this book.

**Laptop Requirement:** Each student registered for Honours is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at [www.cs.uct.ac.za/teaching](http://www.cs.uct.ac.za/teaching). (A tablet or “netbook” will not be suitable). The handbook outlining the current year’s programme is available from the Department (and at [http://www.cs.uct.ac.za](http://www.cs.uct.ac.za)).

**Progression:** While it is expected that all students will complete the degree in a single academic year, students may be allowed to complete missing credits in a second year, with permission from the Dean.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Qualification Level</th>
<th>Convener</th>
<th>Course Entry Requirements</th>
<th>Course Outline</th>
<th>DP Requirements</th>
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<tr>
<td>CSC4002W</td>
<td>COMPUTER SCIENCE HONOURS PROJECT</td>
<td>60</td>
<td>NQF level 8</td>
<td>Dr J Buys</td>
<td>BSc degree with a major in Computer Science from UCT. An overall pass for the coursework component of this degree.</td>
<td>This course is the compulsory research project component of a Computer Science Honours degree. The research project comprises a large project run over the course of the year under academic supervision, with a final mini-dissertation and other project deliverables.</td>
<td>None</td>
<td>Exam: 50% and Coursework: 50%</td>
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<tr>
<td>CSC4007Z</td>
<td>SELECTED HONOURS MODULE IN COMPUTER SCIENCE</td>
<td>12</td>
<td>NQF level 8</td>
<td>Dr J Buys</td>
<td>Permission from the course convener.</td>
<td>This course introduces advanced and cutting edge topics in Computer Science as they emerge with new areas of investigation or practice.</td>
<td>None</td>
<td>Exam: 50% and Coursework: 50%</td>
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<tr>
<td>CSC4010Z</td>
<td>ADVANCED TOPICS IN COMPUTER SCIENCE HONOURS 2</td>
<td>12</td>
<td>NQF level 8</td>
<td>Dr J Buys</td>
<td>Permission from the course convener.</td>
<td>The course aims to introduce students to advanced and cutting edge topics in Computer Science as they emerge as new areas of investigation or practice, and expose students to new research specialisations in the department. Students will obtain an advanced theoretical understanding of the topic and the ability to apply practically skills learnt related to this specific topic.</td>
<td>None</td>
<td>Exam: 50% and Coursework: 50%</td>
</tr>
<tr>
<td>CSC4018W</td>
<td>INFORMATION TECHNOLOGY HONOURS PROJECT</td>
<td>60</td>
<td>NQF level 8</td>
<td>Dr J Buys</td>
<td>BSc degree with a major in Computer Science. An overall pass for the coursework component of this degree.</td>
<td>This course is the compulsory research project component of a Computer Science Honours degree. The research project comprises a large project run over the course of the year under academic supervision, with a final mini-dissertation and other project deliverables.</td>
<td>None</td>
<td>Exam: 50% and Coursework: 50%</td>
</tr>
</tbody>
</table>
CSC4019Z  RESEARCH & INNOVATION
16 NQF credits at NQF level 8
Convener: Dr J Chavula
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology.
Course outline:
This course introduces students to knowledge essential for computer professionals and researchers. The course develops communication and writing skills and introduces basic research methodology. The first module of the course focuses on Professional Communications in general, including written and visual communication.
A second component teaches entrepreneurship as New Venture Planning: a critical element of economic development. This module introduces students to the ideas, theories and concepts associated with entrepreneurial ventures, with a focus on the elements needed to develop a viable business plan.
A third module teaches scientific writing and research methods for statistical analysis and evaluation of data.
DP requirements: None
Assessment: The practical aspects of the work will be evaluated through: a series of 4 NVP assignments (10%/15%/35%/40%), culminating in a business plan; Professional Communications course (25%); and a submitted literature review for the project (35%) and the project proposal (40%). NVP and PCU+RM are equally weighted.

CSC4020Z  FUNCTIONAL PROGRAMMING
12 NQF credits at NQF level 8
Convener: Associate Professor G Nitschke
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology.
Course outline:
This course will expose students to the alternative functional programming paradigm, its theoretical underpinnings in the lambda calculus and its practical implementation in specific languages. Students' theoretical understanding of computability will be expanded from the introduction in the undergraduate theory of algorithms module where a Turing machine approach was used. Students will be introduced to the notion of “functions as rules”.
Students will also learn how to use functional programming as a practical programming skill. Topics include side effect free programming and its benefits; first-class functions and higher-order functions; partial application and defining higher-order operations on aggregates, especially map, reduce/fold, and filter. Important new functional programming concepts including lazy evaluation and monads.
DP requirements: 40% mark in the practical assignments for the course.
Assessment: Final examination: 60%; Practical assignments: 40%

CSC4021Z  COMPILERS 1
12 NQF credits at NQF level 8
Convener: To be advised
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology.
Course outline:
This course will introduce students to the inner mechanics of a modern programming language compiler or interpreter. Students will appreciate why programming languages are designed in particular ways and they will learn how to develop compilers and compiler-related tools. Course content will include: language classes, formal grammars, recursive descent parsing, tokenisers, parsing, and abstract syntax trees.
DP requirements: None
Assessment: Final examination: 60%; Practical assignments: 40%

CSC4022Z  COMPILERS 2
This course will not be offered every year.
12 NQF credits at NQF level 8
Convener: To be advised
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology.
Course outline:
This course will introduce students to the inner mechanics of a modern programming language compiler or interpreter. Students will appreciate why programming languages are designed in particular ways and they will learn how to develop compilers and compiler-related tools. Course content will include: semantic analysis, activation records, intermediate code, optimisations, basic block analysis, instruction selection, liveness analysis and register allocation.

DP requirements: None
Assessment: Final examination: 60%; Practical assignments: 40%

CSC4023Z  BIG DATA MANAGEMENT & ANALYSIS
This course will not be offered every year.
12 NQF credits at NQF level 8
Convener: Associate Professor S Berman
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology. A basic understanding of databases, similar to the CSC2001F database material, is expected.
Course outline:
This course will enable students to understand the challenges of designing and implementing database applications at very large scale. They will know the approaches taken by big data technologies such as relational databases, NoSQL, Hadoop and data mining tools, and have practice in applying this knowledge.
The focus of this course is on systems designed for big data storage and analysis. Topics covered include NoSQL, Hadoop, HBase, HIVE, YARN and Apache Spark, as well as an introduction to data mining techniques and tools. The course concludes with a series of short presentations on new developments in database technology such as spatial, temporal, mobile, multimedia, text and social network data management.

DP requirements: None
Assessment: Final examination: 60%; Practical assignments: 40%

CSC4024Z  HUMAN COMPUTER INTERACTION
This course will not be offered every year.
12 NQF credits at NQF level 8
Convener: Associate Professor M Densmore
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology.
Course outline:
This course will introduce you to basic concepts and practice around user-centred design of digital systems. This course covers how to design and evaluate interactive systems for real users both in the developed and developing worlds. We will look at both theory and practice of designing digital systems. Topics include the design cycle, sketching and storyboarding, task analysis, contextual inquiry, conceptual models, usability inspection, human information processing, experience design, and qualitative and quantitative study design and evaluation. We will also invite guest speakers from industry and research to talk about their own experiences with user-centred design.

DP requirements: None
Assessment: Final examination: 60%; Practical assignments: 40%
CSC4025Z  ARTIFICIAL INTELLIGENCE
This course will not be offered every year.
12 NQF credits at NQF level 8
Convener: Dr J Buys
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology.
Course outline:
This course will expose students to foundational concepts and computational techniques in modern Artificial Intelligence and their theoretical underpinnings in logic, search, optimisation and mathematical statistics. Students will also learn how to select and implement these techniques to solve various real world problems. Core topics will include: problem solving, knowledge representation and reasoning, machine learning and dealing with uncertainty, with selected topics from: planning, agents and natural language processing.
DP requirements: None
Assessment: Final examination: 60%; Practical assignments: 40%

CSC4026Z  NETWORK & INTERNETWORK SECURITY
This course will not be offered every year.
12 NQF credits at NQF level 8
Convener: To be advised
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology. Computer Networking at third year level.
Course outline:
The objective of this course is to introduce cryptographic techniques and protocols for secure exchange of information on networks and internetworks, and to examine the deployment of these in emerging technologies.
The course will cover risk issues (ISO27000; PoPI act); security services; conventional encryption (classical encryption techniques, DES/AES, key distribution, key generation); public-key encryption (RSA algorithm, key management, certification hierarchies); authentication & digital signatures; authentication and key exchange (Kerberos, Diffie-Hellman); electronic messaging security (S-MIME/PGP/WhatsApp); HTTP security (S-HTTP, SSL, capabilities); secure electronic commerce (SET); web application security (OWASP); web-services security (WS-Security, SAML); cloud computing security (public vs private clouds); critical infrastructure security (Stuxnet etc); Security Information & Event Management (SIEM) and next generation Security Operation Centre.
DP requirements: None
Assessment: Final examination: 60%; Practical assignments: 40%

CSC4027Z  COMPUTER GAME DESIGN
This course will not be offered every year.
12 NQF credits at NQF level 8
Convener: Professor J Gain
Course entry requirements: Admission to BSc Hons specialising in Computer Science or Information Technology. Computer Graphics at third year level.
Course outline:
This course will introduce students to the techniques and technologies used in designing and programming computer games and related applications.
This course introduces high-level game programming concepts and practical game construction. By the end of the course, students will be able to design and implement simple 2D and 3D games. The course content include: appropriate terminology, methods, and tools for computer game development are introduced; fundamental algorithms for 2D game development; design and development of simple 3D and networked games; uncertainty and constantly changing gaming environments; and techniques for multiuser and distributed games.
This is a practical course: students collaborate with designers and artists to produce a full games that builds on concepts covered in lectures.

**DP requirements:** None  
**Assessment:** Final examination: 60%; Practical assignments: 40%

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**CSC4028Z  HIGH-PERFORMANCE COMPUTING**  
*This course will not be offered every year.*  
12 NQF credits at NQF level 8  
**Convener:** Associate Professor M M Kuttel  
**Course entry requirements:** Admission to BSc Hons specialising in Computer Science or Information Technology.  
**Course outline:**  
Single-core CPU compute performance has flatlined at 70-100 GFLOPs and no longer doubles every eighteen months. Multicore architectures are now ubiquitous and commodity Graphical Processing Units (GPUs) have overtaken CPUs in terms of processing power, with performance in the 900-1200 GFLOP range. This is the era of heterogeneous parallel computing with multicore and accelerators. As a result, multithreaded computing is increasingly important for effective software development. However, knowledge and experience of both parallel algorithms and architectures is required in order to program a parallel computer effectively, particularly in the case of complex hybrid accelerator/multicore machines. This course cover methods for the practical development of parallel algorithms on multiple cores or GPUs.  
This module covers the following areas: An overview of parallel computing, with a history of a parallel computing in general, clusters, multicore and accelerators; Parallel architectures – clusters, multicore machines and accelerators; General comparison of parallel programming models and methods; Thinking in parallel: Parallel algorithms and applications; Multithreaded computing for multiple cores; A motivation for general purpose computation on GPUs (GPGPU); The CUDA approach to multithreaded computing; CUDA threading and memory models; CUDA performance optimization; and Benchmarking, profiling and proving parallel performance.  
**DP requirements:** None  
**Assessment:** Assignments (50%), Exam (50%). Subminima of 45% for both exam and the assignments.

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**CSC4029Z  INTRODUCTION TO COMPUTER GRAPHICS**  
*This course will not be offered every year.*  
12 NQF credits at NQF level 8  
**Convener:** Associate Professor P Marais  
**Course entry requirements:** Admission to BSc Hons specialising in Computer Science or Information Technology.  
**Course outline:**  
This course will expose students to the foundational theory of 3D computer graphics and provide a short introduction to OpenGL and GLSL shader programming. Theory will encompass the formal description of 3D models and how these can be lit and rendered to produce a desired representation of a 3D scene. On the practical side, a series of short assignments will introduce basic OpenGL and shader programming and allow students to apply the theory they have learned. Topics include: the rendering pipeline and rasterization; 3D mesh model representation; homogeneous coordinates; modelling and viewing transformations; shading, lighting and texturing; GLSL shader programming; OpenGL/WebGL programming; advanced rendering - ray-tracing.  
**DP requirements:** 40% in the practical assignments for the course.  
**Assessment:** Assignment (40%), Exam (60%)
STA4026S  ANALYTICS
18 NQF credits at NQF level 8
Convener: S Britz

Course entry requirements: Undergraduate degree that included a substantial degree of training in quantitative subjects and programming, as assessed by the course convener.

Course outline:
This course will cover computationally-intensive statistical methods for analysing datasets of various sizes. The course will cover three broad sections: (1) Parallel and high-performance computing in R, (2) Supervised Learning and (3) Unsupervised Learning.

In the first section, students will learn how to use R to analyse large datasets on multiple computer processors, and UCT’s own HPC cluster. The second section will expose students to machine learning techniques that are used to infer a regression or classification rule based on labelled training data, including regression and classification trees, bagging and random forests, boosting, neural networks. The last section will cover statistical methods for classifying observations into groups where the group memberships of the training data are not known in advance, including self-organising maps, association rule mining and cluster analysis.

DP requirements: Satisfactory completion of assignments

Assessment: Assignments and Computer-based Exam

Master's specialising in Computer Science by Dissertation

CSC5000W  COMPUTER SCIENCE DISSERTATION
180 NQF credits at NQF level 9
Convener: Professor J Gain

Course entry requirements: Computer Science Honours from UCT prior to 2018, or permission from the Head of Department in exceptional cases. In the normal case, students will be expected to register for Master’s specialising in Computer Science, by coursework and minor dissertation.

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook. Students will be expected to attend a research methods course in the first year.

Master's specialising in Computer Science or Artificial Intelligence, by Coursework and Minor dissertation

The Department offers 2 Master's streams: MSc specialising in Computer Science (CS) and MSc specialising in Artificial Intelligence (AI).

Programme Convener: Professor J Gain

Course structure: See General rules for Master's Degrees in the front section of this book.

Progression: In any given year, students must either be registered for or have passed at least six of the elective courses. Students get two attempts to pass each course. Should a student fail any course on the second attempt, they will not be allowed to continue with the degree. This applies to the Research Methods course as well. Students should pass a minimum of two elective courses per year. With the course convenor’s permission, students who have passed the Research Methods course as
well as four of the six elective courses may be permitted to register for CSC5002W/CSC5037W. Students are not eligible to register for CSC5002W/CSC5037W until they have completed the Research Methods course and at least four (out of six) elective courses.

**CSC5002W**  COMPUTER SCIENCE MINOR DISSERTATION
90 NQF credits at NQF level 9  
Convener: Professor J Gain  
Course entry requirements: Completion of all coursework, or permission of the convener.  
Course outline: 
Upon successful completion of the coursework, students will be required to register for this minor dissertation component and complete a suitable research project under supervision of an appropriate computer science academic staff member. The research component will expose the student to research methodology, experimental design, data analysis techniques, and dissertation writing skills. Students should be in a position to submit the final dissertation by the end of the year.  
Assessment: The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

**CSC5037W**  ARTIFICIAL INTELLIGENCE MINOR DISSERTATION
90 NQF credits at NQF level 9  
Convener: Professor J Gain  
Course entry requirements: Completion of all coursework, or permission of the convener.  
Course outline: 
Upon successful completion of the coursework component, students will be required to register for this minor dissertation component in Artificial Intelligence and complete a suitable research project on a topic within the broad area of Artificial Intelligence under supervision of an appropriate computer science academic staff member. The research component will expose the student to research methodology, experimental design, data analysis techniques, and dissertation writing skills. Students should be in a position to submit the final dissertation by the end of the year.  
Assessment: The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

**CSC5008Z**  DATA VISUALISATION
This course will not be offered every year.  
12 NQF credits at NQF level 9  
Convener: Associate Professor M M Kuttel  
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener.  
Course outline: 
Visualisation is the graphical representation of data with the goal of improving comprehension, communication, hypothesis generation and decision making. This course aims to teach the principles of effective visualisation of large, multidimensional data sets. We cover the field of visual thinking, outlining current understanding of human perception and demonstrating how we can use this knowledge to create more effective data visualisations.  
DP requirements: 40% for assignment component.  
Assessment: Students will be assessed with assignments (50%) and an exam (50%). A sub-minimum of 40% will be required for each of the assignment and exam components of the course.
CSC5020Z  RESEARCH METHODS IN COMPUTER SCIENCE
18 NQF credits at NQF level 9
Convener: Professor J Gain
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener.
Course outline:
The objective of the Research Methods course is to introduce students to a suite of research methods from the perspective of Computer Science, that will prepare them for the minor dissertation component of the degree. More specifically, the aim is to ensure that students are able to write an appropriate research proposal, and have a good understanding of what it means to conduct research within Computer Science.
Course content includes: An introduction to finding and reading research papers; Literature reviews; Writing research proposals; Problem statements, research questions, and hypotheses; Types of research within Computer Science; Research Ethics within Computer Science; Scientific and technical writing; Qualitative and quantitative research methods; Research statistics; Research planning and grant writing; Academic career planning.
DP requirements: None
Assessment: A submitted literature review (50%) and research proposal (50%).

CSC5021Z  COMPUTATIONAL GEOMETRY FOR 3D PRINTING
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Professor J Gain
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener. Computer Graphics at third-year level.
Course outline:
The objective is to master surface and volumetric modelling concepts applicable to 3D printing. The use of 3D printers for rapid prototyping is becoming increasingly prevalent. However, the process used by most current 3D printers of depositing thin layers of semi-molten material, which is known as Fused Deposition Modelling (FDM), is not without limitations. Factors such as material thickness and support structures need to be considered. This course will cover the theoretical concepts required for creating geometric models suitable for 3D printing. From a practical perspective, students will code modelling software, then design and ultimately print a 3D model.
DP requirements: None
Assessment: Exam: open book, 2 hours, 40%. Practical assessments 50%; Final printed show piece, 10%

CSC5022Z  DISTRIBUTED SCIENTIFIC COMPUTING
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Professor R Simmonds
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener. A basic understanding of computer networking and software systems.
Course outline:
The objective is to provide an understanding of the basic components used to build Grid and Cloud computing systems, with a focus on how these can support Scientific Computing.
This course gives an overview of the components that make up Grid and Cloud computing environments. These include the components used to build distributed data and computing grids and
the various “as a Service” systems referred to as Cloud computing. It also looks at how these are used for a range of activities, including supporting large scale Scientific Computing.

**DP requirements:** None
**Assessment:** Final examination: 60%; Practical assignments: 40%

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**CSC5023Z**  
**EVOLUTIONARY COMPUTATION**  
*This course may not be offered every year.*

12 NQF credits at NQF level 9  
**Convener:** Associate Professor G Nitschke

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener. A basic understanding of genetics and evolution is useful, but not required.

**Course outline:**

Evolutionary computation entails the use of simulated biological evolution to solve problems that are difficult to solve using traditional computer science and engineering methods. This course examines different Evolutionary Algorithms (EAs) and the types of problems EAs are best suited to solve. Course objectives include: gaining an understanding of various evolutionary computation techniques, identifying EAs suitable for solving different types of problems, and how to apply EAs to optimisation, machine learning, or design tasks.

The topics covered include: Introduction to Evolutionary Computation; What is an Evolutionary Algorithm; Genetic Algorithms; Evolution Strategies; Evolutionary Programming; Genetic Programming; Niching; Multi-Objective Optimisation; Co-evolution; and Working with EAs.

**DP requirements:** None
**Assessment:** Exam: closed book, 2 hours, 60%; Practical assignment: 40%.

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**CSC5024Z**  
**INFORMATION RETRIEVAL**  
*This course will not be offered every year.*

12 NQF credits at NQF level 9  
**Convener:** Professor H Suleman

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science, or permission from the course convener. Basic understanding of XML data is required. Some background on statistics and linear algebra will be useful.

**Course outline:**

The objective is to understand how search engines work at an algorithmic level. Learn how to build and incorporate basic and specialized search engines into your own projects.

Course content includes: Introduction to Information Retrieval (IR); Models of Basic IR (Boolean, Vector, Probabilistic); IR evaluation and testbeds; Stemming, Stopping, Relevance Feedback; Models of Web and linked-data retrieval (Pagerank, HITS); Latent Semantic Analysis and Clustering; Multimedia IR; Cross-lingual and multilingual IR; and IR in Practice (CMSes, digital libraries, Web, social media, etc.).

Selected topics will be included from: Distributed and Federated IR; Recommender Systems; Natural Language Processing for IR; Sentiment Analysis; Opinion Retrieval; and Text Summarization.

**DP requirements:** None
**Assessment:** Exam (take-home): 40%; Assignments: 40%; Class participation: 20%

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**CSC5025Z**  
**INTELLIGENT SYSTEMS**  
*This course will not be offered every year.*

12 NQF credits at NQF level 9  
**Convener:** Associate Professor D Moodley

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener. A strong mathematics background.
Course outline:
This Computer Science masters course provides an introduction to designing and implementing intelligent systems, using selected Artificial Intelligence techniques. The course will introduce you to at least two widely used Artificial Intelligence approaches, including machine learning and Bayesian Artificial Intelligence. You will learn these techniques from a Computer Science perspective, specifically how to design real world intelligent systems that incorporate such AI techniques.

DP requirements: None
Assessment: 2 hour open book exam: 50%, Practical assignments: 50%

CSC5026Z  INTRODUCTION TO ICT FOR DEVELOPMENT
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener.
Course outline:
The goal is for you to understand basic ideas underlying ICT4D and how they are used in practice. You will learn about and critically evaluate ICT4D projects. You will learn how to design and evaluate development-oriented computing projects.
Course Content: Introduction to key terminology around socio-economic development; Key concepts in ICT4D (e.g. social inclusion, after access); Case studies in specific domains, including healthcare, agriculture, mobile money, education, etc.; Critical evaluation of ICT4D projects.
DP requirements: None
Assessment: Practical assignments: 80%; Case Study Presentation: 10%; Class Participation: 10%

CSC5027Z  LOGICS FOR ARTIFICIAL INTELLIGENCE
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Professor T A Meyer
Course entry requirements: Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener. Familiarity with basic discrete mathematics is highly recommended.
Course outline:
This course will introduce students to logics used in the area of Knowledge Representation - a subarea of Artificial Intelligence. Logic plays a central role in many areas of Artificial Intelligence. This course will introduce students to Description Logics, a family of logics frequently used in the area of Knowledge Representation and Reasoning. Description Logics are frequently used to represent formal ontologies.
Topics covered include the following: The Description Logic ALC; Reasoning in Description Logics with Tableaux Algorithms; Reasoning in the EL family of Description Logics; and Query Answering.
DP requirements: None
Assessment: Exam: open book, 3 hours, 50%; Assignments: 50%.

CSC5028Z  ONTOLOGY ENGINEERING
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Associate Professor M Keet
Course entry requirements: Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener. Experience in modelling (ER, UML Class diagrams) and some familiarity with logic will be helpful.
Course outline:
The principal aim of this module is to provide the participant with an overview of ontology engineering—including language features, automated reasoning, and top-down and bottom-up ontology development—and a main application field being the Semantic Web.

Course Content: Ontologies are used in a wide range of applications, such as data integration, recommender systems, e-learning, semantic scientific workflows, and natural language processing. While some of these applications pass the revue, the main focus of the course is on the ontologies. The topics covered include the following:

- Logic foundations for ontologies: Languages (Description Logics, OWL); and Automated reasoning (class and instance classification, satisfiability and ontology consistency checking).
- Ontology development: Ontology engineering, top-down - foundational ontologies, ontology design patterns; Ontology engineering, bottom-up - exploiting legacy material, such as relational databases, thesauri, text; and Methodologies for ontology development and maintenance, methods to enhance ontology quality and to automate some aspect of the methodology.

DP requirements: None

Assessment: Exam (closed-book but with some material provided) - 50%, assignments - 50%.

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**CSC5029Z**  INTRODUCTION TO IMAGE PROCESSING AND COMPUTER VISION

*This course will not be offered every year.*

12 NQF credits at NQF level 9

**Convener:** Associate Professor P Marais

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener. Experience in modelling (ER, UML Class diagrams) and some familiarity with logic will be helpful.

**Course outline:**
To introduce students to basic concepts in computer vision and image processing, oriented towards solving real world, practical image analysis problems. The student will be introduced to basic concepts from digital signal processing, and a foundation built that will allow understanding of how more sophisticated schemes such as image analysis/segmentation which can be used to describe image and volumetric data at a higher, more useful, levels of abstraction. Case studies and papers will be examined which relate this to real-world problems.

A number of lectures (as indicated below) will be presented by the course convener, interspersed with paper/review sessions in which topical papers are discussed and followed up by review questions.

Topic will include: Basic Signal processing; Image Transforms & Operations; Feature Detection; Object Descriptions; Basic Segmentation & Registration; Fundamental Segmentation techniques; Machine Learning & GAs in Cvision; Case Study; and Paper Reviews.

DP requirements: None

Assessment: Exam: Open Book; 2 hours. Class Record: Practical 60%, Review Questions 40%. Final Mark: Exam 40%, Class Record 60%.

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**CSC5030Z**  ADVANCED TOPICS IN COMPUTER SCIENCE MASTER'S 1

*This course will not be offered every year.*

12 NQF credits at NQF level 9

**Convener:** Professor J Gain

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener.

**Course outline:**
This course introduces advanced and cutting edge topics in Computer Science as they emerge with new areas of investigation or practice.

DP requirements: None

Assessment: Exam: 50% and Coursework: 50%
CSC5031Z  ADVANCED TOPICS IN COMPUTER SCIENCE MASTER'S 2
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Professor J Gain
Course entry requirements: Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener.
Course outline:
To introduce advanced and cutting edge topics in Computer Science as they emerge as new areas of investigation or practice.
DP requirements: None
Assessment: Exam: 50% and Coursework: 50%

CSC5032Z  NETWORKS & INTERNET SYSTEMS
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Dr J Chavula
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener. Working knowledge of computer networks.
Course outline:
The objective is to gain advanced understanding of techniques for traffic engineering and quality of service in the Internet architecture. The course focuses on advanced topics in internetworking, traffic engineering, and mechanisms for measuring performance and Quality of Service (QoS) for network services and the Internet.
Course content includes: New Network and Transport Protocols (IPv6, Mobile IP, IP Multicast, Multipath TCP, QUIC); Routing and Traffic Engineering (Interdomain Routing and Traffic Engineering with Border Gateway Protocol); Traffic Engineering with Overlay Networking (MPLS/GMPL, Location/Identifier Separation Protocols, Software Defined Networking and Network Function Virtualization); Internet Measurements (Quality of Service and Quality of Experience (QoS and QoE), IP Traffic Monitoring and Analysis)
Selected reading/discussion topics will be included from: Cloud Infrastructure; Content Delivery Networks; Internet Access in the Developing World, Community Networks; ICT4D, Online Data Protection and Online Censorship.
DP requirements: None
Assessment: Assignments: 40%. Discussion sessions: 15%. Active Participation in Class: 5%. Final Exam : 40%

CSC5033Z  HUMAN COMPUTER INTERACTION
This course will not be offered every year.
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore
Course entry requirements: Admission into the Master's degree specialising in Computer Science, or permission from the course convener.
Course outline:
This course will introduce you to basic concepts and practice around user-centred design of digital systems.
This course covers how to design and evaluate interactive systems for real users both in the developed and developing worlds. We will look at both theory and practice of designing digital systems.
Topics include the design cycle, sketching and storyboarding, task analysis, contextual inquiry, conceptual models, usability inspection, human information processing, experience design, and qualitative and quantitative study design and evaluation. We will also invite guest speakers from industry and research to talk about their own experiences with user-centred design.
The course will contain additional practical work to distinguish it from the honours level module on Human Computer Interaction (CSC4024Z).

**DP requirements:** None

**Assessment:** Participation: 10% (measured by participation in user studies, in-class activities, in-class discussion/presentations, and pre-class quizzes on Vula) Individual Practical Assessments: 20%. Group Project Assessments: 40% Final Exam: 30%

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**CSC5034Z  MACHINE LEARNING**

*This course will not be offered every year.*

12 NQF credits at NQF level 9

**Convener:** Associate Professor G Nitschke

**Course entry requirements:** Admission into the Master's degree specialising in Artificial Intelligence, or permission from the course convener.

**Course outline:**

This course will expose students to foundational concepts and computational techniques in Machine Learning and underlying theory and concepts related to formulating and implementing machine learning algorithms to solve a wide range of problems. Students will also learn how to implement a broad range of classical to biologically inspired machine learning algorithms with real-world applications. Core topics include supervised and unsupervised learning such as: concept learning, clustering, artificial neural networks and reinforcement learning.

**DP requirements:** None

**Assessment:** Practical work counts 50%; examination counts 50%.

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**CSC5035Z  NATURAL LANGUAGE PROCESSING**

*This course will not be offered every year.*

12 NQF credits at NQF level 9

**Convener:** Dr J Buys

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener.

**Course outline:**

The course will introduce students to fundamental concepts and current approaches in Natural Language Processing. Course content includes: Text preprocessing; Naive Bayes and logistic regression for text classification; Word vectors and distributional semantics; n-gram language models; Sequence labelling with hidden Markov Models; Syntactic parsing; Recurrent neural networks for sequence processing; Encoder-decoder neural networks; Transformers neural networks and contextual embeddings. A selection of Natural Language Processing applications included from: Sentiment analysis, Parts-of-Speech tagging, Named Entity Recognition, machine translation, information extraction and question answering.

**DP requirements:** None

**Assessment:** Exam (take-home): 50%; Assignments: 50%.

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**CSC5036Z  VIRTUAL REALITY**

*This course will not be offered every year.*

12 NQF credits at NQF level 9

**Convener:** Professor J Gain

**Course entry requirements:** Admission into the Master's degree specialising in Computer Science or Artificial Intelligence, or permission from the course convener.

**Course outline:**

Virtual Reality (VR) involves the creation of a digital replacement for the senses (sight, hearing, smell, taste, touch) using devices, such as head-mounted displays and haptic feedback, in such a way that users perceive themselves to be immersed in an alternate or augmented reality. VR has applications in games, simulation and training. This course will introduce the theoretical underpinnings and practical skills necessary for creating virtual environments. Topics covered
Departments in the faculty include the following: Interaction in VR, navigation and locomotion in VR, simulator sickness, immersion and presence, designing VR Environments with Unity, non-visual modalities (binaural output, virtual flavour, haptics).

**DP requirements:** None

**Assessment:** Exam: open book, 24 hours, 50%; Assignments: 50%.

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**Master's specialising in Information Technology by Coursework and Minor dissertation**

**Programme Convener:** Associate Professor M Densmore

**Entry requirements:** The Masters in Information Technology by Coursework and Dissertation is a conversion course designed for those with a degree in a non-IT field to attain a strong background and a qualification in Information Technology. This course follows a Bachelor Honours or equivalent in any non-IT degree. All admissions decisions are at the discretion of the university.

**Course structure:** See General Rules for Master's Degrees in the front section of this book.

**Progression:** Students should pass a minimum of three courses each year. Should a student fail any course on the second attempt, they will not be allowed to continue with their studies. Students are eligible to register for CSC5004W once they have passed 7 of the 8 courses.

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**CSC5004W INFORMATION TECHNOLOGY MINOR DISSERTATION**

90 NQF credits at NQF level 9

**Convener:** Associate Professor M Densmore

**Course entry requirements:** CSC5005H and CSC5006H or (CSC5007Z, CSC5010Z, CSC5011Z, CSC5012Z, CSC5014Z, CSC5015Z, CSC5016Z and CSC5017Z) or permission from the convener.

**Course outline:**
Upon successful completion of the coursework component (Two block modules (CSC5005H and CSC5006H) or all eight individual modules (CSC5007Z, CSC5010Z, CSC5011Z, CSC5012Z, CSC5014Z, CSC5015Z, CSC5016Z and CSC5017Z)), students will be required to register for this minor dissertation course and complete a one year research project under supervision of an appropriate computer science academic staff member.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

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**CSC5005H INFORMATION TECHNOLOGY COURSEWORK PART 1**

_Not offered to new students after 2017._

45 NQF credits at NQF level 9

**Convener:** Associate Professor M Densmore

**Course entry requirements:** An Honours degree or 4-year equivalent plus access to the Internet.

**Course outline:**
CSC5005H and CSC5006H together constitute the coursework component. CSC5005H comprises 4 modules selected from the following: Object-oriented programming; Human-Computer Interaction; Databases; Networks; Web Programming; Software Engineering; Cyberlaw and Ethics; Research Methods. CSC5006H comprises the remaining 4 modules, i.e. excluding modules for which credit was received in CSC5005H. All study is via on-line self-study materials.

**DP requirements:** A subminimum of 40% average for the assignments of at least 3 modules and an average of at least 40% in the mid-year examinations.

**Assessment:** In CSC5005H and CSC5006H assignments count 30% and the examination 70%. A subminimum of 40% for examinations is required in each of CSC5005H and CSC5006H. A module can be repeated once only; two unsuccessful attempts constitute a fail. A student who accumulates two failed modules will not be permitted to continue. To pass each course an overall average of at least 50% is required.
CSC5006H  INFORMATION TECHNOLOGY COURSEWORK PART 2
Not offered to new students after 2017.
45 NQF credits at NQF level 9
Convener: Associate Professor M Densmore
Course entry requirements: An Honours degree or 4-year equivalent plus access to the Internet.
Course outline:
CSC5005H and CSC5006H together constitute the coursework component. CSC5005H comprises 4 modules selected from the following: Object-oriented programming; Human-Computer Interaction; Databases; Networks; Web Programming; Software Engineering; Cyberlaw and Ethics; Research Methods. CSC5006H comprises the remaining 4 modules, i.e. excluding modules for which credit was received in CSC5005H. All study is via on-line self-study materials.
DP requirements: A subminimum of 40% average for the assignment of at least 3 modules and an average of at least 40% in the mid-year examinations.
Assessment: In CSC5005H and CSC5006H assignments count 30% and the examination 70%. A subminimum of 40% for examinations is required in each of CSC5005H and CSC5006H. A module can be repeated once only; two unsuccessful attempts constitute a fail. A student who accumulates two failed modules will not be permitted to continue. To pass each course an overall average of at least 50% is required.

CSC5010Z  MIT: COMPUTER NETWORKS
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore
Course entry requirements: Admission into the Master’s degree specialising in IT, or permission from the course convener.
Course outline:
In the course, a framework for describing the operation of computer networks is developed. Within this framework, we start with the operation of local-area networks, packet-switched networks and the Internet. After this, the module moves to the uses made of these networks, concentrating on business applications. The effect on organisations of introducing such networked applications is also examined.
DP requirements: 40% for assignment component.
Assessment: Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

CSC5011Z  MIT: OBJECT-ORIENTED PROGRAMMING IN PYTHON
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore
Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convener.
Course outline:
The underlying aim of all courses is to develop a foundation in key topics related to the application of computer hardware and software in solving practical problems. This is a basic introduction to object-oriented programming in a modern language, namely, Python. Python is becoming increasingly popular as an effective means of introducing programming concepts to those who are new to programming. Students will be taught how to create simple applications in the Python language.
DP requirements: 40% for assignment component.
Assessment: Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

CSC5012Z  MIT: HUMAN COMPUTER INTERACTION
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore
Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.

Course outline: Introduction to the discipline of human-computer interaction. This module covers how knowledge from fields such as psychology and graphic design can be used to increase the usability of computer software.

DP requirements: 40% for assignment component.

Assessment: Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

CSC5014Z   MIT: SOCIAL ISSUES & PROFESSIONAL PRACTICES
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore

Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.

Course outline: The underlying aim of all courses is to develop a foundation in key topics related to the application of computer hardware and software in solving practical problems. SIPP introduces important considerations relating to ethical and professional issues. It introduces students to ethical issues such as property rights, freedom of expression and privacy, and concepts such as free and open source software, ICT for Development, and Professional Codes of Conduct. It also equips students with tools for critical reasoning in order to construct and analyse ICT policy arguments and evaluate the ethical components in ICT case studies.

DP requirements: 40% for assignment component.

Assessment: Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

CSC5015Z   MIT: SOFTWARE ENGINEERING
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore

Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.

Course outline: This module aims to introduce a range of techniques within both structured and object-oriented methods, in order to enable you to analyse and design well engineered software solutions. You will be introduced to the practical use of CASE tools in modelling and documenting analysis and design specifications. Different life cycle models will also be discussed.

DP requirements: 40% for assignment component.

Assessment: Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

CSC5016Z   MIT: WEB PROGRAMMING
12 NQF credits at NQF level 9
Convener: Associate Professor M Densmore

Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.

Course outline: This course introduces students to the technology underlying the modern Internet. This includes: the systems used to encode information and how the information is architected; the use of Javascript as a dynamic execution model; modern information encoding approaches such as XML; and the creation of Web applications.

DP requirements: 40% for assignment component.
**Assessment:** Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

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**CSC5017Z  MIT: RESEARCH METHODS**

12 NQF credits at NQF level 9  
**Convener:** Associate Professor M Densmore  
**Course entry requirements:** Admission into the Master's degree specialising in IT, or permission from the course convenor.  
**Course outline:**  
This module is intended to provide students with the insight and techniques required to allow them to write a successful postgraduate research project - the final module leading to the Master's Degree. Topics to be covered include: Introduction to IT Research; Ethics in Research; Conducting a Literature Review; Finding a Research Question/Goal; Project Management; Research Proposals; Experimentation; Prototypes; Case Studies; Surveys; Conducting Observations; Testing in IT Research; Modelling; Usability Analysis; Introduction to Statistics; The Writing Process; Research Presentations; and The Masters/PhD Thesis.  
**DP requirements:** 40% for assignment component.  
**Assessment:** Final examination: 70%; Practical assignments: 30%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.  

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**Master's specialising in Data Science**

For details of this course, refer to the Department of Statistical Sciences. The curriculum structure is outlined in the front section of this book.

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**CSC5007Z  DATABASE SYSTEMS**

12 NQF credits at NQF level 9  
**Convener:** Associate Professor S Berman  
**Course entry requirements:** Acceptance into the Master's degree, specialising in Data Science or Information Technology.  
**Course outline:**  
This course will introduce students with little or no prior experience to the three cornerstone database technologies for big data, namely relational, NoSQL and Hadoop ecosystems. The course aims to give students an understanding of how data is organised and manipulated at large scale, and practical experience of the design and development of such databases using open source infrastructure. The relational part will cover conceptual, logical and physical database design, including ER modelling and normalisation theory, as well as SQL coding and best practices for performance enhancement. NoSQL databases were developed for big data and semi-structured data applications where relational systems are too inefficient; all four types of NoSQL architecture will be introduced. Distributed data processing is key in manipulating large data sets effectively. The final section of the course will teach the popular Hadoop technologies for distributed data processing, such as MapReduce programming and the execution model of Apache Spark. The course will be presented in an online format.  
**DP requirements:** 40% for assignment component.  
**Assessment:** Final examination: 50%; Practical assignments: 50%. A sub-minimum of 40% will be required for each of the assignment and exam components of the course.  

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**CSC5009W  DATA SCIENCE MINOR DISSERTATION**

90 NQF credits at NQF level 9  
**Convener:** Associate Professor M M Kuttel  
**Course entry requirements:** Successful completion of the coursework component of the Master's specialising in Data Science.
Course outline:
The research component of the degree is based on a 90 credit dissertation. The topic of the research will be based on an analysis of large data sets from Physics, Astronomy, Medicine, Finance or other areas of application using methodology learnt in coursework component of degree. Alternatively, the dissertation component may focus on methodological developments in Computer Sciences required for the analysis of large amount of data.

PhD

CSC6000W  COMPUTER SCIENCE THESIS
Students will be expected to attend a research methods course in the first year.
360 NQF credits at NQF level 10

Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF ENVIRONMENTAL AND GEOGRAPHICAL SCIENCE

The Department is housed in the Environment & Geographical Science Building, South Lane Telephone (021) 650-2874 Fax (021) 650-3456
The Departmental abbreviation for Environmental & Geographical Science is EGS.

Associate Professor and Head of Department:
F D Eckardt, BSc Hons KCL MSc Cranfield DPhil Oxon

South African Research Chair in Climate Change:
B C Hewitson, BSc Cape Town MSc PhD Penn State

Professor and South African Research Chair in Environmental and Social Dimensions of the Bio-economy:
R P Wynberg, BSc Hons MSc MPhil Cape Town PhD Strathclyde

Professors:
M New, BSc Hons Cape Town MPhil PhD Cantab
M R Sowman, MSc PhD Cape Town

Emeritus Professors:
R F Fuggle, BSc Hons UED Natal MSc Louisiana PhD McGill
S Parnell, BA Hons HDE PG MA PhD Witwatersrand

Emeritus Professor and Senior Research Scholar:
M E Meadows, BSc Hons Sussex PhD Cantab FRSSG FRSSAf

Honorary Professors:
B Chase, BA Portland MSc Sheffield DPhil Oxon
W J Gutowski, BSc Yale PhD MIT

Associate Professors:
B J Abiodun, MTech FUTA PhD Uppsala
P Anderson, BSc Hons PhD Cape Town
Z Patel, BSc Hons MSc Natal PhD Cantab
G Ziervogel, BSc Hons Rhodes DPhil Oxon

Honorary Associate Professor:
S Lwasa, MSc Netherlands Masters PhD Uganda

Senior Lecturers:
J Battersby, BSc Hons London MA Newcastle DPhil Oxon
S Daya, BA Hons Cape Town MA PhD Durham
K J Winter, BA Hons Cape Town MA London PhD Cape Town

Lecturers:
P Mbatha, BSocSc Hons UKZN MSc PhD Cape Town
S Scheba, MPhil Cape Town PhD Manchester
J R von Holdt, BSc Unisa MPhil PhD Cape Town

Honorary Research Associates:
D Fig, BA Cape Town BSc Hons PhD LSE
R Hill, BSc Civil Eng PhD Cape Town
D Scott, BA Hons MA PhD UN

Honorary Research Affiliate:
E W Bergh, BSc Hons PhD Cape Town

Chief Technical Officer:
C Jack, BSc Hons PhD Cape Town

Administrative Officer:
S Adams

Administrative Assistant:
F Hartley

Finance Officer:
Senior Secretary:
T Basadien
Technical Assistant:
S Hess

CLIMATE SYSTEM ANALYSIS GROUP
Director:
B C Hewitson, BSc Cape Town MSc PhD Penn State
Deputy Director:
C Jack, BSc Hons PhD Cape Town
Researchers:
O Crespo, MSc Montpellier II PhD Toulouse III
P Johnston, BSc Hons HDE Stell MSc PhD Cape Town
J Lee, BSocSci Hons MPhil Cape Town
C Lennard, BSc Hons MSc PhD Cape Town
A McClure, BSc Hons MSc Rhodes
I Pinto, Licenciatura Maputo MSc PhD Cape Town
A Steynor, BSc Hons MSc Cape Town
M Tadross, BSc Hons Newcastle PhD Cantab
P Wolksi, MSc Krakow PhD Free University
Research Support:
K Kloppers, MSc NMMU
P Kloppers, BSc Hons MSc Cape Town
L Van Aardenne, BSc Hons MSc Cape Town

RESEARCH IN ENVIRONMENTAL AND GEOGRAPHICAL SCIENCE
Research in Environmental and Geographical Science embraces a variety of topics that are listed below. More detailed information can be obtained by writing to the Department of Environmental and Geographical Science or by consulting the departmental website, www.egs.uct.ac.za.
The Department undertakes research into numerous aspects of the environment but is particularly involved in studies of environmental change and human-environment interactions and sustainability. There is an active graduate programme. The department offers Masters and PhD programmes by research dissertation as well as Masters by coursework and research in Environment, Society and Sustainability, in African Climate and Development, and in Southern Urbanism.
Of major interest is the identification and evaluation of environmental problems, along with the assessment of environmental impacts. The department is active in projects which involve assessing the impact of development projects on the biophysical and social environment.
The problem of urbanization in Africa provides a focus for staff engaged in an analysis of the process in both contemporary and historical contexts. Biogeographical research is also pursued by staff and research students. The ways in which environmental change and human activities have shaped the landscape and vegetation patterns of southern Africa are interpreted through palaeoecological, remote sensing and geomorphological studies. Research in climatology focuses on Southern Hemisphere climate variability, regional implications of global climate change, climate modelling, precipitation controls, satellite climatology, and mesoscale meteorology.
Undergraduate Courses

Fieldwork
All students attending courses in Environmental & Geographical Science are required to take part in fieldwork arranged during the year.

First-Year Courses

**EGS1003S  GEOGRAPHY, DEVELOPMENT & ENVIRONMENT**  
*There is a compulsory fieldwork component involving half-day field excursions.*
18 NQF credits at NQF level 5  
**Convener:** Dr P Mbatha  
**Course entry requirements:** At least 50% for NSC Geography or GEO1009F  
**Course outline:**  
The course introduces students to development, sustainability and environment debates in geography, by exploring different landscapes at different scales and levels, focusing on the historical roots and spatial patterns that underpin development.  
**Lecture times:** Monday - Friday, 2nd period  
**DP requirements:** Attendance and satisfactory completion of tutorial assignments; students must attain an average mark of not less than 40% for the coursework component.  
**Assessment:** Essays, a class test and tutorial work count 50%; one 2-hour theory examination written in November counts 50% (subminimum of 40% required).

**GEO1009F  INTRODUCTION TO EARTH AND ENVIRONMENTAL SCIENCES**  
*This course is presented jointly by the Departments of Archaeology, Environmental & Geographical Science and Geological Sciences, but administered by Geological Sciences. Students are required to attend three half-day excursions in the Cape Peninsula.*
18 NQF credits at NQF level 5  
**Convener:** Associate Professor E M Bordy  
**Course entry requirements:** At least 50% for NSC Geography or at least 60% for NSC Physical Science or Life Sciences. NOTE: Preference will be given to students registered in the Science Faculty.  
**Course outline:**  
This course aims to develop a broad understanding of how the Earth works, leading to majors in Archaeology, Environmental & Geographical Sciences, Geology and Ocean & Atmosphere Science. The course covers the following general topics: structure and dynamics of the Earth; stratigraphy and geological history; climatology; surface processes and evolution of landscapes; biogeography; humans and the environment.  
**Lecture times:** Monday - Friday, 2nd period  
**DP requirements:** An average of 30% on all marked classwork and tests.  
**Assessment:** Marked classwork counts 24%; marked class tests count 16%; June examination 3 hours 60%. A Subminimum of 40% is required in the theory examination paper. Supplementary examinations for GEO1009F will be written in July.

Second-Year Courses

**EGS2013F  THE PHYSICAL ENVIRONMENT**  
*There is a compulsory fieldwork component involving half-day field excursions.*
24 NQF credits at NQF level 6  
**Convener:** Associate Professor F Eckardt  
**Course entry requirements:** GEO1009F
Course outline:
The course focuses on contemporary Atmosphere-Earth surface interactions, in particular the role of precipitation and water from a global to a regional scale and examines temporal dynamics, driven by natural processes as well as anthropogenic pressures. It covers in detail global circulation patterns, climate variability, soil formation, polar response to climate change, informants of regional biome formation, tropical deforestation, and desertification and earth observation technology. It is expected that students will enhance their understanding of Earth system dynamics, systems interactions and develop an appreciation for scales both temporal and spatial. Students are also expected to put the local context into a regional setting and make linkages to the larger global picture.

Lecture times: Monday - Friday, 5th period
DP requirements: Satisfactory completion of practicals and all written assignments, including projects, fieldwork reports, practicals, essays and class tests. Students must attain an average mark of not less than 40% for the coursework.
Assessment: Project, essays, class tests and practical assignments including fieldwork report count 50%; one 3-hour examination written in June count 50% (subminimum of 40% required).

EGS2015S  SOCIETY & SPACE
There is a compulsory fieldwork component involving half-day field excursions.
24 NQF credits at NQF level 6
Convener: Dr S Scheba
Course entry requirements: For BSc: EGS1003S; For BA or BSocSc: EGS1003S or Social Science Foundation course and two full first year Humanities courses, or equivalent.
Course outline:
Spatial thinking sits at the core of Geographical scholarship, and space and human societies are always mutually constitutive. This course explores how geographers have theorised space and place as central to understanding historical processes, social relations and cultural practices. Focusing particularly on Africa and other regions of the global South, the course covers foundational Human Geography concepts including modernity, landscape, memory, heritage, identity and inclusion. Through theoretical work and field-based experiential learning, we examine how space and place both shape and are shaped by a range of power dynamics.

Lecture times: Monday - Friday, 5th period
DP requirements: Attendance and satisfactory completion of practical including fieldwork and tutorial assignments; students must attain an average mark of not less than 40% for the coursework.
Assessment: Essays, a class test, practical assignments based on compulsory fieldwork and tutorial work count 50%; one 2-hour theory examination written in November counts 50% (subminimum of 40% required).

Third-Year Courses

EGS3012S  ATMOSPHERIC SCIENCE
36 NQF credits at NQF level 7
Convener: Associate Professor B J Abiodun
Course entry requirements: GEO1009F or equivalent, EGS2013F or SEA2004F (or SEA2002S or SEA2003F) or any approved 2000-level Science course, and or any approved 1000-level Physics or Mathematics course.
Course outline:
This course aims to provide a thorough understanding of the physical processes that control the Earth's atmosphere. It covers the following topics: atmospheric energy balance, thermodynamics, dynamics, and general circulation; tropical and mid-latitude weather producing systems; weather and climate extreme events (e.g. heat-waves, drought, and floods) in Africa; climate variability and change; atmospheric boundary layer turbulence, chemistry, and pollution. The lectures are complemented with field measurements and laboratory practicals to demonstrate basic data analysis techniques employed in atmospheric sciences.

Lecture times: Monday - Friday, 1st period
**DP requirements:** Satisfactory completion of prakticals and all written assignments, including essays, project reports and class tests.

**Assessment:** Essays and tests count 20%; project reports and prakticals count 20%; one 3-hour examination in November counts 60% (subminimum of 40% required).

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**EGS3021F  SUSTAINABILITY & ENVIRONMENT**

*There is a compulsory fieldwork component involving a half-day field excursion.*

36 NQF credits at NQF level 7

**Convener:** Professor M Sowman

**Course entry requirements:** EGS2013F, EGS2015S

**Course outline:**
The course critically engages with current debates and discourses in the fields of sustainability, vulnerability and environmental management, including examination of key concepts such as integration, systems-thinking, complexity, equity, vulnerability, risk, resilience, adaptation and mitigation. Approaches and methods for analysing environmental problems and integrating risk reduction as well as sustainability principles and practices into policy, programme, plan and project cycle processes are investigated and applied in different contexts.

**Lecture times:** Monday - Friday, 3rd period

**DP requirements:** Attendance and satisfactory completion of prakticals (including fieldwork), other assignments and tests; students must attain an average mark of not less than 40% for the coursework.

**Assessment:** Practical reports (including fieldwork), class tests and other assignments count 50%; one 3-hour June examination counts 50% (subminimum of 40% required).

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**EGS3022S  GEOGRAPHIC THOUGHT**

36 NQF credits at NQF level 7

**Convener:** Associate Professor Z Patel

**Course entry requirements:** EGS2015S

**Course outline:**
The course focuses on debates in classical and contemporary human geography. It considers important thematic areas in the geographical literature, such as development; spatiality; urban, political and feminist geographies. Each thematic area explores specific debates and key author’s work in the field, providing students with an introduction to literature, a content overview, and skills to deconstruct and build conceptual and analytical arguments related to evidence drawn from geographical research from around the world, other than South Africa. The course also emphasises academic reading and writing skills taught in the practical sessions.

**Lecture times:** Monday - Friday, 4th period

**DP requirements:** Satisfactory completion of essay and practical assignments and participation in tutorials; students must attain an average mark of not less than 40% for the coursework.

**Assessment:** Essay and other assignments count 70%; one 3-hour written examination in November count 30% (subminimum of 40% required).

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**EGS3023F  ANTHROPOCENE ENVIRONMENTS IN PERSPECTIVE**

36 NQF credits at NQF level 7

**Convener:** Associate Professor P Anderson

**Course entry requirements:** EGS2013F

**Course outline:**
The course deals with the dynamic physical environment including the human impact on global environments at various spatial and temporal scales during the so-called Anthropocene. The general aim of this course is to illustrate the nature and scale of changes that characterise the earth’s environment, against a background of both natural and anthropogenically-induced processes. This provides an important perspective when thinking about contemporary environments and how they
might change in the future – with obvious consequences for our own species and that of the others with which we share the planet.

Lecture times: Monday - Friday, 5th period

DP requirements: Satisfactory completion of practicals and all written assignments, including fieldwork report, essays and class tests. Students must attain an average mark of not less than 40% for the coursework.

Assessment: Field report, essays, class tests and practical assignments count 50%; one 3-hour examination written in June count 50% (sub-minimum of 40% required).

Postgraduate Courses

Ancillary activities
In addition to formal courses, students undertaking postgraduate courses are required to participate fully in other departmental activities of an academic nature. Such activities are weekly seminars on environmental topics addressed by persons prominent in their fields, field camps and field exercises away from Cape Town, and study tours to obtain first-hand exposure to environmental problems and their solutions. Graduate students who, in the opinion of the Head of Department, have not had adequate exposure to undergraduate courses with environmental content may also be required to attend specified courses.

EGS4001W ATMOSPHERIC SCIENCE HONOURS

Since the code EGS4001W will not carry a NQF credit value, students will be concurrently registered for EGS4052W (coursework component of 120 NQF credits) and EGS4053W (research project of 40 NQF credits).

160 NQF credits at NQF level 8; the combined credit value of both components.

Convener: Associate Professor B J Abiodun

Course entry requirements: As for EGS4004W, with the additional requirement of at least a half-course in Mathematics or a full-course in Physics, as well as a senior undergraduate course in climatology or atmospheric science. Experience with computers is highly recommended.

Course outline:
The Atmospheric Science programme provides a 4th year of development for those interested in following a career associated with atmospheric science and climatology, or for progression to research in this area. The focus is on practical skills and the application of theory to the issues related to the climate system. The programme follows the same pattern as EGS4004W, with the constraint that three of four course modules must be from the atmospheric options, and the fourth module from one of the Honours level physical science options in Environmental & Geographical Science or the Oceanography department. Included in the requirements are a research project, two seminar presentations, and course fieldwork. Students will also attend and present at the annual conference of the South African Society for Atmospheric Scientists.

DP requirements: Students must pass at least three of their coursework electives and achieve a composite pass on the coursework. Students must achieve a pass on their research project to proceed to graduation in the degree.

Assessment: The examinations will follow the same structure as EGS4004W. Not all course options have formal examinations, and a significant portion of the total coursework mark may be based on set project tasks. Examinations on average count 50% and coursework 50% for each module. The combined module results count 75% and the research project counts 25% of the degree as a whole. Students must pass the project component in order to qualify. These component parts of the course will be combined in a final overall mark which will be reflected against the course code EGS4001W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.
EGS4004W  ENVIRONMENTAL & GEOGRAPHICAL SCIENCE HONOURS
Since the code EGS4004W will not carry a NQF credit value, students will be concurrently registered for EGS4054W (coursework component of 120 NQF credits) and EGS4055W (research project of 40 NQF credits). Entrance is limited to 30 students
160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: To be advised
Course entry requirements: A BSc degree with a major in Environmental & Geographical Science or related field. Acceptance will be at the discretion of the Head of Department who will consider quality of final year results, material covered in the undergraduate curriculum, and referee reports. Preference may be given to UCT graduates who meet the course entry requirements.
Course outline:
Students complete four advanced semester modules. One of these four modules must be a research methods module. Students complete a research methods course and then select a further three modules from a range of advanced courses in Environmental and Geographical Science that have foundations in one or more of the following areas of study: Human Geography, Environmental Management, Physical Geography. Curricula must be approved by the course convener in consultation with the Head of Department. In addition, each student completes a research project. At the discretion of the Convener, in consultation with the Head of Department, students may take one course from outside the Department (in addition to the methods course) towards the BSc Hons degree in Environmental & Geographical Science.
DP requirements: Students must pass at least three of their coursework electives and achieve a composite pass on the coursework. Students must achieve a pass on their research project to proceed to graduation in the degree.
Assessment: Courses will be examined at the end of each semester, and the marks combined with project, essay, fieldwork and seminar presentation marks. Examinations on average count 50% and coursework 50% for each module. The combined module results count 75% and the research project counts 25% of the degree as a whole. Students must pass the research project component in order to qualify. These component parts of the course will be combined in a final overall mark which will be reflected against the course code EGS4004W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

EGS4023F/S  RESEARCH METHODS FOR NATURAL SCIENTISTS
30 NQF credits at NQF level 8
Convener: Associate Professor B J Abiodun
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The course has a dual purpose. Firstly, a series of weekly lectures and hands-on practical seminars on the nuts and bolts of quantitative analysis. The analysis techniques investigated are (mostly) the fundamental methods found commonly in the literature; viz: Classification, time series analysis, EOF/PCA, non-linear analysis. In parallel to this are a series of seminars on “the Philosophy of Science” addressing issues of values, perception, the science community, etc.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS4024F/S  MANAGING COMPLEX HUMAN ECOLOGICAL SYSTEMS
30 NQF credits at NQF level 8
Convener: Professor M Sowman
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Increasingly scholars have recognised that many of our environmental problems are complex systems problems that require an understanding of natural, socio-economic and governance systems as well as the interactions that occur between them. Furthermore, research suggests that conventional approaches to managing environmental problems are not moving us in sustainable
directions and hence the call for innovative and alternative approaches to managing these complex systems. EGS 5024F introduces graduate students to important theoretical, methodological and ethical foundations of environmental and coastal management. The module introduces systems thinking and complexity theory and explores tools and governance frameworks for managing complex human-ecological systems. These concepts and theoretical ideas are then applied to cases in the coastal and small-scale fisheries arena.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** Assignments 60%; examination 40%.

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**EGS4030F/S CLIMATE MODELLING**

30 NQF credits at NQF level 8

**Convener:** Associate Professor B J Abiodun

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**
An introduction into the development and application of climate models for exploring climate dynamics, forecasting, and climate change. The course explores the inner workings of climate models, the use in operational seasonal forecasting in Africa (with hands on work with the current forecasts), and actual running model experiments. Students are expected to have done EGS3012S or its equivalent.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** 100% Coursework.

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**EGS4034F/S INTERROGATING SOUTHERN AFRICAN LANDSCAPES**

*NB: enrolment to this course is by invitation only*

30 NQF credits at NQF level 8

**Convener:** Dr S Daya and Professor M Meadows

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**
South African landscapes have always been contested. In the contemporary moment of global environmental crisis and deepening social inequality, it is critical that we build an interdisciplinary understanding of the histories, legacies and transformations playing out in particular places. Geography and allied disciplines offer many different ways of studying how the ecological and the cultural intertwine in shaping our landscapes. In this course, through foundational theoretical engagements and field-based activities, we explore some of the cross-cutting social, political, economic, ecological and biophysical dynamics playing out in the context of the rapidly changing Southern African region.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** Assignments 65%; examination 35%.

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**EGS4038F/S CLIMATE CHANGE AND PREDICTABILITY**

30 NQF credits at NQF level 8

**Convener:** Professor B Hewitson

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**
The course explores the theory of climate change, and then goes into the question of predictability, cross scale relationships and feedbacks in the climate system, the tools and techniques of prediction, and translation of predictions into the user community including impacts and vulnerability analyses and touching on the social dimension.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** 100% Coursework.
EGS4039F/S  URBAN FOOD SECURITY
30 NQF credits at NQF level 8
Convener: Associate Professor J Battersby
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Topics include an overview of poverty and urbanization in Southern Africa; urban food security, methods and issues; urban poverty and vulnerability debates; food security and health; managing urban food systems (ecological, regulatory and fiscal dynamics).
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 75%; examination 25%.

EGS4040F/S  SPECIAL TOPIC IN HUMAN/ENVIRONMENT INTERACTIONS
30 NQF credits at NQF level 8
Convener: Dr S Daya
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Issues and themes in contemporary aspects of the Human/Environmental interface will be covered. Specific attention will be given to profiling core debates in a specialist field of human or environmental geography. The course will focus on using theory, but will encourage the use of case studies. Course outcomes will emphasize the development of conceptual and analytical skills.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework

EGS4041F/S  APPROACHES AND ISSUES IN PHYSICAL AND ENVIRONMENTAL SCIENCES
30 NQF credits at NQF level 8
Convener: Dr S Daya
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Issues and themes in contemporary aspects of the Physical/Environmental interface will be covered. Specific attention will be given to profiling core debates in a specialist field of physical or environmental geography. The course will cover theoretical, empirical and methodological concerns and will include a fieldwork component.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS4043F/S  CLIMATE CHANGE ADAPTATION AND TRANSFORMATION
30 NQF credits at NQF level 8
Convener: Associate Professor G Ziervogel
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The central question of this course is “Why does adaptation to climate change need to be understood from a social and governance perspective?” Climate change adaptation will be explored as a means for responding to global environmental change, at the local, national and international scale and from the perspective of individuals, organisations and government. Coming out of the course you will understand the complexity of adaptation and the relationship between reducing climate risk and broader socio-economic issues, how to position adaptation to climate change in the development context and as a means of transformation. Through the course you will develop skills to critically assess adaptation responses in terms of potential contributions and challenges and identify how the social and governance aspects of adaptation could be strengthened.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.
EGS4044F/S  URBAN ECOLOGY
30 NQF credits at NQF level 8
Convener: Associate Professor P Anderson
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The aim of this module is to introduce students to both the theory and practice of urban ecology. Students will be expected to engage critically with current theories and debates as presented in the urban ecology literature. In addition to this, there will be a significant focus on practical methods and skills. Students will be expected to interrogate the urban landscape, identify and pose relevant ecological questions, and design and implement appropriate methods to answer these ecological questions. Broad theoretical areas to be engaged in, all in the context of the city include: biogeography, alien invasion, landscape fragmentation, conservation, restoration, ecosystem services, and social ecology.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS4045F/S  GEOMORPHOLOGY
30 NQF credits at NQF level 8
Convener: Associate Professor F Eckardt
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The aim of this course is to introduce students to the theory of geomorphological systems and apply this to an area or topic of their choice. The course is particularly targeted at Honours students who have selected physical geography topics for their dissertation. It gives them the opportunity to deepen some of their geomorphological literature relevant to their chosen project. Students are expected to interpret landscapes, identify formative processes and events, examine environmental changes at different spatial and temporal scales, place their area of study into the geological, Quaternary, climatic and applied context in order to appreciate geomorphologic concepts such as systems approach, complexity, relationships, feedbacks, thresholds, equilibrium and cycles.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS4046F/S  WATER RESOURCE MANAGEMENT
30 NQF credits at NQF level 8
Convener: Dr K Winter
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The aim of the module is to develop a comprehensive understanding of issues and challenges in water resources management at both an urban and catchment scale, and with a primary focus on the South African context. The various themes in this module will present a fascinating interplay of tensions and challenges that play out in geographical space and over time, and will involve the consideration of factors such as the increasing demand that society places on scarce water resources; on efforts to meet the basic social need for clean, potable water; on the consequences of interventions and institutional arrangements involved in water governance; and on the role of the private sector in managing water risk in a particular catchment. The module also emphasises the value of an integrated understanding of theories and practices in water resources management and it does so by exploring the perspectives and approaches of sustainability science. Key themes in the module include water quality, monitoring and compliance; new directions in water research in South Africa; a consideration of biological treatment of water; participation in water governance; and how corporate enterprises are becoming leaders in water stewardship, shared water risk and value creation. These and other themes will be discussed in interactive seminar sessions. The course includes a three-week directed reading period, as well as a 4-day field camp.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS4047F/S  POLICY AND GOVERNANCE  
30 NQF credits at NQF level 8  
Convener: Dr Z Patel  
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.  
Course outline: This course looks at the underlying dynamics involved in the negotiation of environmental policy and its implementation. The assumption here is that unsustainable outcomes are not a result of a lack of will or intention, but rather due to vastly varying values, knowledge and data that are brought to bear on decision making for the environment. The approach of this course is to challenge the ‘cultural embeddedness’ of policy i.e. it critiques the cultural processes underlying environmental policy. A deeper understanding of the cultural politics of environmental policy and practice will deal with the processes through which institutions define and mediate policy outcomes; governance arrangements for sustainable development; the roles of power, rationality, knowledge and values in achieving environmental and social justice.  
DP requirements: At least 80% attendance record and submission of all assignments.  
Assessment: Assignments 60%; examination 40%.

EGS4056F/S  IMAGINING SOUTHERN CITIES  
30 NQF credits at NQF level 8  
Convener: Drs S Daya and R Sitas  
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS or a cognate discipline.  
Course outline: The global South is urbanising at roughly twice the rate of the global North, yet dominant narratives of 'the city' continue to privilege London, Los Angeles and Paris over Lagos, Johannesburg and Mumbai. This course explores how cities of the global South are generating new bodies of theory, new forms of social life, and new imaginaries. It does this through novels, films and other textual and visual representations of everyday urbanism, drawing on contemporary theory from the global South to help make sense of these discourses. Situated in the rapidly evolving field of Urban Studies, the course aims to open up conversations across disciplines about the cities we are in and the cities we desire. Students will be expected to read set texts, both fictional and theoretical, and watch set films, in preparation for classes which will take the form of weekly, student-led seminars.  
DP requirements: At least 80% attendance record and submission of all assignments.  
Assessment: Assignments 50%; examination 50%.

EGS4057F/S  URBAN POLITICAL ECOLOGY  
30 NQF credits at NQF level 8  
Convener: Dr S Scheba  
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.  
Course outline: This course explores urbanisation dynamics with a particular interest in examining the role of political economic shifts, history, discourse, and new forms of techno-management in shaping the contemporary urban environment. It does this through drawing on urban political ecology as an interdisciplinary field of study, that provides insights into the power relations underlying unequal access to urban space, resources and infrastructure. Situated in this rapidly evolving field of Urban Studies, the course aims to open up conversations about the dynamics underlying unequal access to cities as well as the possibilities that could support more just and equitable cities. Students will be expected to read set texts, both empirical and theoretical, in preparation for classes, which take the form of weekly, student-led seminars.  
DP requirements: At least 80% attendance record and submission of all assignments.  
Assessment: Assignments 50%; examination 50%.
EGS4058F/S  CRITICAL PERSPECTIVES ON THE BIO-ECONOMY
30 NQF credits at NQF level 8
Convener: Professor R Wynberg
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS or cognate disciplines.
Course outline:
Located at the interface of fast-changing genetic and information technologies, and the juncture of a range of social, environmental and ethical concerns, the so-called bio-economy has changed ways in which biodiversity is used, conserved and commercialised. Although often touted as a panacea for energy crises, livelihoods, environmental remediation and food security, critical questions have been raised about who stands to benefit, the involvement of local communities, and economic and political drivers behind the bio-economy "push". Using a political ecology framing, this interdisciplinary course aims to introduce key theories that situate the bio-economy and to deepen understandings about the nature of emerging debates. These range from contestations about genetically modified crops, and 'biopiracy' charges of patenting biodiversity and traditional knowledge, through to the potential of agroecology as a sustainable agricultural future. The course aims to deepen critical thinking around these questions, and to inspire a scholarship that explores possibilities for socially just and environmentally sustainable approaches, with a particular focus on the Global South. The course involves both theory and practice, drawing on research mostly from Sub-Saharan Africa. Students will be expected to read set texts, to watch set videos, and to prepare seminars. The course includes several short fieldtrips. For more information see bioeconomy.org.za.
DP requirements: At least 80% attendance and submission of all assignments
Assessment: 1 exam - 40%, 1 essay (3000-4000 words) - 30%, 1 seminar presentation - 15%, 1 critique (response to a particular article, policy or media piece) - 15%.

EGS4059F/S  ENVIRONMENTAL GOVERNANCE IN THE GLOBAL SOUTH
30 NQF credits at NQF level 8
Convener: Dr P Mbatha
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
This course aims to introduce students to the theory and praxis of environmental governance relevant to global South contexts. It begins by outlining and discussing dominant historical and current environmental governance theories, models and approaches at the global level. The course then engages with various economic, political, historical, institutional and social drivers that influence environmental governance processes, practices and implementation, using the global South as a lens. It underlines symmetries and asymmetries of environmental governance by drawing on various natural resource use and governance sectors, i.e. biodiversity conservation, mining, forestry, tourism, etc. The course also engages the Sustainable Development Goals from a governance perspective, by critically analysing whether or not they can realistically be in conversation with and address issues relating to environmental governance practice in the global South.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS4066F/S  GEOGRAPHIES OF SEXUALITIES: IDENTITY, PLACE, & HEALTH.
30 NQF credits at NQF level 8
Convener: A Tucker
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
This course explores and critically engages with geographical research related to sexuality, with a particular focus on the interrelationships between identity, place and health. The course explores
how geographical thinking on sexuality – and in particular on Lesbian, Gay, Bisexual, and Trans (LGBT) groups – has evolved over time, and the key relationships that have emerged between the study of sexuality and the study of health needs and inequalities. Starting with an exploration of the historical roots of the geographies of sexualities literature the course will go on to explore the connections such work has had with wider post-structuralist queer theories, globalization debates, and research on sexualities drawn from sub-Saharan Africa. The course will then situate such work in relation to the development of work on HIV/AIDS prevention, treatment and care, by considering how sexualities have been variously framed, and the at times limited conceptual space for an appreciation of diverse sexual identities. The course then draws together these various strands to consider the options and possibilities for current HIV programming in Cape Town for LGBT groups together with a critical examination of the epidemiological logics and conceptual challenges of the public health deployment of ‘men who have sex with men’ (MSM).

**DP requirements:** Class attendance (80%) and submissions of all assignments.

**Assessment:** 1 essay (4000-4500 words) – 35%, 1 seminar presentation – 5%, 1 24hr take-home exam – 60%.

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**EGS4067F/S  AIR QUALITY MONITORING, MANAGEMENT AND PREDICTION**

30 NQF credits at NQF level 8

**Convener:** Dr J von Holdt

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**

Compromised air quality is a major environmental concern, especially in urban environments and even more so in cities in developing parts of the world. This course explores the current state of global air quality but with a focus on examples and case studies from the global south, particularly Africa. We will investigate the factors and role players that have an influence on air quality, the distribution of polluted versus clean air and the impacts on people and the environment. This module will look at the different scales at which people are exposed to poor air quality and the data and tools we use to study and monitor the atmosphere at these different scales and explore the potential for locally developed interventions and solutions. We will also look at air quality management and how the current socio-economic situation is reflected in this space with specific reference to South and southern Africa. Students will be expected to identify an air quality issue of their choice, find and interpret relevant literature, appropriate datasets and methods and produce results which will culminate in a short research report with recommendations for interventions that can potentially result in improvements in the air quality at receptor sites.

**DP requirements:** At least 80% class attendance and 40% minimum in assignments.

**Assessment:** Assignments 60%; Examination 40%

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**EGS5000W  ENVIRONMENTAL & GEOGRAPHICAL SCIENCE DISSERTATION**

180 NQF credits at NQF level 9

**Convener:** Dr S Daya

**Course outline:**

This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.
EGS5003W ENVIRONMENTAL & GEOGRAPHICAL SCIENCE DISSERTATION
180 NQF credits at NQF level 9
Convener: Dr S Daya
Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

EGS5008H ENVIRONMENT, SOCIETY & SUSTAINABILITY COURSEWORK
Entrance is limited to 12 students
90 NQF credits at NQF level 9
Convener: Dr P Mbatha
Course entry requirements: An Honours degree (or equivalent). In special circumstances graduates who have shown by examination, or publication, or a record of appropriate training, that they have reached a level equivalent to an Honours degree may be considered. Since there is a limit of 12 places in this course, admission is competitive. Selection will be at the discretion of the Head of the Department, based on quality of qualification, experiential learning and/or referee reports. For further details refer to the departmental website - see www.egs.uct.ac.za.
Course outline:
This interdisciplinary course is designed for students with diverse backgrounds who have an interest in the issues pertaining to the environment, society and sustainability. This course contributes half of the total credits for a Master’s qualification which can be awarded as an MSc or MPhil, depending on the academic background of the student. The coursework component starts with registration in February. Students select four coursework modules in, for example, Theory & Practice of Environmental Management, Capital Politics & Nature, Geography of Development & Environment, Living with Environmental Change, Urban Food Security, Cultural Geographies, Managing Complex Human-Ecological Systems, or Geomorphology. Upon successful completion of the coursework component, students will be required to register for the minor dissertation component (EGS5009W) in the following year.
Assessment: Assessment for the coursework modules includes both written examinations and coursework assignments such as essays, projects, practical assignments, etc. Examinations on average count 50% and coursework 50% for each module. The combined module results will be reflected as a final coursework result.

EGS5009W ENVIRONMENT, SOCIETY & SUSTAINABILITY MINOR DISSERTATION
90 NQF credits at NQF level 9
Convener: Dr P Mbatha
Course entry requirements: EGS5008H
Course outline:
Students will be required to register for this course in the first semester of the second year and complete a suitable research proposal in consultation with an appropriate supervisor. After approval of the proposal in the first year of registration, students will undertake a research project demonstrating the application of theory to practical issues in the research area of environment,
society and sustainability. The work must be submitted in the form of a minor dissertation early in the second year.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

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### EGS5012W CLIMATE CHANGE AND PREDICTABILITY COURSEWORK

*This course is convened by UCT’s African Climate & Development Initiative; refer to the section “Inter-faculty Units” later in this handbook. The code EGS5012W represents the overall coursework component; the overall coursework result will be reflected against this code. There are a range of possible minor dissertation codes, depending on the discipline in which the student chooses to register for the research component.*

0 NQF credits at NQF level 9

**Convener:** To be advised

**Course entry requirements:** A relevant Honours degree (or equivalent). Students with backgrounds in scientific, planning, engineering, economic, educational, social and legal disciplines are encouraged to apply.

**Course outline:**

This full-time taught Master’s course (MSc or MPhil) is offered over 13 months, beginning in January. It provides interdisciplinary training in climate change and sustainable development, with a focus on the issues of relevance to African development. The course is designed for both recent graduates as well as those with several years’ experience and who wish to gain a broad understanding of the issues involved in climate change and sustainable development from an African and developing world perspective. The curriculum comprises two compulsory core courses, EGS5031F: Introduction to Climate Change & Sustainable Development and EGS5032F/S: Climate Change Adaptation & Mitigation (details of these courses are presented later in this section). In addition, students will choose at least two elective courses, chosen from a range of courses which offer the student the opportunity to explore new areas, or look at climate and development through existing disciplinary backgrounds. A partial list and details of these courses are available from the ACDI handbook.

**Assessment:** To qualify for the Master’s degree, students must pass all coursework with a subminimum of 33% for each core or elective course module; an aggregate coursework mark of 50% is required. A composite grade of the performance on the coursework component as a whole will be reflected against the assessment course EGS5012W. The choice of project for the minor dissertation will be determined by prior qualification. Students may register for a minor dissertation in a range of Departments across the University, including Biological Sciences, Environmental & Geographical Science, Geological Sciences, Chemical Engineering, Mechanical Engineering, Economics, Sociology, Law [Refer to relevant Faculty Handbooks]. Minor Dissertation options in the Science Faculty.

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### EGS5023F/S RESEARCH METHODS FOR NATURAL SCIENTISTS

23 NQF credits at NQF level 9

**Convener:** Associate Professor B J Abiodun

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**

The course has a dual purpose. Firstly, a series of weekly lectures and hands-on practical seminars on the nuts and bolts of quantitative analysis. The analysis techniques investigated are (mostly) the fundamental methods found commonly in the literature; viz: Classification, time series analysis, EOF/PCA, non-linear analysis. In parallel to this are a series of seminars on “the Philosophy of Science” addressing issues of values, perception, the science community, etc. At the NQF level 9 students will do an additional grand challenge submission for their portfolio which will entail the development of an independent research question, aim and methods, and the application of these methods in carrying out the research.

**DP requirements:** At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS5024F/S  MANAGING COMPLEX HUMAN ECOLOGICAL SYSTEMS
23 NQF credits at NQF level 9
Convener: Professor M Sowman
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Increasingly scholars have recognised that many of our environmental problems are complex systems problems that require an understanding of natural, socio-economic and governance systems as well as the interactions that occur between them. Furthermore, research suggests that conventional approaches to managing environmental problems are not moving us in sustainable directions and hence the call for innovative and alternative approaches to managing these complex systems. EGS 5024F introduces graduate students to important theoretical, methodological and ethical foundations of environmental and coastal management. The module introduces systems thinking and complexity theory and explores tools and governance frameworks for managing complex human-ecological systems. These concepts and theoretical ideas are then applied to cases in the coastal and small-scale fisheries arena. At the NQF 9 level students will prepare an additional grand challenge. These students will be required to review an interdisciplinary academic paper and present a seminar to the class, and written review, providing a critique of this paper.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS5029H  CLIMATE CHANGE MINOR DISSERTATION
90 NQF credits at NQF level 9
Convener: Dr M Norton
Course entry requirements: EGS5012W
Course outline:
The minor dissertation is based on a three- to six-month supervised research project, to be submitted at the end of January, with the possibility of extension to June the following year.
Assessment: The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

EGS5030F/S  CLIMATE MODELLING
23 NQF credits at NQF level 9
Convener: Associate Professor B J Abiodun
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
An introduction into the development and application of climate models for exploring climate dynamics, forecasting, and climate change. The course explores the inner working of climate models, the use in operational seasonal forecasting in Africa (with hands on work with the current forecasts), and actual running model experiments. Students are expected to have done EGS3012S or its equivalent. At the NQF level 9 students will do an additional grand challenge submission for their portfolio which will entail the development of an independent research question, aim and methods, and the application of these methods in carrying out the research.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS5031F  INTRODUCTION TO CLIMATE CHANGE & SUSTAINABLE DEVELOPMENT
23 NQF credits at NQF level 9
Convener: Dr M Norton
Course entry requirements: Acceptance for EGS5012W or by permission of the convener
Course outline:
This course provides a broad, integrated, knowledge on key issues in climate change and sustainable development, making students conversant across the spectrum of climate change issues and history. Topics covered include: sustainable development; the climate system, anthropogenic forcing and climate system response; African climate variability and change; international climate change legal frameworks, negotiations, and politics; the economics of climate change and climate change financing; the concept of climate compatible development. The course is lecture, seminar and group-work based. Each section of the course will involve basic framing lectures, supported by either an essay exercise or a group work exercise and seminar.

Assessment: Coursework 75%; Examination 25%

EGS5032F/S  CLIMATE CHANGE ADAPTATION & MITIGATION
This course will run in the second semester in 2022.
23 NQF credits at NQF level 9
Convener: Dr M Norton
Course entry requirements: Acceptance for EGS5012W or by permission of the convener
Course outline:
This course provides in depth coverage of (i) adaptation and (ii) mitigation from both a theoretical and practical/applied point of view. Adaptation and mitigation are the two key domains of academic and applied learning required for students to be qualified to undertake research and be employable in the climate change arena in the South African and developing country context. The issues are explored from a developing country, climate compatible perspective.

Assessment: Coursework 80%; Examination 20%.

EGS5038F/S  CLIMATE CHANGE & PREDICTABILITY
23 NQF credits at NQF level 9
Convener: Professor B Hewitson
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The course explores the theory of climate change, and then goes into the question of predictability, cross scale relationships and feedbacks in the climate system, the tools and techniques of prediction, and translation of predictions into the user community including impacts and vulnerability analyses and touching on the social dimension. At the NQF 9 level students will be expected to compose reports with a higher word count, at a higher intellectual level and with an expectation of a more comprehensive understanding of the pertinent literature. Students at this level will be expected to display a greater commitment and engagement in the oral components of the course.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS5039F/S  URBAN FOOD SECURITY
23 NQF credits at NQF level 9
Convener: Associate Professor J Battersby
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS or cognate disciplines.
Course outline:
Topics include an overview of poverty and urbanization in Southern Africa; urban food security, methods and issues; urban poverty and vulnerability debates; food security and health; managing urban food systems (ecological, regulatory and fiscal dynamics). At the NQF 9 level students will be expected to conduct a small piece of independent fieldwork which will inform their extended essay for the course. In this essay all students are expected to engage a current debate on food security or food systems studies. For students at the NQF 9 level they will use a real world case study to critically engage the theoretical literature. These students will be assessed on their ability to interpret the data and use data to critically engage theory.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 75%; examination 25%.

EGS5040F/S  SPECIAL TOPIC IN HUMAN/ENVIRONMENT INTERACTIONS
23 NQF credits at NQF level 9
Convener: Dr S Daya
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Issues and themes in contemporary aspects of the Human/Environmental interface will be covered. Specific attention will be given to profiling core debates in a specialist field of human or environmental geography. The course will focus on using theory, but will encourage the use of case studies. Course outcomes will emphasize the development of conceptual and analytical skills. At the NQF 9 level there is a strong emphasis on the development of analytical skills and students are expected to apply these skills in the context of an appropriate theory, to a case study of their own specialist field of human or environmental geography.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS5041F/S  APPROACHES AND ISSUES IN PHYSICAL AND ENVIRONMENTAL SCIENCES
23 NQF credits at NQF level 9
Convener: Dr S Daya
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
Issues and themes in contemporary aspects of the Physical/Environmental interface will be covered. Specific attention will be given to profiling core debates in a specialist field of physical or environmental geography. The course will cover theoretical, empirical and methodological concerns and will include a fieldwork component. NQF 9 level there is a strong emphasis on the development of analytical skills and students are expected to apply these skills in the context of an appropriate theory, to a case study of their own specialist field of physical geography.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS5043F/S  CLIMATE CHANGE ADAPTATION AND TRANSFORMATION
23 NQF credits at NQF level 9
Convener: Associate Professor G Ziervogel
Course entry requirements: Acceptance for Master's specialising in EGS.
Course outline:
The central question of this course is “Why does adaptation to climate change need to be understood from a social and governance perspective?” Climate change adaptation will be explored as a means for responding to global environmental change, at the local, national and international scale and from the perspective of individuals, organisations and government. Coming out of the course you will understand the complexity of adaptation and the relationship between reducing climate risk and broader socio-economic issues, how to position adaptation to climate change in the development context and as a means of transformation. Through the course you will develop skills to critically assess adaptation responses in terms of potential contributions and challenges and identify how the social and governance aspects of adaptation could be strengthened. At the NQF 9 level students are required to complete an additional written assignment on one of the seminar themes. Students at this level are required to prepare, manage and lead a course discussion. NQF 9 level students will receive a separate exam paper to those at the NQF 8 level.
Assessment: Coursework 60%; Examination 40%
EGS5044F/S URBAN ECOLOGY
23 NQF credits at NQF level 9
Convener: Associate Professor P Anderson
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The aim of this module is to introduce students to both the theory and practice of urban ecology. Students will be expected to engage critically with current theories and debates as presented in the urban ecology literature. In addition to this, there will be a significant focus on practical methods and skills. Students will be expected to interrogate the urban landscape, identify and pose relevant ecological questions, and design and implement appropriate methods to answer these ecological questions. Broad theoretical areas to be engaged in, all in the context of the city, include: biogeography, alien invasion, landscape fragmentation, conservation, restoration, ecosystem services, and social ecology. At the NQF 9 level students will be expected to apply theoretical considerations in engaging in questions that speak to more than one area of urban ecology, for example speaking simultaneously to urban design and climate change. This expectation will be assessed in both the class essay and in the exam. At the NQF 9 level their ability to simultaneously apply theoretical considerations across different areas of urban ecology will be assessed throughout the course.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS5045F/S GEOMORPHOLOGY
23 NQF credits at NQF level 9
Convener: Associate Professor F Eckardt
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The aim of this course is to introduce students to the theory of geomorphological systems and apply this to an area or topic of their choice. The course is particularly targeted at Honours students who have selected physical geography topics for their dissertation. It gives them the opportunity to deepen some of their geomorphological literature relevant to their chosen project. Students are expected to interpret landscapes, identify formative processes and events, examine environmental changes at different spatial and temporal scales, place their area of study into the geological, Quaternary, climatic and applied context in order to appreciate geomorphologic concepts such as systems approach, complexity, relationships, feedbacks, thresholds, equilibrium and cycles. At the NQF 9 level students will be expected to back their literature review with data analyses including climatic or hydrological in nature and may also consider the application of GIS data and use Remote Sensing. At the NQF 9 level converting and preparing elements of course content towards the use for a publication would be expected.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS5046F/S WATER RESOURCE MANAGEMENT
23 NQF credits at NQF level 9
Convener: Dr K Winter
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline:
The aim of the module is to develop a comprehensive understanding of issues and challenges in water resources management at both an urban and catchment scale, and with a primary focus on the South African context. The various themes in this module will present a fascinating interplay of tensions and challenges that play out in geographical space and over time, and will involve the consideration of factors such as the increasing demand that society places on scarce water resources; on efforts to meet the basic social need for clean, potable water; on the consequences of interventions and institutional arrangements involved in water governance; and on the role of the
private sector in managing water risk in a particular catchment. The module also emphasises the value of an integrated understanding of theories and practices in water resources management and it does so by exploring the perspectives and approaches of sustainability science. Key themes in the module include water quality, monitoring and compliance; new directions in water research in South Africa; a consideration of biological treatment of water; participation in water governance; and how corporate enterprises are becoming leaders in water stewardship, shared water risk and value creation. These and other themes will be discussed in interactive seminar sessions. The course includes a three-week directed reading period, as well as a 4-day field camp. At the NQF 9 level students are required to complete an additional assignment that comprises a literature review on a topic of their choice. Furthermore, students at this level are required to prepare, manage and lead a course discussion. NQF 9 level students will receive a separate exam paper to those at the NQF 8 level.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** Assignments 50%; examination 50%.

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**EGS5047F/S POLICY AND GOVERNANCE**

23 NQF credits at NQF level 9

**Convener:** Associate Professor Z Patel

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**

This course looks at the underlying dynamics involved in the negotiation of environmental policy and its implementation. The assumption here is that unsustainable outcomes are not a result of a lack of will or intention, but rather due to vastly varying values, knowledge and data that are brought to bear on decision making for the environment. The approach of this course is to challenge the ‘cultural embeddedness’ of policy i.e. it critiques the cultural processes underlying environmental policy. A deeper understanding of the cultural politics of environmental policy and practice will deal with the processes through which institutions define and mediate policy outcomes; governance arrangements for sustainable development; the roles of power, rationality, knowledge and values in achieving environmental and social justice. At the NQF 9 level students will be expected to apply theory to appropriate areas of application in the realm of urban environmental policy. Masters level students will be assigned two presentations and subsequent written submissions, with an emphasis on the application of theoretical considerations. The extended policy analysis assignment will contain additional analytical variables to ensure a higher level of analysis.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** Assignments 60%; examination 40%.

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**EGS5052W APPLIED OCEAN SCIENCES MINOR DISSERTATION**

90 NQF credits at NQF level 9

**Convener:** Professor M Vichi and Dr C Reed

**Course entry requirements:** A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.

**Co-requisites:** BIO5012W, BIO5013F, BIO5014F/SEA5011F

**Course outline:**

The minor dissertation, which forms 50% of the overall degree, is based on a six-month supervised research project. The choice of project will be determined by the student's prior qualification and in agreement with the course conveners and supervisors. The dissertation should be submitted at the end of January, with the possibility of extension to June of the next year.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.
EGS5056F/S  IMAGINING SOUTHERN CITIES
23 NQF credits at NQF level 9
Convener: Drs S Daya and R Sitas
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS or cognate disciplines.
Course outline: The global South is urbanising at roughly twice the rate of the global North, yet dominant narratives of 'the city' continue to privilege London, Los Angeles and Paris over Lagos, Johannesburg and Mumbai. This course explores how cities of the global South are generating new bodies of theory, new forms of social life, and new imaginaries. It does this through novels, films and other textual and visual representations of everyday urbanism, drawing on contemporary theory from the global South to help make sense of these discourses. Situated in the rapidly evolving field of Urban Studies, the course aims to open up conversations across disciplines about the cities we are in and the cities we desire. Students will be expected to read set texts, both fictional and theoretical, and watch set films, in preparation for classes which will take the form of weekly, student-led seminars.

DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS5057F/S  URBAN POLITICAL ECOLOGY
23 NQF credits at NQF level 9
Convener: Dr S Scheba
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.
Course outline: This course explores urbanisation dynamics with a particular interest in examining the role of political economic shifts, history, discourse, and new forms of techno-management in shaping the contemporary urban environment. It does this through drawing on urban political ecology as an interdisciplinary field of study, that provides insights into the power relations underlying unequal access to urban space, resources and infrastructure. Situated in this rapidly evolving field of Urban Studies, the course aims to open up conversations about the dynamics underlying unequal access to cities as well as the possibilities that could support more just and equitable cities. Students will be expected to read set texts, both empirical and theoretical, in preparation for classes, which take the form of weekly, student-led seminars.

DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 70%; examination 30%.

EGS5058F/S  CRITICAL PERSPECTIVES ON THE BIO-ECONOMY
23 NQF credits at NQF level 9
Convener: Professor R Wynberg
Course entry requirements: Acceptance for Honours or Master’s specialising in EGS or cognate disciplines.
Course outline: Located at the interface of fast-changing genetic and information technologies, and the juncture of a range of social, environmental and ethical concerns, the so-called bio-economy has changed fundamentally ways in which biodiversity is used, conserved and commercialised. Although often touted as a panacea for energy crises, livelihoods, environmental remediation and food security, critical questions have been raised about who stands to benefit, the involvement of local communities, and economic and political drivers behind the bio-economy "push". Using a political ecology framing, this interdisciplinary course aims to introduce key theories that situate the bio-economy and to deepen understandings about the nature of emerging debates. These range from contestations about genetically modified crops, and 'biopiracy' charges of patenting biodiversity and traditional knowledge, through to the potential of agroecology as a sustainable agricultural future. The course aims to deepen critical thinking around these questions, and to inspire a scholarship that explores possibilities for socially just and environmentally sustainable approaches, with a particular
focus on the Global South. The course involves both theory and practice, drawing on research mostly from Sub-Saharan Africa. Students will be expected to read set texts, to watch set videos, and to prepare seminars. The course includes a short fieldtrip.

**DP requirements:** At least 80% attendance and submission of all assignments

**Assessment:** 1 exam - 40%, 1 essay (4000-5000 words) - 30%, 1 seminar presentation - 15%, 1 critique (response to a particular article, policy or media piece) - 15%.

EGS5059F/S ENVIRONMENTAL GOVERNANCE IN THE GLOBAL SOUTH
23 NQF credits at NQF level 9
Convener: Dr P Mbatha

**Course entry requirements:** Acceptance for Honours or Master’s specialising in EGS.

**Course outline:**
This course aims to introduce students to the theory and praxis of environmental governance relevant to global South contexts. It begins by outlining and discussing dominant historical and current environmental governance theories, models and approaches at the global level. The course then engages with various economic, political, historical, institutional and social drivers that influence environmental governance processes, practices and implementation, using the global South as a lens. It underlines symmetries and asymmetries of environmental governance by drawing on various natural resource use and governance sectors, i.e. biodiversity conservation, mining, forestry, tourism, etc. The course also engages the Sustainable Development Goals from a governance perspective, by critically analyzing whether or not they can realistically be in conversation with and address issues relating to environmental governance practice in the global South.

**DP requirements:** At least 80% attendance record and submission of all assignments.

**Assessment:** Assignments 60%; examination 40%.

EGS5060W URBAN STUDIES COURSEWORK
0 NQF credits at NQF level 9
Convener: Dr A Selmeczi

**Course outline:**
This full time taught Masters course (MPhil) is offered over 24 months, beginning in February. It provides interdisciplinary training in urban studies, with a focus on the issues of relevance to African and global southern city contexts. The course is designed for both recent graduates as well as those with several years' experience and who wish to gain a broad understanding of debates in urban studies from an African and global south perspective. The curriculum comprises three compulsory core courses, The City Research Studio and two of the following courses: Urban Theory, The Urban Everyday and Curating Urban Regulation. In addition, students will choose a minimum of 23 credits of elective courses chosen from an approved list of electives which offer the student the opportunity to explore urban studies through existing disciplinary and thematic approaches. Details of these courses are available from the Urban Studies Masters handbook.

**DP requirements:** The three required courses must be passed to proceed to the dissertation component of the Masters of Philosophy.

**Assessment:** The minor dissertation must be presented for formal examination. Upon successful completion of the coursework component, students will be required to register for the minor dissertation component (EGS5061W) in the second semester of the first year.

EGS5061W URBAN STUDIES MINOR DISSERTATION
90 NQF credits at NQF level 9
Convener: Dr A Selmeczi

**Course outline:**
The Masters in Southern Urbanism (an MPhil specialising in Urban Studies) is designed for students who have completed four-year bachelor degrees, as well as students with existing Masters degrees, in specific disciplines. The programme has been designed to provide a rigorous theoretical as well as
methodological foundation in interdisciplinary urban studies. It is intended as a bridgehead into PhD-D-level research, producing skilled researchers able to conduct compelling doctoral research. The MPhil curriculum combines Coursework (50%) and a minor dissertation (50%), a full-time load completed over a period of 18-24 months.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

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**EGS5062F**  THE URBAN EVERYDAY IN SOUTHERN CITIES
23 NQF credits at NQF level 9  
**Convener:** Dr L Nkula-Wenz  
**Co-requisites:** The City Research Studio (EGS5065W); and, either Urban Theory (EGS5063F) or Curating Urban Regulation (APG5089S).

**Course outline:**
Cities in the African and broader global southern context have come to the fore as crucial sites for the analysis of everyday forms of agency central to contemporary urban life. This body of work makes visible economic, political and social practices that far exceed formal state-driven and sanctioned development processes. This seminar course draws on a social science and humanities inspired literature on southern cities to reflect on everyday urban practice and diverse subjectivities and agencies that constitute contemporary everyday African and southern city life.

**DP requirements:** Written coursework.

**Assessment:** Three 'reaction' papers to engage literature and field-based work (30%); long paper (40%); course participation and seminar presentation (10%); weekly journal reflecting on literature and new learning (20%)

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**EGS5063F**  URBAN THEORY
23 NQF credits at NQF level 9  
**Convener:** Professor E Pieterse and Dr A Selmeczi  
**Co-requisites:** The City Research Studio (EGS5065W); and, either Everyday Perspectives on the Urban (EGS5062F) or Curating Urban Regulation (APG5089S).

**Course outline:**
This course will ground students in contemporary debates on how best to theorise and understand contemporary urbanisms in Africa, with due respect for the larger genealogy of urban studies. The course is further designed to create a foundation stone for going on to a PhD in urban studies because there is a desperate shortage of academics and scholars with the requisite training to generate novel and contextually relevant scholarly work in urban studies from the perspective of Africa and the global South.

**DP requirements:** Written coursework and participation.

**Assessment:** Three 'reaction' papers to engage literature and field-based work (30%); long paper (40%); course participation and seminar presentation (10%); weekly journal reflecting on literature and new learning (20%)

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**EGS5064W**  THEORIES OF JUSTICE & INEQUALITY MINOR DISSERTATION
90 NQF credits at NQF level 9  
**Convener:** Dr S Daya  
**Course outline:**
Students will complete a suitable research proposal in consultation with an appropriate supervisor. After approval of the proposal, students will undertake a research project critically interrogating established paradigms of understanding justice and inequality and/or demonstrating the application of theory to empirical issues related to justice and inequality.

**Assessment:** By Faculty external examination process.
EGS5065W   CITY RESEARCH STUDIO: RESEARCH PRACTICE & METHODS
23 NQF credits at NQF level 9
Convener: Dr A Selmeczi

Course entry requirements: Acceptance into the MPhil, specialising in Urban Studies.

Course outline:
The City Research Studio is the cornerstone of this Master's course. It has been built as a learning context in which students experiment with multiple forms of urban knowledge, expertise, and research practice beyond the conventional classroom context. It serves two key purposes: It provides a structured space in the degree for exploration and engagement in the City (in Cape Town primarily). It is also a context to engage with methods, and experiment with research practice and writing. Through an interactive pedagogical approach, it engages through practice with key debates in urban studies.

DP requirements: Papers, journal and proposal.
Assessment: Three papers (30%), narrative and visual journal on research practice in studio (30%), group contributions to exhibition (20%), thesis research proposal (10%), participation (10%).

EGS5066F/S   GEOGRAPHIES OF SEXUALITIES: IDENTITY, PLACE, & HEALTH
23 NQF credits at NQF level 9
Convener: A Tucker

Course entry requirements: Acceptance for Honours or Master’s specialising in EGS.

Course outline:
This course explores and critically engages with geographical research related to sexuality, with a particular focus on the interrelationships between identity, place and health. The course explores how geographical thinking on sexuality – and in particular on Lesbian, Gay, Bisexual, and Trans (LGBT) groups – has evolved over time, and the key relationships that have emerged between the study of sexuality and the study of health needs and inequalities. Starting with an exploration of the historical roots of the geographies of sexualities literature the course will go on to explore the connections such work has had with wider post-structuralist queer theories, globalization debates, and research on sexualities drawn from sub-Saharan Africa. The course will then situate such work in relation to the development of work on HIV/AIDS prevention, treatment and care, by considering how sexualities have been variously framed, and the at times limited conceptual space for an appreciation of diverse sexual identities. The course then draws together these various strands to consider the options and possibilities for current HIV programming in Cape Town for LGBT groups together with a critical examination of the epidemiological logics and conceptual challenges of the public health deployment of ‘men who have sex with men’ (MSM).

DP requirements: Class attendance (80%) and submissions of all assignments.
Assessment: 1 essay (6000-6500 words) – 30%, 1 seminar presentation – 10%, 1 24hr take-home exam – 60%.

EGS5067F/S   AIR QUALITY MONITORING, MANAGEMENT AND PREDICTION
23 NQF credits at NQF level 9
Convener: Dr J von Holdt

Course outline:
Compromised air quality is a major environmental concern, especially in urban environments and even more so in cities in developing parts of the world. This course explores the current state of global air quality but with a focus on examples and case studies from the global south, particularly Africa. We will investigate the factors and role players that have an influence on air quality, the distribution of polluted versus clean air and the impacts on people and the environment. This module will look at the different scales at which people are exposed to poor air quality and the data and tools we use to study and monitor the atmosphere at these different scales and explore the potential for locally developed interventions and solutions. We will also look at air quality management and how the current socio-economic situation is reflected in this space with specific reference to South and
southern Africa. Students will be expected to identify an air quality issue of their choice, find and interpret relevant literature, appropriate datasets and methods and produce results which will culminate in a short research report with recommendations for interventions that can potentially result in improvements in the air quality at receptor sites.

**DP requirements:** At least 80% class attendance and 40% minimum in assignments.

**Assessment:** Literature review 10%, data analysis assignment and paper 35%, discussion piece 10%, project poster and presentation 15%, final capstone exam 30%.

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**EGS6003W  ENVIRONMENTAL & GEOGRAPHICAL SCIENCE THESIS**

360 NQF credits at NQF level 10

**Course outline:**

The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Prospective candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF GEOLOGICAL SCIENCES

The Department is housed in the Geological Sciences Building, 13 University Avenue
Telephone (021) 650-2931 Fax (021) 650-3783
The Departmental abbreviation for Geological Sciences is GEO.

Associate Professor and Head of Department:
P E Janney, BSc New Hampshire PhD San Diego

Philipson Stow Professor of Mineralogy & Geology:
C Harris, MA DPhil Oxon

Chamber of Mines Professor of Geochemistry:
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Emeritus Professors:
A P le Roex, BSc Stell BSc Hons PhD Cape Town
S H Richardson, BSc Hons Cape Town PhD MIT

Associate Professors:
E M Bordy, MSc Budapest PhD Rhodes
J F A Diener, MSc Stell PhD Melbourne

Emeritus Associate Professors:
J S Compton, BA San Diego PhD Harvard
D L Reid, MSc Wellington PhD Cape Town

Senior Lecturers:
G Howarth, MSc PhD Rhodes
R Pickering, MSc Witwatersrand PhD Berne
A Sloan, MSc PhD Cantab

Chief Research Officer:
P J le Roux, BSc Hons PhD Cape Town

Lecturers:
M Abrahams, BSc Hons Cape Town
D Quiros Ugalde, BSc Florida Institute of Technology PhD Cornell
R Tostevin, MSc Cantab PhD UCL

Honorary Research Associates:
A Fagereng, BSc Hons Cape Town PhD Otago
H E Frimmel, PhD Vienna
R J Gibbon, MSc PhD Witwatersrand
D C Salazar Garcia, PhD Valencia
W L Taylor, MSc PhD Rochester

Principal Technical Officers:
D Basson
J Harrison

Chief Scientific Officers:
K Gray, MSc Cape Town
F Rawoot, BSc UWC
C E Tinguely, MSc Clermont-Ferrand

Senior Scientific Officers:
N Laidler, BSc Hons Cape Town
K Moses, MSc Pret

Senior Technical Officer:
R van der Merwe

Technical Officer:
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Administrative Officer:
N Barends
Administrative Assistant:
E Roos

Technical Assistants:
J van Rooyen
I Wilson

RESEARCH IN GEOLOGICAL SCIENCES
Research in Geological Sciences embraces a variety of topics that are listed below. More detailed information can be obtained by writing to the Department of Geological Sciences. The Department has research strengths in geochemistry, structural geology and tectonics, igneous and metamorphic petrology, sedimentology, marine geology, economic geology and geophysics. General research interests include: global tectonics and geodynamics with emphasis on Gondwana geology; structural geology; oceanic and continental igneous processes and the geochemical evolution of the Earth’s mantle; kimberlites and the genesis of diamonds; open and closed system behaviour during metamorphism and related ore genesis; economic geology with emphasis on base metal deposits; environmental geochemistry; sedimentology, sedimentary geochemistry, and sedimentary processes; chemical stratigraphy and crisis in the geological record; marine sedimentology and geophysics. The Department is well equipped for analytical studies with X-ray fluorescence and electron microprobe equipment, solution and laser ablation ICP-MS and MC-ICP-MS facilities, and access to gas-source mass spectrometers for oxygen, hydrogen and carbon stable isotope measurements. The Department is also equipped for structural and tectonic analysis and seismic interpretation, with microcomputer laboratories and relevant software.

Undergraduate Courses

Field excursions:
All students attending courses in Geology are required to take part in field excursions which take place during the Easter and September mid-semester vacations; full daily participation is required by all students.

NOTE: Supplementary examinations are not normally granted to students for senior courses in Geology. Students who pass the coursework, but underperformed in the final exam may be recalled for a re-exam immediately after the exam, but before the results are approved. Notification will be issued by email to the UCT email account.

First-Year Courses

GEO1006S INTRODUCTION TO MINERALS, ROCKS & STRUCTURE
18 NQF credits at NQF level 5
Convener: Dr R Tostevin
Course entry requirements: A minimum of 45% in GEO1009F
Course outline:
This course introduces students to the Geology major and covers the essentials of the discipline as follows: crystals and minerals; igneous and metamorphic rocks; structural geology; mineral deposits and economic geology; palaeontology; the interpretation of geological maps. A three-day field trip to the Western Cape serves as an introduction to field geology.
Lecture times: Monday - Friday, 5th period
DP requirements: An average of 30% in all marked classwork and tests.
Assessment: Class tests count 35%; field reports count 15%; one 2-hour theory examination written in November counts 50%. A subminimum of 40% is required in the theory examination paper.
GEO1009F  INTRODUCTION TO EARTH AND ENVIRONMENTAL SCIENCES  
This course is presented jointly by the Departments of Archaeology, Environmental & Geographical Science and Geological Sciences, but administered by Geological Sciences. Students are required to attend three half-day excursions in the Cape Peninsula.  
18 NQF credits at NQF level 5  
Convener: Associate Professor E M Bordy  
Course entry requirements: At least 50% for NSC Geography or at least 60% for NSC Physical Science or Life Sciences. NOTE: Preference will be given to students registered in the Science Faculty.  
Course outline:  
This course aims to develop a broad understanding of how the Earth works, leading to majors in Archaeology, Environmental & Geographical Sciences, Geology and Ocean & Atmosphere Science. The course covers the following general topics: structure and dynamics of the Earth; stratigraphy and geological history; climatology; surface processes and evolution of landscapes; biogeography; humans and the environment.  
Lecture times: Monday - Friday, 2nd period  
DP requirements: An average of 30% on all marked classwork and tests.  
Assessment: Marked classwork counts 24%; marked class tests count 16%; June examination 3 hours 60%. A Subminimum of 40% is required in the theory examination paper. Supplementary examinations for GEO1009F will be written in July.  

Second-Year Courses  

GEO2001F  MINERALOGY & CRYSTALLOGRAPHY  
Entrance is limited to 35 students  
24 NQF credits at NQF level 6  
Convener: Professor C Harris  
Course entry requirements: GEO1009F and GEO1006S, CEM1000W or equivalent.  
Course outline:  
This course covers the fundamentals of physical and chemical mineralogy as a basis for senior courses in petrology. The course comprises four inter-related sections as follows: crystallography, crystallographic calculations and a brief introduction to X-ray crystallography; Crystal optics: the theory and practice of identifying minerals by means of the polarising microscope; Mineralogy: the chemical, physical and optical properties of selected groups of rock-forming minerals; Phase diagrams: interpretation of one, two and simple three component phase diagrams; Classification and petrography of igneous rocks; physical processes in magma chambers; the relationship between chemical and mineralogical composition.  
Lecture times: Monday - Friday, 2nd period  
DP requirements: Attendance at 80% of practicals and an average of 30% in all marked class work and tests.  
Assessment: Marked class work, including tests, count 20%; one 2-hour practical examination in June counts 30%; one 2-hour theory examination in June counts 50%. Subminima of 40% are required in practical and theory examination papers.  

GEO2004S  PHYSICAL GEOLOGY  
24 NQF credits at NQF level 6  
Convener: Associate Professor J F Diener  
Course entry requirements: GEO2001F, PHY1031F or equivalent  
Course outline:  
This course builds on the previous mineralogy course and explores the physical processes involved in igneous, metamorphic and sedimentary rock formation, modification and destruction as follows: Stratigraphy of South Africa; transport and deposition of siliciclastic sediment; sedimentary textures and structure; siliciclastic, carbonate, evaporitic and other sedimentary rocks; earthquakes, stress,
displacement and strain; brittle and ductile deformation; interpretation of geological maps and cross sections; introduction to tectonics and global geophysics; types of metamorphism, metamorphic textures and mineral assemblages.

**Lecture times:** Monday - Friday, 2nd period

**DP requirements:** An average of 30% in marked class work, and attendance at 80% of practicals.

**Assessment:** Class tests and practicals count 25%; one 2-hour practical examination in November counts 30%; one 2-hour theory examination in November counts 45%. Subminima of 40% are required in practical and theory examination papers.

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**GEO2005X**  FIELD GEOLOGY & GEOLOGICAL MAPPING

24 NQF credits at NQF level 6

**Convener:** Associate Professor J F Diener

**Course entry requirements:** GEO1006S, GEO2004S (co-requisite)

**Course outline:** This is a field-based course that introduces techniques used to identify, describe and document rocks in the field and for interpreting their inter-relationships, with the view to producing geological maps, stratigraphic logs and structural sections. Techniques covered include: mineralogical and textural descriptions of rocks using a hand-lens; measurement of attitude of bedding using compass and clinometer; measurement, description and interpretation of depositional and deformational structures; stereo plots, interpretation and use of aerial photographs; identifying contact relationships; GPS positioning. Course material is taught over four separate field camps spread over two years of study.

**Lecture times:** None

**DP requirements:** Attendance at all field camps

**Assessment:** Maps and reports count 70%; three 2-hour practical examinations in June and November count for 30%.

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**Third-Year Courses**

**GEO3001S**  STRATIGRAPHY & ECONOMIC GEOLOGY

36 NQF credits at NQF level 7

**Convener:** Dr G Howarth

**Course entry requirements:** GEO2004S and DP in GEO3005F

**Course outline:** This course covers the development of the oceanic and continental rock record and associated ore deposits as follows: the principles of stratigraphy with examples drawn from the South African rock record; the methods and procedures involved in dating rocks; the genesis of economic mineral deposits, their microscopic textures, and their valuation and exploitation; geophysical techniques.

**Lecture times:** Monday - Friday, 2nd period

**DP requirements:** An average of 30% in all marked class work and class tests.

**Assessment:** Practicals and tests count 25%; one 3-hour theory examination written in November counts 45%; two 2-hour practical examinations written in November count 30%. Subminima of 40% required in practical and theory examination papers.

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**GEO3005F**  PETROLOGY & STRUCTURAL GEOLOGY

36 NQF credits at NQF level 7

**Convener:** Associate Professor P E Janney

**Course entry requirements:** GEO2001F, GEO2004S

**Course outline:** This course covers key concepts in igneous, metamorphic and sedimentary petrology in combination with structural geology as follows: interpreting major and trace element and isotope variations in igneous rocks; origin and evolution of the major magma series; thermodynamics, kinetics and chemography of metamorphic reactions; tectonic setting of metamorphic terrains; principles of
interpretations and classification of continental and marine sedimentary environments; kinematic principles, deformation mechanisms, microstructure, faulting and tectonic geomorphology.

Lecture times: Monday - Friday, 2nd period

DP requirements: Attendance at 80% of practicals and an average of 30% in all marked class work and tests.

Assessment: Class work counts 20%; one 4-hour practical examination written in June counts 30%; one 3-hour theory examination written in June counts 50%. Subminima of 40% required in practical and theory examination papers.

Postgraduate Courses

GEO4000W  GEOLOGY HONOURS
Since the code GEO4000W will not carry a NQF credit value, students will be concurrently registered for GEO4003W (coursework component of 120 NQF credits) and GEO4004W (research project of 40 NQF credits). Entrance is limited to 16 students.
160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: Associate Professor J F Diener
Course entry requirements: A BSc degree with a major in Geology, first qualifying courses in Chemistry and Mathematics. A first qualifying course in Physics is recommended. The Senate may accept other courses as being equivalent to these and this criterion will be applied when considering science graduates from other universities. Registrations are limited to 16 and acceptance will be at the discretion of the Head of Department, who will consider quality of final year results, material covered in undergraduate curriculum, and referee reports in making decisions. Preference will be given to UCT graduates who meet the course entry requirements.
Course outline:
Students are required to take 7 compulsory modules which cover the following subject areas: Geochemistry (including Isotope and Marine Geochemistry), Geophysics, Economic Geology, Igneous, Metamorphic and Mantle Petrology, Palaeontology, Quaternary Geology, Petroleum Geology, Sedimentary Basins, Tectonics, Geological Data Interpretation & Analysis, and Scientific Communication. In addition, each student is required to undertake a supervised research project. Choice of research project requires the approval of the Honours course co-ordinator and Head of Department. All students are required to attend a two week fieldtrip held during the year.
Assessment: The modules will be examined in mid-year and in October, and the latter examinations will include a 3 hour General Exam. Examinations will count 60%, practical and assignment work done during the year counts 15%, and the research project 25% towards the final grade. Subminima are required for the overall examination mark (40%) and for the research project (50%). These component parts of the course will be combined in a final overall mark which will be reflected against the course code GEO4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

GEO4001W  GEOCHEMISTRY HONOURS
As for GEO4000W above. Students undertaking a geochemical or analytical geochemistry project can elect to graduate in Geochemistry, subject to the approval of the Head of Department. Since the code GEO4001W will not carry a NQF credit value, students will be concurrently registered for GEO4005W (coursework component of 120 NQF credits) and GEO4006W (research project of 40 NQF credits).
160 NQF credits at NQF level 8; the combined credit value of both components.

GEO5000W  GEOLOGY DISSERTATION
180 NQF credits at NQF level 9
Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall
demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of the handbook.

**GEO5003W  GEOCHEMISTRY DISSERTATION**
180 NQF credits at NQF level 9

**Course outline:**
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found at the front of the handbook.

**GEO5005H  CLIMATE CHANGE MINOR DISSERTATION**
90 NQF credits at NQF level 9

**Convener:** To be advised

**Course entry requirements:** EGS5012W (refer to entry in Department of Environmental and Geographical Science section)

**Course outline:**
The minor dissertation is based on a three- to six-month supervised research project, to be submitted at the end of January, with the possibility of extension to June of the next year.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

**GEO6000W  GEOLOGY THESIS**
360 NQF credits at NQF level 10

**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Prospective candidates are referred to the rules for the PhD degree in Book 3, General Rules and Policies.
GEO6001W  GEOCHEMISTRY THESIS
360 NQF credits at NQF level 10

Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Prospective candidates are referred to the rules for the PhD degree in Book 3, General Rules and Policies.
DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

The Department is housed in the Mathematics Building, 7 University Avenue
Telephone (021) 650-3191 Fax (021) 650-2334. The department’s website is www.math.uct.ac.za
We also have a Facebook page at www.facebook.com/UCTMAM/
The Departmental abbreviation for Mathematics and Applied Mathematics is MAM.

Associate Professor and Head of Department:
D J Erwin, MSc Natal PhD Western Michigan

South African Research Chair in Computational Mechanics:
B D Reddy, BSc (Eng) Cape Town PhD Cantab FRSSAf, MASSAf, OMB

South African Research Chair in Physical Cosmology:
A Weltman, BSc Hons Cape Town PhD Columbia

Professors:
I V Barashenkov, MSc Moscow PhD Dubna
B A Bassett, MSc Cape Town PhD Trieste
P K S Dunsby, BSc PhD London
G Janelidze, MSc PhD Tbilisi Georgia DSc St Petersburg
J Murugan, MSc PhD Cape Town

Senior Scholar and Emeritus Distinguished Professor of Complex Systems:
G F R Ellis, BSc Hons BCom (Hons) Cape Town PhD Cantab DSc (h.c) Natal, Haverford

Emeritus Professors:
R I Becker, BSc Hons Cape Town PhD MIT
G C L Brünnmer, MSc Stellenbosch Docts Math Amsterdam PhD Cape Town
D S Butterworth, MSc Cape Town PhD London
K A Driver, BSc Hons Witwatersrand MSc Stanford PhD Witwatersrand
J H Webb, BSc Hons Cape Town PhD Cantab

Associate Professors:
E E Berdysheva, BSc MSc PhD Ekaterinburg Habil Stuttgart-Hohenheim
P V Bruyns, MA DPhil Oxon LRSM MSc Cape Town
A Schauerte, BSc Hons Natal MSc Cape Town PhD McMaster
J P Shock, MPhys Bristol PhD Southampton
H Skokos, BSc PhD Athens

Adjunct Associate Professor:
C A Clarkson, BSc Hons Edinburgh PhD Glasgow

Emeritus Associate Professors:
R W Cross, MA St Andrews PhD DSc London
C R A Gilmour, MSc PhD Cape Town

Honorary Research Associates:
V Brattka, MSc PhD Hagen Germany
E E Plagányi-Lloyd, BSc Natal MSc PhD Cape Town
R A Rademeyer, MSc PhD Cape Town
F D Richardson, BSc (Agric) Nottingham PhD London PhD Cape Town

Senior Lecturers:
N V Alexeeva, MSc Sofia PhD Cape Town
Á de la Cruz-Dombriz, MSc London PhD Madrid
F Ebobisse Bille, PhD Pisa
R Moolman, MSc Johannesburg PhD Witwatersrand
N R C Robertson, MSc PhD Cape Town
F Russo, MSc PhD Naples Federico II
J Sánchez-Ortega, MSc PhD Málaga
T C van Heerden, MAST Cantab MEd Cape Town

Lecturers:
P W Adams, MSc PhD Cape Town
DEPARTMENTS IN THE FACULTY

I Allie, BSc Cape Town PhD UWC
S Chili, BScEng Cape Town
T Chinyoka, MSc Zimbabwe PhD Virginia Tech
E Fredericks, MSc PhD Witwatersrand
S Haque PhD Wisconsin
T Janelidze-Gray, MSc Tbilisi PhD Cape Town
B Mongwane, BSc Limpopo BSc Hons PU MSc PhD Cape Town
C M Rohwer, MSc PhD Stellenbosch
H Spakowski, PhD Heinrich-Heine Germany
C S Swart, MSc Natal MSc PhD London
M Vandeyar, MSc Cape Town

Assistant Lecturer:
M Mokhithi, BScEng Cape Town
T W Robertson, MSc Stellenbosch

Visiting Professor and Principal Research Officer:
R Maartens, PhD Cape Town

Senior Research Officers:
A D G Brandao, BSc Witwatersrand MSc PhD Cape Town
C L de Moor, PhD Imperial College, London
S J Holloway, MSc PhD Cape Town

IT Technical Officer:
N Matotong, NDip VUT

Administrative Manager:
H S Leslie, BA Hons UPE

Financial Administrators:
A Ansary
A Willis-Thomas

Postgraduate Administrator:
T Hannival

Undergraduate Administrator:
--

Senior Secretaries:
N Hlwele
--

Departmental Assistants:
S Allie
T Mobo

Campus Cleaning Services Supervisor:
M Louw

Campus Cleaning Services:
N Bam
M Magwevana
T Mbonja
M Valentyn

MARAM Administrator:
D Lapido Loureiro

Research in Mathematics and Applied Mathematics

Research activities in the Department cover the spectrum of mathematics, and there are groups which are active in areas as diverse as Topology, Analysis, Discrete Mathematics and Theoretical Computer Science, General Relativity and Cosmology, Biological Modelling, and Continuum Mechanics. Fields of research of staff members include:

Functional Analysis, Operator Theory (J J Conradie, R W Cross, F Ebobisse, R Martin, N R C Robertson, J H Webb)

Financial Mathematics (R Becker)
Dynamical Systems (A B Ianovský)
Group Theory, Universal Algebra, Set Theory and Model Theory (P V Bruyns, H-P A Künzi, F Russo)
Industrial Mathematics (H de G Laurie)
Discrete Mathematics, Combinatorics, Computational Complexity, Cryptography, Graph Theory (C Blackman, D J Erwin, F Russo, H Spakowski, C S Swart)
Marine Population Dynamics (A Brandão, D S Butterworth, C de Moor, S J Holloway)
Mathematical Ecology (H de G Laurie)
Mathematics Education (C Blackman, J J Conradie, G F R Ellis, J L Frith, C R A Gilmour, H de G Laurie, R Moolman, K Rafel, T C van Heerden, J H Webb)
Nonlinear Dynamics and Mathematical Physics (I V Barashenkov, N V Alexeeva)
Partial Differential Equations of Mechanics, Numerical Analysis, Dynamical Systems (F Ebobisse-Bille, B D Reddy)
Approximation theory, special functions (K Driver)
Computational Fluid Dynamics (T Chinyoka)
Stochastic Ordinary Differential Equations (E Fredericks)
Rangeland Systems Modelling (F D Richardson)
Topology and Category Theory (J L Frith, C R A Gilmour, G Janelidze, H P A Künzi, F Russo, A Schauerte, G C L Brümmer)
String Theory and Quantum Gravity (J Murugan, J P Shock, A Weltman)
Category Theory (G Janelidze, T Janelidze-Gray)
Nonlinear dynamical systems, chaotic dynamics and Computational Mathematics (H Skokos)
Leavitt Path Algebras, Non-Associative Algebra, Ring Theory, Computer Algebra, Linear and Multilinear Algebra, Algebraic Combinatorics, Dialgebras (J Sanchez-Ortega)
Further information may be found on the Department's website at www.math.uct.ac.za.

Courses Offered by the Department
For convenience and ease of reference, the undergraduate courses have been grouped separately under Applied Mathematics and Mathematics. All postgraduate courses offered by the Department are listed together.

1. All students registered for a course in the Department will be required to attend the lectures and tutorial classes prescribed for that course.
2. Most syllabi indicate the contents of the various courses as recently given. All courses are subject to revision without advance notice.
3. For courses offered by the Department to Engineering and Commerce Faculty students refer to the relevant Faculty Handbooks.
4. In exceptional cases, the usual course entry requirements may be waived with special permission of the Head of Department.

Undergraduate Courses in Applied Mathematics

Recommended course selection
The following are recommended course selections emphasising particular interests:

Mathematical Modelling/Mechanics:
Mathematical Physics:
MAM1043H, MAM1044H, MAM2046W (or MAM2047H+MAM2004H), MAM3040W with courses in Physics, Astronomy and Mathematics.

**Biomathematics and Life Sciences:**
MAM1043H, MAM1044H, STA1006S, MAM2046W, MAM3041H (modules 3ND and 3AN) with courses in the Life Sciences or Environmental & Geographical Science.

**Prerequisites for 2nd and 3rd year courses**
Students wishing to register for the module 2BP (in the 2nd year applied mathematics course MAM2046W) must obtain a final mark of at least 45% for the module 2OD. Students planning to take modules in the third year applied mathematics course MAM3040W must obtain a final mark of 45% or higher for each of the prerequisite modules shown below:

<table>
<thead>
<tr>
<th>Semester</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>3MP</td>
<td>Methods of Mathematical Physics</td>
</tr>
<tr>
<td>3CV</td>
<td>Methods of Functions of Complex Variables</td>
</tr>
<tr>
<td>3AN</td>
<td>Advanced Numerical Methods</td>
</tr>
<tr>
<td>3GR</td>
<td>Introduction to General Relativity</td>
</tr>
<tr>
<td>3FD</td>
<td>Fluid Dynamics</td>
</tr>
</tbody>
</table>

| 1          | 2AC, 2OD, and 2ND |
| 1          | 2RA               |
| 2          | 2LA and 2NA       |
| 2          | 2AC               |
| 2          | 2AC, 2OD, and 2BP |

**First-Year Courses in Applied Mathematics**
The Mathematics Hot Seat in Room 210 on level 2 in the Mathematics Building is open for several hours every day and students in the courses MAM1042S, MAM1043H and MAM1044H are encouraged to go there for help with their mathematics problems.

**Undergraduate Courses**

**First-Year Courses**

**MAM1008S**  **INTRODUCTION TO DISCRETE MATHEMATICS**
18 NQF credits at NQF level 5

**Convener:** Dr I Allie

**Co-requisites:** MAM1000W or MAM1004S (unless a pass has been obtained for MAM1004F or MAM1005H)

**Objective:** To introduce students to the language and methods of the area of Discrete Mathematics, and to show students how discrete mathematics can be used in modern computer science (with the focus on algorithmic applications).

**Course outline:**
This course provides a foundation for Computer Science and Applied Statistics. Many areas of Computer Science and Applied Statistics require the ability to work with concepts from discrete structures, which include topics such as set theory, logic, graph theory, and probability theory. In this course, you will learn about (1) sets, relations and functions; (2) basic logic, including propositional logic, logical connectives, truth tables, propositional inference rules and predicate logic; (3) proof techniques, including the structure of mathematical proofs, direct proofs, disproving by counterexample, proof by contradiction; (4) basics of counting, including counting arguments, the pigeonhole principle, permutations and combinations, solving recurrence relation; (5) graphs and trees; (6) discrete probability, including finite probability space, axioms of probability, conditional probability; and, (7) linear algebra, including vectors, matrices and their applications. The course is offered in a blended-learning format. Students are provided with a set of video lectures that they can watch multiple times. Student contact time is in a tutorial format aimed at reinforcing the principles introduced in the online lectures and giving students time to do exercises under the supervision of tutors.

**Lecture times:** No face-to-face lectures. The course content is delivered online.

**DP requirements:** Class Record of at least 30% and attendance at 10 or more (out of 12) tutorials.
Assessment: Class Record counts 50% and Exam counts 50%.

MAM1043H  MODELLING & APPLIED COMPUTING
This course can be taken in conjunction with MAM1044H as lectures are arranged so that this is possible. Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.math.uct.ac.za. (A tablet or “netbook” will not be suitable). The course convener will provide details of additional software (open source) required.
18 NQF credits at NQF level 5
Convener: Dr P W Adams
Co-requisites: MAM1000W
Course outline:
The aim of this course is to introduce Applied Mathematics and Mathematical Modelling including approximations and estimation theory, numerical methods, dynamical systems and modelling and simulation of discrete and continuous processes with MATLAB and/or Julia. Exposure to research methodology and mathematical communication is provided.
Lecture times: First Semester: 2nd period Monday, Wednesday, Friday. Second Semester: 2nd period Tuesday, Thursday.
DP requirements: A class record of 30% or more.
Assessment: Class record counts 50%; one 3-hour examination written in October/November makes up the balance.

MAM1044H  DYNAMICS
This course can be taken in conjunction with MAM1043H as lectures are arranged so that this is possible.
18 NQF credits at NQF level 5
Convener: Professor P Dunsby
Co-requisites: MAM1000W
Course outline:
The aim of this course is to introduce the elements of mechanics. Topics covered include: Kinematics in three dimensions. Newton's laws of motion, models of forces (friction, elastic springs, fluid resistance). Conservation of energy and momentum. Simple systems of particles, including brief introduction to rigid systems. Orbital Mechanics with applications to the planning of space missions to the outer planets.
Lecture times: First semester: 2nd period Tuesday, Thursday. Second semester: 2nd period Monday, Wednesday, Friday.
DP requirements: A class record of 30% or more.
Assessment: Class record counts up to 40%. A project and one 2.5-hour examination written in October/November make up the balance.

Second-Year Courses
Students may not simultaneously register for MAM1000W and any of MAM2000W, MAM2004H, and MAM2002S.

MAM2046W  APPLIED MATHEMATICS 2046
The course MAM2046W consist of four modules and students must take all of these. Students wishing to register for the module 2BP must obtain a final mark of at least 45% for 2OD. Students planning to take MAM3040W should be aware that registration for some of the modules in that course requires a final mark of 45% or higher in some of the modules in MAM2046W.
48 NQF credits at NQF level 6
Convener: Dr P W Adams
Course entry requirements: MAM1043H, MAM1044H and MAM1000W
Course outline:
This course will provide students with fundamental topics in Applied Mathematics. It consists of the following four modules:

**2NA: NUMERICAL ANALYSIS (MAM2053S in EBE)**

**2OD: ORDINARY DIFFERENTIAL EQUATIONS**
First order equations; existence and uniqueness of solutions. Linear equations of the n-th order; systems of n linear first-order equations. Nonhomogeneous linear equations and systems; variation of parameters; qualitative theory of nonlinear equations; phase plane analysis; externally and parametrically driven oscillators; resonances; application to the theory of nonlinear vibrations. Calculus of variations.

**2BP: BOUNDARY-VALUE PROBLEMS (MAM2050S in EBE)**

**2ND: NONLINEAR DYNAMICS**

Lecture times: Monday - Friday, 3rd period

DP requirements: A class record of 30% or more is required in each module of the course.

Assessment: For each module the class record counts 30% and one no longer than 2-hour examination paper counts 70%.

MAM2047H APPLIED MATHEMATICS 2047
24 NQF credits at NQF level 6
Convener: Dr P W Adams

Course entry requirements: MAM1043H, MAM1044H and MAM1000W

Course outline:
The aim of this course is to introduce the student to a selection of fundamental topics in Applied Mathematics. This half-course consists of two modules from MAM2046W, one of which should be the module 2OD: ORDINARY DIFFERENTIAL EQUATIONS, which covers:
First order linear and nonlinear equations; existence and uniqueness of solutions. Linear equations of the n-th order and systems of n linear first order equations. Nonhomogeneous linear equations and systems; variation of parameters; qualitative theory of nonlinear equations; phase plane analysis; externally and parametrically driven oscillators; resonances; application to the theory of nonlinear vibrations. Calculus of variations.

Lecture times: Depending on modules chosen, as for MAM2046W.

DP requirements: A class record of 30% or more is required in each module of the course.

Assessment: Please refer to the MAM2046W examination requirement entry for the class record and examination weighting for each module.
MAM2048H  APPLIED MATHEMATICS 2048
24 NQF credits at NQF level 6
Convener: Dr P W Adams
Course entry requirements: MAM2047H
Course outline:
The aim of this course is to introduce the student to a selection of fundamental topics in Applied Mathematics. This course is for students who have already obtained credit for MAM2047H. It consists of two modules of MAM2046W which were not taken as MAM2047H. A student who takes both MAM2047H and MAM2048H may count the combination as equivalent to MAM2046W.
Lecture times: Depending on modules chosen, as for MAM2046W.
DP requirements: A class record of 30% or more is required in each module of the course.
Assessment: Please refer to the MAM2046W examination requirement entry for the class record and examination weighting for each module.

Third-Year Courses

MAM3040W  APPLIED MATHEMATICS 3040
The course MAM3040W consists of five modules. Students must take four of these, including the compulsory module 3MP. Some modules in MAM3040W have prerequisite (require a minimum final mark of 45%) modules in MAM2000W and MAM2046W. Details can be found in the handbook section Undergraduate Courses in Applied Mathematics.
72 NQF credits at NQF level 7
Convener: Professor I V Barashenkov
Course entry requirements: MAM2000W and either MAM2046W or both MAM2047H and MAM2048H
Course outline:
This course introduces students to advanced topics in Applied Mathematics.
3MP: METHODS OF MATHEMATICAL PHYSICS (MAM3043F in EBE)
3CV: METHODS OF FUNCTIONS OF COMPLEX VARIABLES
Complex calculus, calculus of residues, special functions, applications to physics.
3AN: ADVANCED NUMERICAL METHODS (MAM3050S in EBE)
3GR: INTRODUCTION TO GENERAL RELATIVITY (MAM3049S in EBE)
This course introduces special relativity, taught in a blended learning fashion (online lectures and tutorials) and general relativity including tensors, the metric tensor, symmetries, curvature, Einstein's field equations and solutions of Minkowski space and Black Holes.
3FD: FLUID DYNAMICS (MAM3054S in EBE)
Application, description of fluids, equations of fluid flow for simple fluids, analytical techniques.
Lecture times: Monday - Friday, 3rd period
DP requirements: A class record of 30% or more is required in each module of the course.
Assessment: For modules 3GR and 3FD the year mark counts 25% and the examination counts 75%. For modules 3MP, 3AN and 3CV, the year mark counts 35% and the examination counts 65%. The examinations for module 3MP and 3CV are written in June and modules 3FD, 3GR and 3AN are written in October/November. All examinations are no longer than 2 hours, except 3GR which is no longer than 3 hours.
MAM3041H  APPLIED MATHEMATICS 3041  
36 NQF credits at NQF level 7  
**Convener:** Professor I V Barashenkov  
**Course entry requirements:** MAM2000W and either MAM2046W or both MAM2047H and MAM2048H  
**Course outline:**  
The aim of this course is to introduce students to a selection of advanced topics in Applied Mathematics. This half course consists of two modules of MAM3040W, at least one of which should be 3MP: METHODS OF MATHEMATICAL PHYSICS (MAM3043S in EBE), the content of which may be found in the entry for MAM3040W.  
**Lecture times:** Depending on modules chosen, as for MAM3040W.  
**DP requirements:** A class record of 30% or more is required in each module of the course.  
**Assessment:** Please refer to the MAM3040W examination requirements entry for the class record and examination weighting for each module.

MAM3048H  APPLIED MATHEMATICS 3048  
36 NQF credits at NQF level 7  
**Convener:** Professor I V Barashenkov  
**Course entry requirements:** MAM3041H  
**Course outline:**  
This course is for students who have already obtained credit for MAM3041H. It consists of two modules of MAM3040W which were not taken as MAM3041H and which, together with MAM3041H, would constitute the contents of MAM3040W. A student who takes both MAM3041H and MAM3048H may count the combination as equivalent to MAM3040W.  
**Lecture times:** Depending on modules chosen, as for MAM3040W  
**DP requirements:** A class record of 30% or more is required in each module of the course.  
**Assessment:** Please refer to the MAM3040W examination requirements for the class record and examination weighting for each module.

MAM3055Z  PROJECT/INTERNSHIP IN APPLIED MATHEMATICS  
0 NQF credits at NQF level 7  
**Convener:** Professor I V Barashenkov  
**Course outline:**  
With permission from the Convenor, and subject to the availability of a suitable supervisor in the Department, students may complete a project or internship on a topic in Applied Mathematics. This is strongly recommended for students intending to continue to Honours in Applied Mathematics.

**Undergraduate Courses in Mathematics**

Students who are registered for the courses MAM1000W, MAM1004F/S, MAM1005H, MAM1006H, MAM1008S, MAM1010F/S, MAM1012F/S, MAM1020F/S, MAM1021F/S, MAM1023F/S, MAM1024F/S, MAM1110F/H, and MAM1112S will be able to access an EBook version of the prescribed textbook at no extra cost (i.e., students in these courses do not have to buy the textbook).

**First-Year Courses in Mathematics**

One full course in Mathematics at first-year level is offered in the Science Faculty, MAM1000W. (The courses MAM1010F/S and MAM1012F/S are intended for Commerce students and the courses MAM1020F/S and MAM1021F/S for Engineering students. Details of these can be found in the Handbooks for the Faculty of Commerce and the Faculty of Engineering & the Built Environment respectively). Credit equivalent to MAM1000W can be obtained by passing MAM1005H and
MAM1006H. In special cases MAM1004F or MAM1004S may be taken in place of MAM1005H; detailed rules are given under the entry for MAM1006H.

Students who intend to major in Mathematics must take the half course MAM1019H, usually during their first year of study.

Unless special permission is granted by the MAM HoD, students who intend to major in Computer Science, and whose other majors do not explicitly require MAM1000W, are expected to take the courses MAM1004F and MAM1008S instead of MAM1000W.

No student may register for more than one of MAM1000W, MAM1004F, MAM1004S, MAM1005H and MAM1006H simultaneously. Credit will not be given for more than one of MAM1004F, MAM1004S and MAM1005H. Credit for any first-year half course in Mathematics falls away on obtaining credit for MAM1000W.

The course STA1001F/S carries no credit in the Faculty of Science.

The Mathematics Hot Seat in Room 210 on level 2 in the Mathematics Building is open for several hours every day and students in all first year courses are encouraged to go there for help with their mathematics problems.

**Prerequisites for 2nd and 3rd year courses:**

Students planning to take modules in the 2nd or 3rd year mathematics courses MAM2000W and MAM3000W must obtain a final mark of 45% or higher for each of the prerequisite modules shown below:

<table>
<thead>
<tr>
<th>Semester</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>2LA</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>2AC</td>
<td>Advanced Calculus</td>
</tr>
<tr>
<td>2IA</td>
<td>Introductory Algebra</td>
</tr>
<tr>
<td>2RA</td>
<td>Real Analysis</td>
</tr>
<tr>
<td>2DE</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>3AL</td>
<td>Modern Abstract Algebra</td>
</tr>
<tr>
<td>3DM</td>
<td>Discrete Mathematics</td>
</tr>
<tr>
<td>3MS</td>
<td>Metric Spaces</td>
</tr>
<tr>
<td>3CA</td>
<td>Complex Analysis</td>
</tr>
<tr>
<td>3TA</td>
<td>Topics in Algebra</td>
</tr>
<tr>
<td>3TN</td>
<td>Topics in Analysis</td>
</tr>
</tbody>
</table>

**Undergraduate Courses**

**First-Year Courses**

**MAM1000W** MATHEMATICS 1000

36 NQF credits at NQF level 5

Convener: Dr T Janelidze-Gray

Course entry requirements: At least 70% in NSC Mathematics. Students registered for this course will be assessed in week 5; if it is judged that they are not coping with the level and pace of the course, and would benefit from an opportunity to strengthen foundational concepts and learn new material at a slower pace, they will be required to transfer to MAM1005H from week 7.

Course outline:

The aim of this course is to introduce students to the fundamental ideas in calculus, linear algebra and related topics. It includes differential and integral calculus of functions of one variable, differential equations, partial derivatives, vector geometry, matrix algebra, complex numbers, Taylor polynomials. This course is necessary for entry into second year mathematics.

Lecture times: Five lectures per week, Monday - Friday, 1st or 3rd period.
DP requirements: Minimum of 30% for class tests, minimum 30% for weekly online tests, and satisfactory tutorial work.

Assessment: Year mark counts 33.3%; two no longer than 3-hour papers written in October/November make up the balance.

MAM1004F  MATHEMATICS 1004
18 NQF credits at NQF level 5
Convener: To be advised
Course entry requirements: At least 70% in NSC Mathematics. Students registered in other faculties who do not meet the 70% NSC requirement may instead complete MAM1014F followed by MAM1015S with a mark of 70% or higher to gain entry to MAM1004F and MAM1004S. Students who fail MAM1004F are expected to register for MAM1004S in the 2nd semester.

Course outline:
The aim of this course is to provide mathematics for applications, particularly in the Life and Earth sciences. The syllabus covers the following topics: Functions and graphs. Straight lines, power functions, polynomials, exponential and logarithmic functions, trigonometric functions (radians). Discrete-time dynamical systems. Stability and equilibria. Rates of change. Limits, derivatives. Maxima and minima. Concavity. Asymptotes and curve sketching. Antiderivatives and integrals. Mathematical modelling. Separable and linear differential equations.

Lecture times: Monday - Friday, 1st period

DP requirements: Minimum of 30% in class tests, and satisfactory tutorial attendance.

Assessment: Year mark counts 50%; one 3-hour examination makes up the balance.

MAM1004S  MATHEMATICS 1004
18 NQF credits at NQF level 5
Convener: To be advised
Course entry requirements: At least 70% in NSC Mathematics. Students registered in other faculties who do not meet the 70% NSC requirement may instead complete MAM1014F followed by MAM1015S with a mark of 70% or higher to gain entry to MAM1004F and MAM1004S. Students who fail MAM1004F are expected to register for MAM1004S in the 2nd semester.

Course outline:
The aim of this course is to provide mathematics for applications, particularly in the Life and Earth sciences. The syllabus covers the following topics: Functions and graphs. Straight lines, power functions, polynomials, exponential and logarithmic functions, trigonometric functions (radians). Discrete-time dynamical systems. Stability and equilibria. Rates of change. Limits, derivatives. Maxima and minima. Concavity. Asymptotes and curve sketching. Antiderivatives and integrals. Mathematical modelling. Separable and linear differential equations.

Lecture times: Monday - Friday, Meridian

DP requirements: Minimum of 30% in class tests, and at least 80% attendance at tutorials.

Assessment: Year mark counts up to 40%; one 3-hour examination (written in June for MAM1004F, written in November for MAM1004S) makes up the balance.

MAM1005H  MATHEMATICS 1005
18 NQF credits at NQF level 5
Convener: Associate Professor B Osano
Course entry requirements: At least 70% in NSC Mathematics. The permission of the Dean or Head of Department is required prior to registration for this course. NOTES: 1) This course only begins in week 7 and is intended for students who have been advised to transfer to this course after initially registering for MAM1000W (see entry for MAM1000W). 2) The course places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. 3) MAM1005H +
MAM1006H is equivalent to MAM1000W in level, credit value towards the degree and as prerequisite for certain other courses.

Course outline:
Similar to the full-year course MAM1000W, the aim of this course is to introduce the fundamental ideas in calculus and related topics. It will cover the topics in the first half of MAM1000W including differential and integral calculus of functions of one variable, but extended over the full year.

Lecture times: Students attend Monday - Friday in 1st or 3rd period (depending on the rest of their timetable); Workshops: Monday, 6th and 7th period.

DP requirements: Minimum of 35% for class record and very satisfactory attendance at all lectures, workshops and tutorials.

Assessment: Year mark counts up to 50%; one 2-hour examination written in October/November makes up the balance.

MAM1006H MATHEMATICS 1006
18 NQF credits at NQF level 5
Convener: Dr R Moolman

Course entry requirements: MAM1005H or a pass with at least 65% in MAM1004F/S. Students who have passed MAM1004F/S with less than 65% and who wish to register for MAM1006H will be required to write and pass the examination paper for MAM1005H in November or the supplementary examination paper in January before they are allowed to register for MAM1006H. Such students are required to inform the course co-ordinator for MAM1005H by 1 September or 1 December, respectively, of their intention to write the examination and at the same time obtain information about the reading to be done as preparation for the examination. NOTES: 1) This course follows on from MAM1005H and also places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning. 2) MAM1005H + MAM1006H is equivalent to MAM1000W in level, credit value towards the degree and as prerequisite for certain other courses.

Course outline:
Similar to the full-year course MAM1000W, the aim of this course is to introduce the fundamental ideas in calculus, linear algebra and related topics. This course consists of those topics in the MAM1000W syllabus that were not covered in MAM1005H the previous year, including differential equations, partial derivatives, vector geometry, matrix algebra, complex numbers, Taylor series.

Lecture times: Lectures on Monday, Tuesday, Wednesday and Friday in first period. Tutorials on Thursday in first period. No workshops.

DP requirements: Minimum of 35% in class tests and very satisfactory attendance at lectures and tutorials.

Assessment: Year mark counts up to 40%; one 2-hour examination written in October/November makes up the balance.

MAM1019H FUNDAMENTALS OF MATHEMATICS
Students who intend to major in mathematics are expected to take MAM1019H during their first year of study.
18 NQF credits at NQF level 5
Convener: 1st semester: Associate Professor D Erwin. 2nd semester: M Vandeyar

Course entry requirements: At least 70% in NSC Mathematics

Co-requisites: MAM1000W or equivalent.

Course outline:
The aim of this course is to familiarise students with the most fundamental concepts and tools of modern mathematics at an elementary level. These include: fundamentals of logic and set theory, concepts of a function, of relations, of equivalence and order relations as well as some basic mathematical structures and the fundamental number systems.

Lecture times: Five lectures every two weeks in meridian.

DP requirements: Minimum of 30% in year mark.
Assessment: Year mark counts up to 40%; one 2-hour examination paper written in November makes up the balance.

Second-Year Courses
Students may not simultaneously register for MAM1000W and any of MAM2000W, MAM2004H, and MAM2002S.

MAM2000W  MATHEMATICS 2000
The course MAM2000W consists of five modules. Students must take four of these. In the first semester students take 2LA and 2AC, and in the second semester they take two of 2RA, 2IA and 2DE. Some modules in MAM2000W are prerequisites for other modules in MAM2000W, MAM3000W, and MAM3040W; for these modules, a final mark of 45% or higher must be obtained. Details can be found in the handbook sections Undergraduate Courses in Mathematics and Undergraduate Courses in Applied Mathematics. Due to the prerequisite system, students who obtain a final mark of less than 45% for 2AC or 2LA will be required to deregister from MAM2000W.

48 NQF credits at NQF level 6
Convener: T C Van Heerden
Course entry requirements: MAM1000W or equivalent. With permission from the MAM2000W convenor, students who obtained 70% or higher for both MAM1010 and MAM1012 may register for MAM2000W.

Course outline:
This course aims to introduce students to the fundamentals of mathematics.

2AC: ADVANCED CALCULUS

2DE: DIFFERENTIAL EQUATIONS (for Actuarial and Business Science students)

2IA: INTRODUCTORY ALGEBRA

2LA: LINEAR ALGEBRA

2RA: REAL ANALYSIS
Lecture times: Monday - Friday, 5th period. In the second semester 2DE is taught in the 4th period, and 2RA is taught in 4th and 5th period.

DP requirements: Minimum of 30% in class record and satisfactory tutorial attendance.
Assessment: Year mark counts up to 40%; the examination mark makes up the balance. The examination consists of four papers of up to 2 hours each. First semester modules will be examined in June and second semester modules in October/November.
MAM2002S MATHEMATICS 2002
MAM2002S is a half-course in Mathematics at second-year level. It is usually taken by students who are doing it in addition to either MAM2000W or MAM2004H.
24 NQF credits at NQF level 6
Convener: T C Van Heerden
Course entry requirements: MAM1000W (or equivalent).
Course outline:
The aims of these half courses are to introduce the student to a selection of fundamental topics in mathematics. Each half course consists of two modules. A student may register for a half course in the same year as MAM2000W or in a subsequent year. Refer to the MAM2000W course outline for the module details.
Lecture times: Same as MAM2000W.
DP requirements: Minimum of 30% in class record.
Assessment: As for MAM2000W except that the examination consists of two papers of up to 2 hours each.

MAM2004H MATHEMATICS 2004
MAM2004H is a half-course in Mathematics at second-year level. It is also the minimum co-requisite for MAM2046W and for PHY2014F, in which case modules 2LA and 2AC are compulsory.
24 NQF credits at NQF level 6
Convener: T C Van Heerden
Course entry requirements: MAM1000W (or equivalent).
Course outline:
The aims of these half courses are to introduce the student to a selection of fundamental topics in mathematics. Each half course consists of two modules. A student may register for a half course in the same year as MAM2000W or in a subsequent year. Refer to the MAM2000W course outline for the module details.
Lecture times: Same as MAM2000W.
DP requirements: Minimum of 30% in class record.
Assessment: As for MAM2000W except that the examination consists of two papers of up to 2 hours each.

Third-Year Courses

MAM3000W MATHEMATICS 3000
The course MAM3000W consists of six modules. Students must take four of these, including at least one of 3AL and 3MS. Some modules in MAM3000W are prerequisites (require a minimum final mark of 45%) for other modules in MAM3000W, and some MAM3000W modules have prerequisite modules in MAM2000W. Details can be found in the handbook section Undergraduate Courses in Mathematics. Students who are considering continuing to MAM4000W (Honours in Mathematics) should consult the Honours Program website (www.mamhonours.uct.ac.za) and/or the Honours Program Convenor before choosing their MAM3000W modules. These students are strongly urged to consider taking the project module MAM3006Z. Some MAM4000W modules require certain MAM3000W modules; a poorly considered choice of MAM3000W modules might make it very difficult to continue to Honours.
72 NQF credits at NQF level 7
Convener: Dr N R C Robertson
Course entry requirements: MAM2000W and MAM1019H (with permission from the Head of Department, MAM1019H may be taken concurrently with MAM3000W. However, this permission will usually only be granted for students who decide after first year of study to major in mathematics).
Course outline:
This course aims to introduce students to advanced topics in mathematics.
3AL: MODERN ABSTRACT ALGEBRA
Group Theory (Isomorphism Theorems, p-Groups, Sylow Theory, Direct Products and finitely
generated Abelian Groups). Further Linear Algebra (Primary decomposition, Jordan normal forms,
Bilinear forms).
3CA: COMPLEX ANALYSIS
Field of complex numbers. Power series. Analytic functions. Complex integration. Liouville’s
Cauchy’s Integral Formula. Counting Zeros and Open Mapping Theorems. Goursat’s Theorem.
Singularities. Laurent series. Residues.
3DM: DISCRETE MATHEMATICS
Graph theory, combinatorial counting, discrete probability
theory, recurrences, algorithms, applications.
3MS: METRIC SPACES
Metric spaces and topology; applications
3TA: TOPICS IN ALGEBRA
A selection from lattices and order, congruences, Boolean algebra, representation theory, naive set
theory, universal algebra.
3TN: TOPICS IN ANALYSIS
Compactness in metric spaces, normed spaces, linear continuous mappings between normed spaces,
Hilbert spaces, orthogonal projection, differential calculus on normed spaces, review of the Riemann
integral and its limitations.
Lecture times: Monday - Friday, 5th period
DP requirements: A class record of 30% or more.
Assessment: Year mark counts up to 40%; the examination mark counts at least 60% of the final
mark. The examination consists of four papers of up to 2 hours each. First-semester modules will be
examined in June and second-semester modules in October/November.

MAM3001W  MATHEMATICS 3001
72 NQF credits at NQF level 7
Convener: Dr N R C Robertson
Course entry requirements: MAM1019H and MAM2000W
Course outline:
The aim of this course is to introduce the student to a selection of advanced topics in mathematics.
The modules offered are the same as those for MAM3000W. A second-year module may be selected
with the course co-ordinator's approval. MAM3001W is a third-year senior course for students
selecting four modules which do not satisfy the requirements for the major course MAM3000W.
Refer to the MAM3000W course outline for the module details.
Lecture times: Monday - Friday, 5th period
DP requirements: A class record of 30% or more.
Assessment: Year mark counts up to 40%; the examination mark accounts for the balance. The
examination consists of four papers of up to 2 hours each. First-semester modules will be examined
in June and second-semester modules in October/November.

MAM3002H  MATHEMATICS 3002
MAM3002H is a half course for students who register at the beginning of the year.
36 NQF credits at NQF level 7
Convener: Dr N R C Robertson
Course entry requirements: MAM1019H and MAM2000W
Course outline:
These half courses may consist of any two third-year modules. Either half course may be taken
instead of a full course or in addition to it. A student who takes both MAM3002H and MAM3003S
may count the combination as a major only if the four modules studied would be acceptable for
MAM3000W.
Lecture times: Monday - Thursday, 5th period with options in 4th period.
DP requirements: A class record of 30%. 
Assessment: As for MAM3000W, except that the examination consists of two papers of up to 2 hours each.

MAM3003S MATHEMATICS 3003
MAM3003S is a half course for those who register in the second semester, or those who have already obtained credit for MAM3002H.
36 NQF credits at NQF level 7
Convener: Dr N R C Robertson
Course entry requirements: MAM1019H and MAM2000W
Course outline:
These half courses may consist of any two third-year modules. Either half course may be taken instead of a full course or in addition to it. A student who takes both MAM3002H and MAM3003S may count the combination as a major only if the four modules studied would be acceptable for MAM3000W.
Lecture times: Monday - Thursday, 5th period with options in 4th period.
DP requirements: A class record of 30%.
Assessment: As for MAM3000W, except that the examination consists of two papers of up to 2 hours each.

MAM3006Z PROJECT IN MATHEMATICS
0 NQF credits at NQF level 7
Convener: Dr I Allie
Course outline:
With permission from the Convenor, and subject to the availability of a suitable supervisor in the Department, students may complete a project on a topic in Mathematics. This is strongly recommended for students intending to continue to Honours in Mathematics.

Postgraduate Courses

There are a number of Honours courses available to students who have completed senior courses in Applied Mathematics and Mathematics. Details can be found on the website www.mamhonours.uct.ac.za. Those interested should contact the Honours Program Convenor, Associate Professor D J Erwin.

MAM4000W MATHEMATICS HONOURS
Since the code MAM4000W will not carry an NQF credit value, students will be concurrently registered for MAM4013W (coursework component of 130 NQF credits) and MAM4014W (research project of 30 NQF credits). Students registered for MAM4000W are expected to tutor in the Department of Mathematics and Applied Mathematics.
160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: Associate Professor D J Erwin
Course entry requirements: (i) 65% or higher for MAM3000W (or the equivalent at another institution), and, (ii) The average of the four marks for MAM1000W, MAM1019H, MAM2000W, and MAM3000W (or the equivalents at another institution) should be 65% or higher. In all cases acceptance is subject to individual approval by the Head of Department.
Course outline:
This course provides an introduction to some topics that are basic to a professional mathematician. Students do a mathematics project, at least three of the four core modules in Algebra, Analysis, Differential Geometry, and Topology, and other modules for a total of at least 160 credits (most modules are 20 credits; the project, which consists of a thesis and two seminars, is 40 credits total). Students have some flexibility in selecting their other modules but all curricula must be approved by the convenor. The decision about which modules will be offered is made by the Department, but typically includes (in addition to the previously mentioned core modules) a selection from such
DEPARTMENTS IN THE FACULTY

topics as Algebraic Geometry, Category Theory, Computational Complexity, Cryptology, Differential Topology, Functional Analysis, Graph Theory, Homological Algebra, Lie Algebras, Measure Theory, Number Theory, Operator Theory, Partial Differential Equations, and Theory of Hamiltonian Groups. Students may, with permission from the convener and with agreement from a suitable supervisor in the Department, pursue reading modules on topics that are not offered as taught modules.

Assessment: The project counts 25% of the final mark and must be passed (with 50%). On average, the examination counts at least 50% of the balance of the final mark for the course. Three core modules together count 37.5% of the final mark. The remaining 37.5% of the final mark is calculated using the student’s best marks in their other modules. These component parts of the course will be combined in a final overall mark which will be reflected against the course code MAM4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

MAM4001W APPLIED MATHEMATICS HONOURS
Since the code MAM4001W will not carry an NQF credit value, students will be concurrently registered for MAM4015W (coursework component of 120 NQF credits) and MAM4016W (research project of 40 NQF credits). Students registered for MAM4001W are expected to tutor in the Department of Mathematics and Applied Mathematics. 160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: Associate Professor D J Erwin

Course entry requirements: (i) 65% or higher for MAM3040W (or the equivalent at another institution), and, (ii) The average of the three marks for MAM1043H/1044H, MAM2046W, and MAM3040W (or the equivalents at another institution) should be 65% or higher. In all cases acceptance is subject to individual approval by the Head of Department.

Course outline: This course provides an introduction to a selection of topics in applied mathematics. Students do an applied mathematics project and modules for a total of at least 160 credits (most modules are 20 credits; the project, which consists of a thesis and two seminars, is 40 credits total). Each student’s curriculum must be approved by the convener and must include a minimum of 60 credits of applied mathematics modules taught by MAM (CERECAM and DMTCS modules are considered in this category). There is considerable flexibility in the structure of individual curricula and students are encouraged to include suitable modules from MAM4000W and from cognate departments (for example: Computer Science, Physics, Statistics, Economics, Oceanography). The decision about which modules will be offered is made by the Department, but typically includes a selection from such topics as Advanced Mathematical Methods, Continuum Mechanics, Finite Element Analysis, Mathematical Biology, General Relativity and Cosmology, and String Theory. Students may, with permission from the convener and with agreement from a suitable supervisor in the Department, pursue reading modules on topics that are not offered as taught modules.

Assessment: The project and seminar together count 25% of the final mark and must be passed (with 50%). On average, the examination counts at least 50% of the balance of the final mark for the course. At least 37.5% of the final mark must come from the previously mentioned applied mathematics modules taught by MAM. The remaining 37.5% of the final mark is calculated using the student’s best marks in their other modules. These component parts of the course will be combined in a final overall mark which will be reflected against the course code MAM4001W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

AST4007W ASTROPHYSICS & SPACE SCIENCE HONOURS
Since the code AST4007W will not carry a NQF credit value, students will be concurrently registered for AST4008W (coursework component of 128 NQF credits) and AST4009W (research project of 32 NQF credits). 160 NQF credits at NQF level 8; the combined credit value of both components.
Convener: To be advised
Course entry requirements: AST3002F and AST3003S or PHY3004W or MAM3040W or equivalent. Candidates with an Engineering background will also be considered. Enrollments are limited to 20 students. Candidates must satisfy the Steering Committee that they have sufficient background in Mathematics and Physics. Admission is subject to the approval of the Steering Committee and an application must be made before 30th September of the preceding year. Late applications will also be considered.

Course outline:
The Honours course in Astrophysics & Space Science consists of courses presented by distinguished South African researchers from research institutions participating in NASSP. There is a theory component which includes courses in spectroscopy, electrodynamics, general relativity, general astrophysics, galaxies, computational physics, astrophysical fluid dynamics and computational methods, as well as an observational techniques component which includes optical and infrared astronomy and radio astronomy. In addition students will complete a mini research project as well as a main research project and go on a number of fieldtrips to the national facilities.

DP requirements: Satisfactory lecture attendance (minimum 50%); class record of at least 40%.

Assessment: The assessment of the coursework is based on the class records and examinations for each of the modules. In general they are made up from tests, oral presentations, projects and a final examination. Examinations count 40%, class record 40% and research project 20% of the final result. The project component must be passed at 50%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code AST4007W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

AST5003F  ASTROPHYSICS & SPACE SCIENCE COURSEWORK
(National Astrophysics & Space Science Programme (NASSP). All students on the National Astrophysics & Space Science Programme (NASSP) will enrol (and pay fees) for the coursework component (AST5003F) at the start of their first year of registration. Those who choose to remain at UCT to complete the minor dissertation component (AST5001W, MAM5005W or PHY5003W) will be required to enrol (and pay fees) for the minor dissertation component in July. Where the minor dissertation is not submitted by the February deadline of the subsequent year, the student will be required to enrol (and pay fees) for the minor dissertation component in the subsequent year/s.
90 NQF credits at NQF level 9
Convener: To be advised

Course entry requirements: This course is open to Honours graduates in Astronomy and Space Science (AST4007W), Physics (PHY4000W, PHY4001W, PHY4002W) or equivalent, and Engineering. Entrance is subject to a minimum pass mark of 60% in the Honours degree.

Course outline:
This course consists of a selection of advanced topics presented by distinguished South African researchers from research institutions participating in NASSP. The courses vary from year to year but usually include cataclysmic variables, extragalactic astronomy, space technology, hot topics in cosmology, advanced general relativity, high energy astrophysics, observational cosmology, geomagnetism and aeronomy, plasma physics and magnetohydrodynamics.

Assessment: On average, examinations of individual modules count 60% of the final result, and marked practical work counts 40%.

MAM5000W  MATHEMATICS DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and
analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

**MAM5001W  APPLIED MATHEMATICS DISSERTATION**
180 NQF credits at NQF level 9  
**Course outline:**
The course will consist of the investigation of one or two topics chosen for intensive study by the candidate and approved by the Head of Department. Examination will be by dissertation. An oral examination may be required. The Department has research programmes in four particular areas of Applied Mathematics, namely (i) general relativity and astrophysics, (ii) mathematical modelling of biological, ecological and environmental systems, (iii) continuum mechanics, applied analysis and finite elements, and (iv) nonlinear evolution equations and non-integrable systems. See also 'Research in Mathematics & Applied Mathematics'. Candidates will be particularly encouraged to take part in one of these programmes. General rules for this degree may be found in the front of the handbook.

**MAM5005W  ASTROPHYSICS & SPACE SCIENCE MINOR DISSERTATION**
(National Astrophysics & Space Science Programme (NASSP); for further details see entry under Department of Astronomy)  
90 NQF credits at NQF level 9  
**Course entry requirements:**: AST5003F  
**Assessment:** Students will work on an approved research topic on which a minor dissertation must be presented for formal examination.

**MAM6000W  MATHEMATICS THESIS**
360 NQF credits at NQF level 10  
**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the general rules for the PhD as set out in Book 3, General Rules and Policies.

**MAM6001W  APPLIED MATHEMATICS THESIS**
360 NQF credits at NQF level 10  
**Course outline:**
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field.
field. Candidates are referred to the general rules for the PhD as set out in Book 3, General Rules and Policies.
DEPARTMENT OF MOLECULAR AND CELL BIOLOGY

The Department is housed in the Molecular Biology Building, 22 University Avenue
Telephone (021) 650-2494 Fax (021) 650-1861
The Departmental abbreviation for Molecular and Cell Biology is MCB.

Associate Professor and Head of Department:
S Rafudeen, BSc Hons PhD Cape Town

Deputy Head of Department – Postgraduate:

Deputy Head of Department – Undergraduate:
R Hurdayal, MSc UKZN PhD Cape Town (January to June 2022)
R A Ingle, BA Hons DPhil Oxon (from July 2022)

South African Research Chair in Molecular Physiology of Plant Desiccation Tolerance:
J M Farrant, BSc Hons PhD Natal

Professors:
J P Hapgood, BSc Hons PhD Cape Town
N Illing, MSc Cape Town DPhil Oxon

Emeritus Professor:
E P Rybicki, BSc Hons MSc PhD Cape Town
J A Thomson, BSc Cape Town MA Cantab PhD Rhodes

Emeritus Associate Professors:
V R Abratt, BSc Hons Rhodes PhD Cape Town
S J Reid, BSc Hons PhD Rhodes

Associate Professors:
V E Coyne, BSc Hons PhD Cape Town
I Hitzeroth, BSc Hons PhD Cape Town
R A Ingle, BA Hons DPhil Oxon
S Rafudeen, BSc Hons PhD Cape Town

Senior Lecturers:
R Hurdayal, MSc UKZN PhD Cape Town
P Meyers, BSc Hons PhD Cape Town
C O’Ryan, BSc Hons PhD Cape Town

Lecturers:
F Dube, BSc Hons PhD Cape Town
T Oelgeschläger, Dr rer nat Hanover
M J Williams, BSc Hons PhD Cape Town

Senior Research Officer:
A Meyers, BSc Hons PhD Cape Town

Research Officer:
C Avenant, BSc Hons Stell PhD Cape Town

Junior Research Fellow:
A R van Zyl, BSc Hons MSc UFS PhD Cape Town

Principal Scientific Officers:
K Iyer, PhD Cape Town
T Millard, BSc Pret

Chief Scientific Officers:
B L Arendze-Bailey, BSc Hons Cape Town
K Cooper, MSc Cape Town
M D Krige, MSc Stell
S Sattar, MSc Cape Town

Senior Scientific Officer:
P Liebrich, MSc Cape Town
Scientific Officers:
I Hoffman-Jacobs, MSc Stell
A Marthinus, BSc Hons Cape Town

Research Assistant:
K van der Merwe, HDipEd CPUT

Principal Technical Officer:
N Bredekamp

Chief Technical Officer:
D September

Senior Technical Officer:
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Department Manager:
Y L Burrows

Finance Administrator:
C Saunders

Administrative Assistant:
G Spannenberg

Senior Secretary:
A Aranjo

Departmental Assistants:
M Adams
P Bhewuza
K Makalima

Lab Assistants:
D August, NDip Biotech CPUT
D Marubelela, BA Human Ecology UWC
S Mzuzu

RESEARCH IN MOLECULAR AND CELL BIOLOGY
The Department has interests and expertise in diverse areas of biology. Plant desiccation research (Professors Farrant and Illing): the problem of desiccation in plants is being tackled by a combination of physiological and molecular approaches. Plant biotechnology (Professor Rybicki with Associate Professors Hitzeroth and Rafudeen; and Dr Meyers): research is focused on optimising transient expression of pharmaceutically-relevant proteins in plants and other systems, and developing virus-resistant and drought-tolerant crops, respectively. Eukaryotic gene expression (Professors Hapgood and Illing, Associate Professor Ingle and Dr Oelgeschläger): projects include regulation of transcription by steroid receptors, the role of circadian rhythms in regulating the plant immune responses, the regulation of gene transcription in the malaria parasite Plasmodium, and the regulation of gene expression during neuronal differentiation. Autism Spectrum Disorder Genetics (Dr O'Ryan): This research focuses on the genetic, epigenetic and biochemical associations of Autism Spectrum Disorder. Molecular virology (Professor Rybicki): studies focus on the expression of antigens from human and animal viruses in plants and insect cells for use as human and animal vaccines, and on the genetic diversity and molecular biology of single-stranded DNA viruses. Research in biochemistry (Professors Hapgood and Dr Oelgeschläger): includes investigating the structure, function and posttranslational modification of HIV proteins and their interactions with host proteins with a view to understanding mechanisms of viral pathogenesis and drug development, and studies into the structure, assembly, function and regulation of the transcription initiation machinery in Plasmodium falciparum. Research in cellular and molecular immunology (Dr Hurdayal) includes gene-deficient murine-models of human Leishmaniasis and parasite-based transcriptomics/proteomics to understand host susceptibility or resistance to Leishmania infection. Research in marine biotechnology (Associate Professor Coyne): includes the development of vaccines for farmed kob, genomic and proteomic studies of the effect of stress and disease on the abalone immune system, and the role of marine microorganisms in abalone nutrition and disease resistance. Research in microbiology (Drs Meyers, Dube and Williams): South African soil and
marine actinomycete bacteria are being screened for novel antibiotics; the population genetics of *Streptococcus pneumoniae* in South African children is being characterised; and the physiology of mycobacteria (environmental and pathogenic) is being studied to identify enzymes that can be targeted for the development of new drugs and diagnostic tools.

**Undergraduate Courses**

*Each student registered for any MCB undergraduate course is required to have an "entry level" laptop for use during class sessions as well as after hours (www.icts.uct.ac.za; A tablet or "netbook" will not be suitable).*

**Second-Year Courses**

**MCB2020F  BIOLOGICAL INFORMATION TRANSFER**

*Entrance is limited to 140 students; No semester abroad students will be admitted to this course.*
24 NQF credits at NQF level 6
Convener: Dr C O’Ryan
Course entry requirements: CEM1000W or equivalent, BIO1000F and BIO1004S (or equivalent).
Course outline:
This course introduces students to fundamental concepts in genetics and examines how biological information is organised, used and transferred in viruses, prokaryotes and eukaryotes. Topics covered include the biological explanations for Mendel's laws of genetics, principles of evolutionary genetics, genome organisation, horizontal gene transfer and gene structure and regulation.
Lecture times: Monday - Friday, 4th period
DP requirements: 50% average for assignments and practical reports; attendance at all practicals and tutorials.
Assessment: Tests and assignments count 40%; practicals count 10%; one three-hour paper written in June counts 50%. A subminimum of 40% in the examination is required.

**MCB2021F  MOLECULAR BIOSCIENCE**

*Entrance is limited to 140 students; No semester abroad students will be admitted to this course.*
24 NQF credits at NQF level 6
Convener: Associate Professor V Coyne
Course entry requirements: CEM1000W or equivalent, BIO1000F and BIO1004S (or equivalents)
Course outline:
This course will introduce students to the concepts of biological chemistry fundamental to understanding the distinctive properties of living matter and biological processes. The course covers core principles in three major areas, (i) the structural chemistry of key components of living matter and the relationship between chemical structure and biological function of these components, (ii) metabolism - the nature of chemical reactions that occur in living matter and (iii) the chemistry of molecules and processes involved in the transmission of biological information. In addition to these core principles, students will learn about scientific method, basic biochemistry/molecular biology techniques and experimental design.
Lecture times: Monday - Friday, 5th period
DP requirements: 50% average for assignments and practical reports; attendance at all practicals and tutorials.
Assessment: Tests and assignments count 40%; practicals count 10%; one three-hour paper written in June counts 50%. A subminimum of 40% in the examination is required.
MCB2022S  METABOLISM & BIOENGINEERING  
*Entrance is limited to 140 students.*
24 NQF credits at NQF level 6

**Convener:** Dr M Williams

**Course entry requirements:** MCB2020F and MCB2021F (or a minimum final mark of 45% (supplementary) for these courses)

**Course outline:**
This course will introduce students to some key aspects of metabolic energy production in eukaryotic and prokaryotic systems. It aims to raise awareness of issues at the forefront of the discipline and give students the ability to dissect problems in order to identify solutions. Topics covered may include carbohydrate and lipid metabolism, metabolic integration, the metabolic diversity in Bacteria and Archaea, and bioengineering in bacteria and plants.

**Lecture times:** Monday - Friday, 5th period

**DP requirements:** 50% average for assignments and practical reports; attendance at all practicals and tutorials.

**Assessment:** Tests and assignments count 40%; practicals count 10%; one three-hour paper written in November counts 50%. A subminimum of 40% in the examination is required.

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MCB2023S  FUNCTIONAL GENETICS  
*Entrance is limited to 140 students*
24 NQF credits at NQF level 6

**Convener:** Professor N Illing

**Course entry requirements:** MCB2020F and MCB2021F (or a minimum final mark of 45% (supplementary) for these courses)

**Course outline:**
The course lays the foundation for the major in genetics, and shows how the tools of classical and molecular genetics can be applied to understanding the regulation of gene expression, cell differentiation and patterning in bacteria and eukaryotes. Concepts covered include gene mapping, forward and reverse genetics; microbial genetics, including regulation of the lac operon; CRISPR/Cas9 gene editing and DNA repair; alternative splicing and sex-determination; epigenetic mechanisms used in dosage compensation; the genetic analysis of cell cycle regulation; stem cell technology and axis determination in *Drosophila*.

**Lecture times:** Monday - Friday, 4th period

**DP requirements:** 50% average for assignments and practical reports; attendance at all practicals and tutorials.

**Assessment:** Tests and assignments count 40%; practicals count 10%; one three-hour paper written in November counts 50%. A subminimum of 40% in the examination is required.

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**Third-Year Courses**

*NOTE: All MCB majors must complete MCB3012Z (Research project in Molecular and Cell Biology) during the second semester. This course replaces practical classes for both third year second semester MCB courses.*

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MCB3012Z  RESEARCH PROJECT IN MOLECULAR & CELL BIOLOGY
0 NQF credits at NQF level 7

**Convener:** Associate Professor R Ingle

**Course entry requirements:** MCB3025F or MCB3026F (or concurrent registration in MCB3023S or MCB3024S).

**Course outline:**
Groups of students will select and perform a research project two afternoons per week by arrangement. The work will be written up in the form of a research paper. This course replaces practical classes for all the third year second semester MCB courses.
DP requirements: None
Assessment: Project counts 100%

**MCB3023S  MOLECULAR EVOLUTIONARY GENETICS & DEVELOPMENT**
36 NQF credits at NQF level 7
Convener: Dr F Dube
Course entry requirements: MCB2020F, MCB2021F and MCB2022S or MCB2023S
Course outline:
This course provides advanced level studies in the area of molecular evolutionary genetics and development. Focus is placed on understanding key experiments in these fields and on interpreting data. Topics covered include: The origins and molecular genetics of viruses, principles of mouse molecular genetics applied to limb and neural development; evo-devo or how genetic change leads to morphological diversity; interactions between genetics, the environment and development.
Lecture times: Monday - Friday, 4th period
DP requirements: None
Assessment: Tests count 40%; one 3-hour examination written in November counts 60%. A subminimum of 40% in the examination is required.

**MCB3024S  DEFENCE & DISEASE**
36 NQF credits at NQF level 7
Convener: Professor J Hapgood
Course entry requirements: MCB2020F, MCB2021F and MCB2022S or MCB2023S
Course outline:
This course will initially examine the innate immune systems of plants. The focus will switch to the adaptive immune system, with emphasis on three major disease challenges in South Africa; namely, HIV, TB and malaria. Host-pathogen interactions will also be discussed, with a focus on viruses and how they infect mammals. Finally, the course will examine strategies to produce vaccines that enable immunity to viral infection.
Lecture times: Monday - Friday, 5th period
DP requirements: None
Assessment: Tests count 40%; one 3-hour examination written in November counts 60%. A subminimum of 40% in the examination is required.

**MCB3025F  STRUCTURAL & CHEMICAL BIOLOGY**
Entrance is limited to 90 students.
36 NQF credits at NQF level 7
Convener: Dr R Hurdayal
Course entry requirements: MCB2020F, MCB2021F and MCB2022S or MCB2023S
Course outline:
This course addresses how modern techniques of structural and chemical biology are being used to solve biological problems. It draws on multiple aspects of macromolecular biochemistry including nucleic acid structure and interactions, signalling proteins and membrane proteins, and demonstrates how this knowledge can be used in drug discovery and protein design in biotechnology. Topics include: mechanisms of reversible and irreversible enzyme inhibitors, ligand binding, protein folding, molecular basis for protein function, regulation of protein activity, cell signalling and proteomics.
Lecture times: Monday - Friday, 5th period
DP requirements: 50% average for assignments and practical reports; attendance at all practicals and tutorials.
Assessment: Tests count 40%; practicals, tutorials essays and assignments count 10%; one 3-hour examination written in June counts 50%. A subminimum of 40% in the examination is required.
MCB3026F  MOLECULAR GENETICS AND GENOMICS

*Entrance is limited to 90 students.*

36 NQF credits at NQF level 7

**Convener:** Associate Professor S Rafudeen

**Course entry requirements:** MCB2020F, MCB2021F and MCB2022S or MCB2023S

**Course outline:**
This course explores various topics in molecular genetics covering humans, plants, bacteria, viruses and mobile genetic elements (MGEs). Focus is given to understanding genetic mechanisms by studying genes, proteins, antisense RNA, sRNA and the role they play in regulatory and biochemical processes. Topics include plasmid biology, regulation of viral lifecycles, bacterial biosynthetic pathways, human genetic disorders, transgenic plants and metagenomics among others. Different and cutting-edge tools in modern day molecular biology are taught with an emphasis on data analyses and interpretation and these include bioinformatics (DNA sequence analysis, assembly, annotation, databases, BLAST, primer design), phylogenetics, Next generation sequencing, RNA sequencing and genome projects.

**Lecture times:** Monday - Friday, 4th period

**DP requirements:** 50% average for assignments and practical reports; attendance at all practicals and tutorials.

**Assessment:** Tests count 40%; practicals, tutorials, essays and assignments count 10%; one 3-hour examination written in June counts 50%. A subminimum of 40% in the examination is required.

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**Postgraduate Courses**

MCB4002W  MOLECULAR & CELL BIOLOGY HONOURS

*Since the code MCB4002W will not carry a NQF credit value, students will be concurrently registered for MCB4003W (coursework component of 96 NQF credits) and MCB4004W (research project of 64 NQF credits). Entrance is limited to 30 students.*

160 NQF credits at NQF level 8; the combined credit value of both components.

**Convener:** Dr T Oelgeschläger

**Course entry requirements:** BSc degree with a major in Biochemistry, Biotechnology, Genetics or Microbiology. Molecular-based courses are highly recommended. Preference may be given to UCT graduates. Entrance is limited to 30 students, dependent on availability of supervisors and funding. Acceptance will be at the discretion of the Head of Department who will consider quality of senior course results and material covered in the undergraduate curriculum.

**Course outline:**
The first part of this course consists of a ten-week techniques course including gel electrophoresis, recombinant DNA technology, PCR, sequencing, bioinformatics, gene expression, protein isolation and analysis, confocal and electron microscopy, and large data set analysis. After successful completion of the techniques course, a six-month research project on a specific topic will be undertaken.

**DP requirements:** Techniques examination must be passed at 50% to continue course.

**Assessment:** Two 3-hour techniques examinations written in May, and the techniques course assignments, count 20%; essays count 15%; oral presentations count 20%; statistics module 1%, one 4-hour examination written in November counts 10%; project counts 34%. The research project must be passed at 50%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code MCB4002W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.
**MCB5005W  MOLECULAR & CELL BIOLOGY DISSERTATION**  
180 NQF credits at NQF level 9  
**Course outline:**  
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

**MCB6002W  MOLECULAR & CELL BIOLOGY THESIS**  
360 NQF credits at NQF level 10  
**Course outline:**  
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF OCEANOGRAPHY

The Department is housed on the lower ground level in the RW James Building, Residence Road
Telephone (021) 650-3277 Fax (021) 650-3979
The Departmental abbreviation for Oceanography is SEA.

Professor and Head of Department:
I J Ansorge, BSc Plymouth MSc PhD Cape Town
South African Research Chair in Modelling of the Coupled Ocean-Land-Atmosphere
Phenomena Related to Climate:
M Rouault, MSc PhD Aix-Marseille
Professor and UCT Fellow:
C J C Reason, BSc Hons Cape Town MPhil City MSc PhD British Columbia
Professor:
M Vichi, MSc Bologna PhD Oldenburg
Emeritus Professors:
G B Brundrit, BSc Hons PhD Manchester
F A Shillington, BSc Hons Witwatersrand MSc PhD Cape Town
Associate Professor:
J Hermes, BSc Bangor PhD Cape Town (SAEON)
Senior Lecturers:
K E Altieri, MA Princeton PhD Rutgers
S E Fawcett, BA Hons Harvard MA PhD Princeton
Lecturer:
M N Ragoasha, MSc Cape Town PhD Cape Town
Honorary Research Associates:
B Backeberg, PhD Cape Town
S Bernard, BSc Soton PhD Cape Town (CSIR)
J Deshayes, PhD Paris
S Herbette, PhD Uni de Bretagne Occidentale
W Joubert, PhD Cape Town
M Krug, MSc PhD Cape Town
T Lamont, PhD Cape Town
S Pous, PhD Uni de Bretagne Occidentale
P Penven, PhD Uni de Bretagne Occidentale
C Rautenbach, PhD TUC Norway
S Swart, PhD Cape Town
Honorary Research Associates: MA-RE
P M S Monteiro, MSc PhD Cape Town (CSIR)
S Thomalla, PhD Cape Town
Departmental Librarian:
N Jabaar, Blnf Unisa
Principal Technical Officer:
P Truter, BSc Stell
Principal Scientific Officer:
R Roman, MSc PhD Cape Town
Administrative Officer:
C Karriem, Dipl Office Administration Rosebank College

NANSEN-TUTU CENTRE FOR MARINE ENVIRONMENTAL RESEARCH:
I J Ansorge, BSc Plymouth MSc PhD Cape Town
M Rouault, MSc PhD Aix-Marseille
MARINE AND ANTARCTIC RESEARCH CENTRE FOR INNOVATION AND SUSTAINABILITY (MARIS)

The Department of Oceanography is affiliated with the Marine and Antarctic Research Centre for Innovation and Sustainability (MARIS). For more information refer to the “Inter-Faculty Units” section, further on in this handbook.

RESEARCH IN OCEANOGRAPHY AND ATMOSPHERIC SCIENCE


Undergraduate Courses

Second-Year Courses

SEA2004F  PRINCIPLES OF OCEANOGRAPHY
24 NQF credits at NQF level 6
Convener: Dr K Altieri
Course entry requirements: BIO1004F/S or GEO1009F, CEM1000W, or permission of the convener
Course outline:
An introduction to the principles of oceanography, including an introduction to physical, biological and chemical oceanography, marine geology, and the ocean atmosphere system. The course comprises multiple modules, which cover the above topics. Oceanographic instrumentation and methods of data analysis will be covered in the tutorials and practicals.
Lecture times: Monday - Friday, 4th period
DP requirements: Attendance at practicals and a class mark of at least 40%.
Assessment: Practicals and tests count 50%; one 3-hour examination written in June/July counts 50%. A subminimum of 40% in the examination is required.

SEA2005S  MARINE SYSTEMS
24 NQF credits at NQF level 6
Convener: Dr S E Fawcett
Course entry requirements: BIO1004F/S or GEO1009F, CEM1000W, SEA2004F, or permission of the convener
Course outline:
Building on the Principles of Oceanography SEA2004F course, this more advanced course will cover the main ocean and atmosphere systems, with a particular emphasis on their biogeochemical functioning. This includes an introduction to the major marine biogeochemical cycles, seawater carbonate chemistry, phytoplankton-nutrient interactions and growth kinetics, surface ocean-lower atmosphere interactions, and an introduction to Earth system dynamics. The physical forcings and their biogeochemical and ecosystem responses will be quantitatively illustrated for upwelling systems, oligotrophic systems, coastal systems around South Africa, and the Southern Ocean. Emphasis will be placed on treating the systems in an integrative manner. Methods of data sampling and analysis, and computation of biogeochemical pools, rates and feedbacks will be covered in the tutorials and practicals.
Lecture times: Monday - Friday, 4th period
DP requirements: Attendance of lectures and practicals, and a class mark of at least 40%.
Assessment: Practicals and tests count 50%; a final examination written in October/November counts 50%. A subminimum of 40% in the examination is required.
Third-Year Courses

**SEA3004F** OCEAN & ATMOSPHERE DYNAMICS  
36 NQF credits at NQF level 7  
**Convener:** Professor M Vichi  
**Course entry requirements:** PHY1031F or equivalent, BIO1004S or GEO1009F, CEM1000W, SEA2004F, SEA2005S.  
**Course outline:**  
The Ocean & Atmosphere dynamics course will begin to specialise in advanced material related to physical oceanography, atmospheric science and climate. These topics will include a quantitative approach to ocean/atmosphere dynamics, theories of circulation and the development of ocean and atmospheric weather systems, coupled ocean/atmosphere processes, interactions and feedbacks with the carbon cycle in the earth system and climate change. Methods of analysis of both observations and model data will be covered in the tutorials and practicals.  
**Lecture times:** Monday - Friday, 4th period  
**DP requirements:** Attendance at tutorials and practicals, and a class mark of at least 40%.  
**Assessment:** Tutorials/practicals and tests count 40%; one 3-hour examination written in October counts 60%. A subminimum of 40% in the examination is required.

Postgraduate Courses

**SEA4001W** OCEAN & ATMOSPHERE SCIENCE HONOURS  
Since the code SEA4001W will not carry a NQF credit value, students will be concurrently registered for SEA4003W (coursework component of 112 NQF credits) and SEA4004W (research project of 48 NQF credits).  
160 NQF credits at NQF level 8; the combined credit value of both components.  
**Convener:** Professor I J Ansorge  
**Course entry requirements:** A BSc degree with a major/specialisation in Ocean & Atmosphere Science or in a related discipline. CEM1000W or equivalent is a prerequisite. Acceptance will be at the discretion of the Head of Department who will consider quality of final year results, material covered in the undergraduate curriculum, and possibly referee reports. Preference may be given to UCT graduates who meet the course entry requirements.  
**Course outline:**  
Honours students intending careers in ocean and atmosphere science will complete a full set of modules and a research project. Honours students from Environmental & Geographical Science, Applied Mathematics, and other physical science and engineering departments, are encouraged to attend selected modules. The curriculum includes lecture-tutorials, seminars and practical work in advanced oceanography, meteorology and climate, an introduction to modelling and data analysis. Practical work includes fieldwork at sea and may include dive training (class 4 diving qualification, at the students own cost if they choose to do the dive course). Student performance in each module may be assessed by project work, seminar presentations, written assignments and examinations, together making up 65% of the final mark. In the second half of the year the research project will take priority. Students will be expected to present a seminar on their projects at the year’s end.  
**Assessment:** Module assessment by submission of a research portfolio, which includes fieldtrip reports, skills examination and formal test results. A weighted average of the continuous assessment of reports and tests counts 65% of the final mark; the research project counts 35% of the final mark. The research project must be passed at 50%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code SEA4001W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.
SEA5000W  OCEAN & ATMOSPHERE SCIENCE DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

SEA5001W  PHYSICAL OCEANOGRAPHY DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

SEA5011F  OPERATIONAL OCEANOGRAPHY COURSEWORK
50 NQF credits at NQF level 9

Convener: Professor M Vichi

Course entry requirements: A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.

Co-requisites: This course is a component of the Applied Ocean Sciences Master's coursework (refer to BIO5012W). Co-requisites are BIO5013F and minor dissertation code chosen from the ones listed in the BIO5012W handbook. Changes in the dissertation code are allowed according to the student background and prior to consultation with the course conveners.

Course outline:
This course is comprised of 4 modules focusing on the usage and provision of marine services that describe the ocean physical and biogeochemical state through observational and modeling components. The course covers the global ocean and coastal observing systems, the usage of ocean diagnostics and climate indicators as well as an introduction to the major monitoring techniques for physical and biogeochemical oceanography. Qualified students will have the possibility of participating to an open ocean research cruise in July. In addition, students will choose at least two elective courses, chosen from a range of modules offered in both disciplinary streams. They provide the student the opportunity to explore new areas, or look at more specific disciplinary backgrounds in the vast subject of ocean sciences. The list and details of these courses will be made available at the opening of each registration period in the BIO5012W handbook on the Marine and Antarctic Research Centre for Innovation and Sustainability (MARIS) website.

Assessment: Every module is assessed independently either with a class test or individual project assignments. The syllabus and the relative weight for each module are described in a handbook that
will be made available on the BIO5012W website (hosted by the Marine and Antarctic Research Centre for Innovation and Sustainability).

**SEA5012W  APPLIED OCEAN SCIENCES MINOR DISSERTATION**

90 NQF credits at NQF level 9  
**Convener:** Professor M Vichi and Dr C Reed  
**Course entry requirements:** A relevant Honours degree (or equivalent). Students with backgrounds in scientific and engineering disciplines are encouraged to apply.  
**Co-requisites:** BIO5012W, BIO5013F, BIO5014F/SEA5011F  
**Course outline:**  
The minor dissertation, which forms 50% of the overall degree, is based on a six-month supervised research project. The choice of project will be determined by the student's prior qualification and in agreement with the course conveners and supervisors. The dissertation should be submitted at the end of January, with the possibility of extension to June of the next year.  
**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

**SEA6000W  OCEAN & ATMOSPHERE SCIENCE THESIS**

360 NQF credits at NQF level 10  
**Course outline:**  
The PhD is a research degree on an advanced topic under supervision, which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF PHYSICS

The Department is housed in the R W James Building, 9 University Avenue
Telephone (021) 650-3326 Fax (021) 650-3342 Website: www.phy.uct.ac.za

The Departmental abbreviation for Physics is PHY.

Associate Professor and Head of Department:
S W Peterson, MA PhD Wisconsin

Professors:
M S Allie, MSc PhD Cape Town (CHED)
A Buffler, MSc PhD HDE Cape Town
A Peshier, MA PhD Dresden

Senior Scholar:
C A Dominguez, MSc PhD Buenos Aires FRSSAf

Emeritus Professors:
D G Aschman, BSc Hons Cape Town DPhil Oxon
D T Britton, MSc PhD London

Associate Professors:
M D Blumenthal, BSc Witwatersrand Dipl Phys Bonn PhD Cantab
T Dietel, Dipl Phys Heidelberg Dr phil nat Frankfurt am Main
W A Horowitz, MA MSc PhD Columbia
D L Taylor, BSc Hons HDE UKZN MSc PhD Witwatersrand (CHED)
H W G Weigert, Dipl Phys Dr rer nat habil Regensburg
S Yacoob, MSc Cape Town PhD Northwestern

Emeritus Associate Professors:
R W Fearick, BSc Hons PhD Witwatersrand
M Härting, Dipl Phys Regensburg Dr. Ing BW München
G N v d H Robertson, BSc Hons Cape Town DPhil Oxon

Adjunct Associate Professor:
S R Naidoo, PhD Witwatersrand

Honorary Professor:
F Azaiez, MSc Paris PhD Orsay

Senior Lecturers:
K Cole, MPhys Hons Manchester MSc Liverpool PhD ICL
T Leadbeater, MSc PhD Birmingham
S M Wheaton, MSc PhD Cape Town

Lecturers:
D R Geduld, MSc Cape Town
J M Keaveney, PhD Dublin
T Salagaram, MSc PhD UKZN

Honorary Research Associates:
J A Ayala, PhD Minnesota
L A Hernandez, PhD Cape Town
M Loewe, PhD Hamburg
K Schilcher, PhD Vienna
M Spiesberger, PhD Mainz

Chief Scientific Officer:
N Razak, MSc PhD Cape Town

Scientific Officers:
K Maibane, MSc UWC
M R van Heerden, MSc(Eng) Cape Town

Research Officer:
N B Ndabeni, MSc PhD Stell
Junior Research Fellow (MeASURe):
T Hutton, EngD Birmingham

Principal Technical Officers:
J Dickson
G K Fowle
K J Ontong
C J J Sadler

Chief Technical Officer:
M Christians

Department Administrator:
N Lovric

Administrative Assistants:
B Matubatuba
J Patel

Laboratory Attendant:
R Hansen

Departmental Assistant:
N Mzamo

RESEARCH IN PHYSICS
The Department of Physics is accommodated in the R W James Building, which houses laboratories equipped for nuclear physics, solid state and nanophysics, ultracold physics (8 mK dilution refrigerator), and physics education research. Additional facilities available to the Department are provided by iThemba Laboratories for Accelerator-Based Sciences (200 MeV cyclotron and other particle accelerators).

Major areas of interest at present include:
1. Experimental nuclear physics at iThemba LABS (A Buffler, R W Fearick, T Leadbeater, N B Ndabeni and S W Peterson) comprising: (a) Gamma ray spectroscopy with the AFRODITE array; (b) Giant resonance reactions with the magnetic spectrometer; (c) Fast neutron physics; (d) Radiation detection and measurement.
2. Theoretical Physics (C A Dominguez, W A Horowitz, A Peshier and H W G Weigert), comprising: (a) Research within the Centre for Theoretical and Mathematical Physics; (b) Structure of elementary particles; (c) Neutrino physics and astrophysics; (d) Quantum field theory, quantum electrodynamics and chromodynamics in free space, in the cavity and at extreme temperatures and pressures; (e) Renormalization group equations, both linear and nonlinear (Color Glass Condensate); (f) Nonlinear effects in QCD at high densities; (g) Phenomenology of heavy ion reactions; (h) Quark gluon plasma.
3. Experimental high energy physics (T Dietel, S Yacoob and J M Keaveney), comprising: (a) Research within the UCT-CERN Research Centre; (b) Relativistic heavy ion collisions within the ALICE collaboration at CERN; (c) High energy proton-proton collisions within the ATLAS collaboration at CERN.
4. Nanophysics and solid state physics (M D Blumenthal and T Salagaram), comprising: (a) Research within the Nanoelectronics Research Laboratory; (b) Structural and electrical properties of nanomaterials; (c) Single electron transport and interactions; (d) Computational studies.
5. Applied Physics (M D Blumenthal, A Buffler, K E Cole, T Leadbeater, S W Peterson, T Salagaram, T Hutton, N B Ndabeni and S M Wheaton), comprising: (a) Research within the Metrological and Applied Sciences University Research Unit (MeASURe). (b) Positron Emission Particle Tracking at PEPT Cape Town, iThemba LABS and the Position Imaging Centre, University of Birmingham, UK; (c) Radiation transport modelling in industrial and medical systems; (d) Applied nuclear physics and engineering; (e) Electrical and radiation measurement standards.
6. Tertiary physics education (M S Allie, A Buffler, T Salagaram, D L Taylor and S M Wheaton), comprising: (a) Curriculum design and evaluation; (b) Role of language; (c) Understanding of measurement and uncertainty; (d) Modelling and visualization; (e) Computational physics education.
Undergraduate Courses

Credit will not be given for both PHY1023H and PHY1031F. Credit can be given for both of PHY1023H and PHY1004W.

First-Year Courses

PHY1004W  MATTER & INTERACTIONS
Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.phy.uct.ac.za. (A tablet or “netbook” will not be suitable). The course convener will provide details of additional software (open source) required.
36 NQF credits at NQF level 5
Convener: Dr S M Wheaton
Course entry requirements: At least 60% for NSC Physical Science. MAM1000W (or equivalent) must have been passed or be taken concurrently. Students registered for this course will be assessed in week 5; if it is judged that they are not coping with the level and pace of the course, and would benefit from an opportunity to strengthen foundational concepts and learn new material at a slower pace, they will be required to transfer to PHY1031F or PHY1023H from week 7.
Course outline:
PHY1004W is an advanced calculus-based introductory course for Science students intending to continue with second-year Physics. It features the modelling of physical systems from fundamental principles, and computational problem solving using VPython. The course includes the following topics: Modern mechanics: Conservation laws, the momentum principle, atomic nature of matter, conservation of energy, energy in macroscopic systems, energy quantization, multi-particle systems, exploring the nucleus, angular momentum, entropy. Electric and magnetic interactions: Electric fields, electric potential, magnetic fields, electric circuits, capacitance, resistance, magnetic force, Gauss' Law, Ampere's Law, Faraday's Law, induction, electromagnetic radiation, waves and particles.
Lecture times: Monday - Friday, 3rd period
DP requirements: Minimum of 40% in class record, including 50% in laboratory assessment.
Assessment: Class record (weekly problem sets, class tests and laboratory record) counts 50%; one 2-hour examination in June counts 25%; one 2-hour examination in November counts 25%.

PHY1023H  PRINCIPLES OF PHYSICS
Students passing PHY1023H may proceed into PHY1032F. Students who pass PHY1023H and then register for and pass PHY1004W will gain credit for both courses.
18 NQF credits at NQF level 5
Convener: Associate Professor D L Taylor
Course entry requirements: At least 60% for NSC Physical Science. The permission of the Dean or Head of Department is required prior to registration for this course. Notes: 1) This course only begins in week 7 and is intended for students who have been advised to transfer to this course after initially registering for PHY1004W or PHY1031F (see entries for these courses). 2) The course places an emphasis on the strengthening of foundational concepts and skills, the carefully-paced introduction of new material, and the development of sound approaches to effective learning.
Course outline:
PHY1023H is an algebra-based introductory course for Science students. Some calculus may be used. The course includes the following topics: Tools and skills: Essential mathematical, diagrammatic and conceptual tools and skills for Physics, co-ordinate systems, vectors, rates of change, the fundamental forces, mathematical techniques and their relationship with physical phenomena. Mechanics: kinematics, forces, dynamics, momentum, impulse, work, energy, power, collisions, rotation, rotational dynamics, torque, angular momentum, static equilibrium, gravitation. Properties of matter: elasticity, hydrostatics, hydrodynamics. Vibrations and waves: simple
harmonic motion, damped oscillations, forced oscillations, resonance, travelling waves, superposition, standing waves, sound waves, sound intensity and Doppler Effect.

**Lecture times:** Monday - Friday, 3rd period

**DP requirements:** Minimum of 40% for the class record, including 50% in laboratory assessment.

**Assessment:** Class record (weekly problem sets, class tests and laboratory record) counts 50%; one 2-hour written examination in November counts 50%.

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**PHY1031F**  GENERAL PHYSICS A
18 NQF credits at NQF level 5  
**Convener:** Dr S M Wheaton

**Course entry requirements:** At least 60% for NSC Physical Science. Note: Students registered for this course will be assessed in week 5; if it is judged that they are not coping with the level and pace of the course, and would benefit from an opportunity to strengthen foundational concepts and learn new material at a slower pace, they will be required to transfer to PHY1023H from week 7.

**Course outline:**  
PHY1031F is an algebra-based introductory course for Science students who do not intend proceeding to second-year courses in Physics. Some calculus may be used. The course includes the following topics: Mechanics: vectors, kinematics, forces, dynamics, momentum, impulse, work, energy, power, collisions, rotation, rotational dynamics, torque, angular momentum, static equilibrium, gravitation. Properties of matter: elasticity, hydrostatics, hydrodynamics. Vibrations and waves: simple harmonic motion, damped oscillations, forced oscillations, resonance, travelling waves, superposition, standing waves, sound waves, sound intensity and Doppler Effect.

**Lecture times:** Monday - Friday, 3rd period

**DP requirements:** Minimum of 40% for the class record, including 50% in laboratory assessment.

**Assessment:** Class record (weekly problem sets, class tests and laboratory record) counts 50%; one 2-hour written examination in June counts 50%.

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**PHY1032F**  GENERAL PHYSICS B
18 NQF credits at NQF level 5  
**Convener:** Dr T Salagaram

**Course entry requirements:** PHY1031F or PHY1023H

**Course outline:**  
PHY1032F is an algebra-based introductory course usually taken by Science students who have completed PHY1023H. Some calculus may be used. The course includes the following topics: Electricity and magnetism: electric charge, electric field, Gauss’ law, electric potential, capacitance, current, current density, emf, resistance, resistivity, networks, magnetic field, Biot Savart law, Ampere’s law, electromagnetic induction, inductance, alternating currents. Thermal physics: temperature, heat, kinetic theory of gases, first and second laws of thermodynamics. Optics: Geometrical optics, polarization, electromagnetic waves, interference, diffraction. Modern physics: atomic structure, quantum physical phenomena, wave-particle duality, X-rays, elementary nuclear physics, radioactivity.

**Lecture times:** Monday - Friday, 3rd period

**DP requirements:** Minimum of 40% for the class record, including 50% in laboratory assessment.

**Assessment:** Class record (weekly problem sets, class tests and laboratory record) counts 50%; one 2-hour written examination in June counts 50%.
PHY1032S  GENERAL PHYSICS B  
18 NQF credits at NQF level 5  
**Convener:** Associate Professor H W G Weigert  
**Course entry requirements:** PHY1031F or PHY1023H  
**Course outline:**  
PHY1032F is an algebra-based introductory course usually taken by Science students who have completed PHY1023H. Some calculus may be used. The course includes the following topics: Electricity and magnetism: electric charge, electric field, Gauss’ law, electric potential, capacitance, current, current density, emf, resistance, resistivity, networks, magnetic field, Biot Savart law, Ampere’s law, electromagnetic induction, inductance, alternating currents. Thermal physics: temperature, heat, kinetic theory of gases, first and second laws of thermodynamics. Optics: Geometrical optics, polarization, electromagnetic waves, interference, diffraction. Modern physics: atomic structure, quantum physical phenomena, wave-particle duality, X-rays, elementary nuclear physics, radioactivity.  
**Lecture times:** Monday - Friday, 3rd period  
**DP requirements:** Minimum of 40% for the class record, including 50% in laboratory assessment.  
**Assessment:** Class record (weekly problem sets, class tests and laboratory record) counts 50%; one 2-hour written examination in November counts 50%.  

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Second-Year Courses  

PHY2004W  INTERMEDIATE PHYSICS  
*Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.phy.uct.ac.za. (A tablet or “netbook” will not be suitable). The course convenor will provide details of additional software (open source) required.*  
48 NQF credits at NQF level 6  
**Convener:** Associate Professor S W Peterson  
**Course entry requirements:** PHY1004W, a full first-year course in Mathematics, and MAM2000W or (MAM2004H and MAM2047H) as co-requisite.  
**Course outline:**  
PHY2004W develops the foundations of a major in Physics and allows continuation to third-year Physics. The theory component features a set of intermediate topics, and the laboratory component develops both experimental and computational skills. The course includes the following topics: Mechanics: Review of Newton’s Laws, inertial and non-inertial frames, transformations, equations of motion for 1D systems, oscillations, resonance, non-linear systems, Euler’s equation, Lagrange’s equation, generalized co-ordinates and constrained systems, Hamiltonian formalism, phase space and Liouville’s theorem, effective potentials, planetary motion, systems of particles, angular momentum, collisions, rigid bodies, simple harmonic motion, resonance, coupled oscillators, wave equation, special relativity, relativistic mechanics.  
Electromagnetism: Vector calculus (div, grad, curl), electrostatics, special techniques for potentials, electric fields in matter, magnetostatics, magnetic fields in matter, current, Ohm’s law, circuits, electromagnetic induction, electrodynamics, Maxwell’s equations.  
Quantum Mechanics: The basic assumptions of quantum mechanics, solutions of Schrödinger's equation, properties of wave functions and operators, one-dimensional applications, angular momentum in quantum mechanics, three-dimensional applications, the hydrogen atom, approximate methods.  
Laboratory: Practical and computational tasks designed to develop advanced skills of experimentation and problem solving within the context of Mechanics, Electromagnetism and Quantum Mechanics.  
**Lecture times:** Monday - Friday, 4th period  
**DP requirements:** Minimum of 40% for the class record; completion of all laboratory reports and 75% of tutorial work and problem sets; attendance at all tests.
Assessment: Class record (tests, weekly problem sets and laboratory work) counts 50%; one 3-hour examination in June counts 25%; one 3-hour examination in November counts 25%. A subminimum of 40% is required in each of the two examinations.

Third-Year Courses

**PHY3004W**  ADVANCED PHYSICS
*Each student registered for this course is required to have a laptop for use during class sessions as well as after hours. The minimum specifications of the laptop are available at www.phy.uct.ac.za. (A tablet or “netbook” will not be suitable). The course convenor will provide details of additional software (open source) required.*

72 NQF credits at NQF level 7

Convener: Dr T W Leadbeater

Course entry requirements: PHY2004W, and 40% in MAM2000W or (MAM2004H and MAM2047H).

Course outline:
This course completes the major in Physics. The theory component aims to develop advanced skills in problem solving within physics, and includes the following topics:

- Electromagnetism: Maxwell's equations in vacuum and matter, momentum and angular momentum in electromagnetic fields, electromagnetic waves, wave guides, gauge transformations, retarded potentials, electric and magnetic dipole radiation, special relativity, relativistic kinematics and electrodynamics, electromagnetic field tensor.
- Thermodynamics and Statistical Physics: Temperature, heat and work, laws of thermodynamics, ensembles and entropy, Boltzmann distribution and Helmholtz free energy, thermal radiation, chemical potential and Gibbs distribution, Fermi-Dirac statistics, electrons in metals, Bose-Einstein statistics, phonons, photons and the black-body distribution, the Bose-Einstein condensate, applications to classical and quantum systems.
- Applications of Quantum Mechanics: Atomic Physics (atomic structure and spectra, selection rules, spin, fine structure, Zeeman effect, time dependent and independent perturbation theory); Nuclear and Particle Physics (properties of nuclei, nuclear forces, structure, reactions and models, nuclear models, interactions of elementary particles, quarks and leptons, symmetries and the gauge forces); and Solid State Physics (crystal structure, lattice vibrations, electron states in solids, energy band theory, semiconductor physics and devices).

The laboratory component includes practical and computational tasks to develop advanced skills of experimentation and scientific report writing.

Lecture times: Monday - Friday, 4th period

DP requirements: Minimum of 40% for the class record; attendance at all tests; completion of all laboratory reports; completion of the project and completion of 75% of tutorials and problem sets.

Assessment: Class record (tests, weekly problem sets, laboratory work and project) counts 50%; two 2-hour examinations in June count 25%; two 2-hour examinations in November count 25%. A subminimum of 40% exists in the weighted average of the four examinations.

Postgraduate Courses

**PHY4000W**  PHYSICS HONOURS

*Since the code PHY4000W will not carry a NQF credit value, students will be concurrently registered for PHY4006W (coursework component of 120 NQF credits) and PHY4007W (research project of 40 NQF credits).*

160 NQF credits at NQF level 8; the combined credit value of both components.

Convener: Dr J M Keaveney

Course entry requirements: The entrance requirement is a BSc degree with a major in Physics. Acceptance will be at the discretion of the Head of Department who will consult the Honours course convenor. Criteria for acceptance include a pass of 60% in PHY3004W, or equivalent; and a pass of
60% in MAM2000W or MAM2046W, or equivalent; and in cases where the Head of Department deems it necessary, favourable referee reports. Enrolment is limited to 15 students. Preference may be given to UCT graduates who meet the course entry requirements.

Course outline:
The Honours course in Physics consists of several modules. Each student needs to design a module package which sums up to at least 12 units, and not more than 14 units. The Research Project (3 units) is compulsory. The compulsory modules (1 unit each) are: Electromagnetism 1, Quantum Mechanics 1 and Statistical Physics. At least five further modules (1 unit each) must be chosen from: Electromagnetism 2, Quantum Mechanics 2, Classical Mechanics, Computational Physics, Particle Physics, Nuclear Physics, Relativistic Quantum Mechanics, Quantum Field Theory, and Solid State Physics. Students are strongly encouraged to include both Electromagnetism 2 and Quantum Mechanics 2 in their module choice. The course starts with a compulsory non-credit bearing module dealing with mathematical tools and skills, and aspects of physics education. Furthermore, the course can be complemented by physics-related modules offered by the Departments of Astronomy, and Mathematics and Applied Mathematics, for example. The choice of modules and research project must be approved by the Head of Physics in consultation with the PHY4000W convener. Details appear on the Physics website: www.phy.uct.ac.za. The Department of Physics is presently reviewing the curriculum of PHY4000W.

DP requirements: 30% for class tests and problem sets, and suitable progress in the Research Project.

Assessment: The pass mark is 50% and is based on an aggregation of the results of all modules, and is further subject to the subminimum criteria of obtaining a minimum mark of 50% in the Research Project, passing two thirds of all modules, and achieving a mark of at least 35% in all but one of the compulsory modules. The Research Project will count 25% of the final mark. These component parts of the course will be combined in a final overall mark which will be reflected against the course code PHY4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

PHY5000W PHYSICS DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

PHY5001W THEORETICAL PHYSICS DISSERTATION
180 NQF credits at NQF level 9

Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the
field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

**PHY5003W  ASTROPHYSICS & SPACE SCIENCE MINOR DISSERTATION**  
*(National Astrophysics & Space Science Programme (NASSP); for further details see entry under Department of Astronomy)*  
90 NQF credits at NQF level 9  
**Course entry requirements:** AST5003F  
**DP requirements:** None.  
**Assessment:** Students will work on an approved research topic on which a minor dissertation must be presented for formal examination.

**PHY5006W  TERTIARY PHYSICS EDUCATION DISSERTATION**  
180 NQF credits at NQF level 9  
**Course outline:**  
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the front of the handbook.

**PHY5007Z  DATA SCIENCE FOR PARTICLE PHYSICS**  
12 NQF credits at NQF level 9  
**Convener:** Associate Professor T Dietel  
**Course entry requirements:** Core modules of the Masters course in Data Science.  
**Course outline:**  
This course introduces students to the important computational aspects of high-energy nuclear and particle physics research. Using examples from current research at the European Organization for Nuclear Research (CERN), the students are introduced to: the basic principles of high-energy physics, the Grid computing model employed by the Worldwide LHC Computing Grid (WLCG), the simulation of interactions between subatomic particles and their detection, the ROOT data analysis tool used by all the large high-energy physics collaborations, the signal extraction and significance estimation techniques employed by the most recent particle discoveries including concepts like nuisance parameters and the look-elsewhere effect.  
**DP requirements:** 50% average for the two projects.  
**Assessment:** Two projects: 25% each. Practical 'take-home' Computing examination: 50%. A sub-minimum of 50% for each of the project and examination components will be required.

**PHY5008W  DATA SCIENCE MINOR DISSERTATION**  
90 NQF credits at NQF level 9  
**Convener:** Dr S Er  
**Course entry requirements:** Successful completion of the coursework component of the Masters course in Data Science.  
**Course outline:**  
The research component of the degree is based on a 90 credit dissertation. The topic of the research will be based on an analysis of large data sets from Physics.
PHY6000W  PHYSICS THESIS
360 NQF credits at NQF level 10
Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.

PHY6001W  TERTIARY PHYSICS EDUCATION THESIS
360 NQF credits at NQF level 10
Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in Book 3, General Rules and Policies.
DEPARTMENT OF STATISTICAL SCIENCES

The Department is housed in the P D Hahn Building, Level 5
Telephone (021) 650-3219 Fax (021) 650-4773
The Departmental abbreviation for Statistical Sciences is STA.

Associate Professor and Head of Department:
F N Gumedeze, MSc PhD Cape Town

Professor:
F Little, MSc PhD Cape Town

Emeritus Professors:
G D I Barr, MSc PhD Cape Town
D Bradfield, BSc Hons MSc PhD Cape Town

Senior Scholars:
L M Haines, BA MA Cantab BSc Hons Natal MPhil UCL PhD Unisa
T J Stewart, BSc (Chem Eng) Cape Town MSc (OR) PhD Unisa FRSSAf

Associate Professors:
R Altwegg, PhD Zurich
T Gebbie, BSc Hons Witwatersrand MSc PhD Cape Town CPhys. MInstP. (IoP) FRM (GARP)
L D Scott, MSc PhD Cape Town
S Silal, PhD Cape Town

Honorary Research Associates:
F Abadi, PhD Bern
A Antoniadis, PhD DSc Grenoble I
D Borchers, PhD St Andrews
J Colville, PhD Cape Town
T Gridley, PhD St Andrews
J Hutton, PhD Imperial College London
D Maphisa, PhD Cape Town
S Mecenero, PhD Cape Town

Emeritus Associate Professors:
J M Juritz, BSc Hons Unisa MSc PhD Cape Town
C Thiart, BSc (Agric) Hons Stell MSc PhD Cape Town

Senior Lecturers:
A Clark, MSc Cape Town
G Distiller, PhD Cape Town
S Er, PhD Istanbul
B Erni, BSc Hons MSc Cape Town PhD Basel
J C Nyirenda, BSc Newcastle Upon Tyne PhD Cantab

Adjunct Associate Professor:
I Durbach, MSc PhD Cape Town

Adjunct Senior Lecturers:
M J P Lacerda, MSc Cape Town PhD Galway
I Meyer, MSc MBA Pret PhD Unisa

Lecturers:
S Britz, MSc UFS
D Katshunga, BSc Hons DRC MSc Cape Town
M Mavuso, MPhil MSc Cape Town
M Ngwenya, MSc Cape Town
E Pienaar, PhD Cape Town
R G Rakotonirainy, PhD Stell
S Salau, MSc Witwatersrand
N Watson, MSc Cape Town
Research Officer (Statistical Consultant):
I Karangwa, MSc PhD UWC

Administrative Manager:
B King, HDE UWC

Administrative Assistants:
C Jansen-Fielies
N Maqubela

Financial Officer:
D Davids

Senior Clerk:
K Jeptha

CENTRE FOR STATISTICS IN ECOLOGY, ENVIRONMENT AND CONSERVATION (SEEC)

Director:
R Altwegg, PhD Zurich

Core members:
D Borchers, PhD St Andrews
A E Clark, MSc Cape Town
J Colville, PhD Cape Town
G Distiller, PhD Cape Town
I Durbach, PhD Cape Town
B Erni, BSc Hons MSc Cape Town PhD Basel
T Gridley, PhD St Andrews
N Karenyi, PhD NMMU
D Maphisa, PhD Cape Town
M Ngwenya, MSc Cape Town
J Slingsby, PhD Cape Town
V Visser, PhD Sheffield
H Winker, PhD Rhodes

RESEARCH IN STATISTICAL SCIENCES

The department focuses on research in statistics, operations research and decision modelling and the underlying methodology and application of these methods to ecology, medicine, finance and big data. Specific research areas that fall into these groupings include:

BAYESIAN DECISION THEORY: General principles of Bayesian statistical analysis; applications in sequential stochastic optimisation and other fields (T J Stewart).

BIOSTATISTICS: Medical applications of statistics (F Little, L M Haines, F Gumede, S Silal, W Msemburi). The objectives of the Biostatistics Interest Group are to develop statistical methodology motivated by medical problems.

DATA SCIENCE: Development and application of statistical methods for the analysis of large data sets (S Er, J Nyirenda, S Britz, E Pienaar).

FINANCIAL MODELLING AND MARKET MICROSTRUCTURE: Econometric techniques are being used to test theories related to the South African economy in the fields of finance, monetary economics, interest rate theory and stock market research. Time series, portfolio construction and risk management (T Gebbie).

MIXED EFFECTS LINEAR MODELS: Longitudinal data analysis, analysis of repeated measures data, generalized linear (mixed) models, hierarchical generalized linear mixed models (robust estimation and diagnostics) (F Gumede, F Little).

OPERATIONAL RESEARCH and MULTICRITERIA DECISION SUPPORT: The development of interactive decision aids, to assist in the analysis of decision problems with multiple and conflicting objectives, with particular reference to natural resource management and others; combinatorial optimisation; application to decision making and planning in private and public sectors (T J Stewart, L Scott, J Nyirenda, N Watson, R G Rakotonirainy).
OPTIMAL DESIGN: The design of experiments in agriculture, biology and engineering which are in some sense optimal (L M Haines).

SOCIAL SCIENCE STATISTICS: Research surveys; local government support; analysis of poverty and development, structural equation modelling (S Er).

SPATIAL STATISTICS AND TIME SERIES: (B Erni, M Ngwenya, C Thiart).

STATISTICS IN ECOLOGY: Applications of statistics to biological and environmental data (B Erni, G Distiller, R Altwegg, A Clark)

STOCHASTIC MODELLING: (M Mavuso, E Pienaar)

Undergraduate Courses

**NOTE**: Students who intend to specialise in Statistics are strongly advised to include Computer Science in their curriculum.

A student cannot obtain credits for more than one of STA1000F/S/P/L, STA1007S, STA1006S, STA1008F/S.

A student cannot obtain credits for more than one of STA2020F/S, STA2007F/H/S, STA2005S.

A student cannot obtain credits for both STA2004F and STA2030S.

A student cannot obtain credits for both STA3030F and STA3041F.

A student cannot obtain credits for both STA3043S and (STA3047S+STA3048S)

First-Year Courses

**STA1000F**  INTRODUCTORY STATISTICS

(No first year students) STA1000F and STA1000S are identical courses offered in first and second semesters. Owing to the mathematics prerequisites, first-year students can only register for STA1000S in the second semester and STA1000F on completion of the mathematics prerequisite. One lecture per week, one workshop per week and one tutorial per week. A student cannot obtain credits for more than one of STA1000F/S/P/L, STA1007S, STA1006S, STA1008F/S.

18 NQF credits at NQF level 5

**Convener**: Associate Professor L Scott

**Course entry requirements**: A pass in any of MAM1004F/S or MAM1005H or MAM1000W or MAM1006H or MAM1020F/S or MAM1010F/S.

**Course outline**: This is an introductory statistics course aimed at exposing students to principles and tools to support appropriate quantitative analysis. The aim is to produce students with a functional sense of statistics. We introduce students to statistical modelling and also cover exploratory data analysis. Appropriate tools for display, analysis and interpretation of data are discussed. This course is offered predominantly, but not exclusively, to Commerce students. The aim is to give a foundation to students who will encounter and apply statistics in their other courses and professions. Topics covered include: exploratory data analysis and summary statistics; probability theory; random variables; probability mass and density functions; Binomial, Poisson, Exponential, Normal and Uniform distributions; sampling distributions; confidence intervals; introduction to hypothesis testing (including tests on means; tabular data and bivariate data); determining sample sizes; simple linear regression and measures of correlation. Students are assessed on their knowledge of the topics covered and their ability to perform simple and appropriate statistical analyses using spreadsheet functions.

**DP requirements**: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or exercises as set out in course outline. Class record of at least 35%.

**Assessment**: Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.
STA1000S  INTRODUCTORY STATISTICS

STA1000F and STA1000S are identical courses offered in first and second semesters. Owing to the mathematics prerequisites, first-year students can only register for STA1000S in the second semester and STA1000F on completion of the mathematics prerequisite. One lecture per week, one workshop per week, and one tutorial per week. A student cannot obtain credits for more than one of STA1000F/S/P/L, STAI007S, STA1006S, STA1008F/S.

18 NQF credits at NQF level 5

Convener: Associate Professor L Scott

Course entry requirements: A pass in any of MAM1004F/S or MAM1005H or MAM1020F/S or MAM1010F/S. In addition students will be admitted to STA1000S if they (1) are concurrently registered for MAM1000W, or (2) are concurrently registered for MAM1005H, or (3) have a supplementary examination for MAM1010F, MAM1004F, or MAM1020F that will be written in November of the year of registration.

Course outline:

This is an introductory statistics course aimed at exposing students to principles and tools to support appropriate quantitative analysis. The aim is to produce students with a functional sense of statistics. We introduce students to statistical modelling and also cover exploratory data analysis. Appropriate tools for display, analysis and interpretation of data are discussed. This course is offered predominantly, but not exclusively, to Commerce students. The aim is to give a foundation to students who will encounter and apply statistics in their other courses and professions. Topics covered include: exploratory data analysis and summary statistics; probability theory; random variables; probability mass and density functions; Binomial, Poisson, Exponential, Normal and Uniform distributions; sampling distributions; confidence intervals; introduction to hypothesis testing (including tests on means, tabular data and bivariate data); determining sample sizes; simple linear regression and measures of correlation. Students are assessed on their knowledge of the topics covered and their ability to perform simple and appropriate statistical analyses using spreadsheet functions.

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or exercises as set out in course outline. Class record of at least 35%.

Assessment: Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

STA1000P/L  INTRODUCTORY STATISTICS

(offered during summer and winter terms)

18 NQF credits at NQF level 5

Convener: Associate Professor L Scott

Course entry requirements: Students should have obtained a DP for either STA1000F/S.

Course outline:

This is an introductory statistics course aimed at exposing students to principles and tools to support appropriate quantitative analysis. The aim is to produce students with a functional sense of statistics. We introduce students to statistical modelling and also cover exploratory data analysis. Appropriate tools for display, analysis and interpretation of data are discussed. This course is offered predominantly, but not exclusively, to Commerce students. The aim is to give a foundation to students who will encounter and apply statistics in their other courses and professions. Topics covered include: exploratory data analysis and summary statistics; probability theory; random variables; probability mass and density functions; Binomial, Poisson, Exponential, Normal and Uniform distributions; sampling distributions; confidence intervals; introduction to hypothesis testing (including tests on means, tabular data and bivariate data); determining sample sizes; simple linear regression and measures of correlation. Students are assessed on their knowledge of the topics covered and their ability to perform simple and appropriate statistical analyses using spreadsheet functions.

DP requirements: Satisfactory attendance of tests and completion of assignments and/or exercises as set out in course outline. Class record of at least 35%.
Assessment: Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Entry Requirements</th>
<th>Course Outline</th>
<th>DP Requirements</th>
<th>Assessment: Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA1006S</td>
<td>MATHEMATICAL STATISTICS I</td>
<td></td>
<td>This is an introduction to statistics: the study of collecting, analysing, and interpreting data. It is the key entry-point into a Mathematical Statistics major and hence it is compulsory for students intending to major in Mathematical Statistics. This course provides foundation knowledge in statistical theory, and is useful for any student who wishes for an introduction to the fundamentals of statistics, from a mathematical perspective. Topics covered include: Types of data variables. Exploratory data analysis. Grouping and graphing of data. Set theory and counting rules. Probability: conditional probabilities, independence. Bayes theorem. Random variables and values, probability mass and density functions, cumulative distribution functions. Population models and parameters: binomial, Poisson, geometric, negative binomial, hypergeometric. Uniform, exponential, Gaussian, expectation. Coefficient of variation. Sampling: sampling distribution t, Chi-square, F and their tables. Point and interval estimation. Sample size estimation. Hypotheses testing: Z-test and T-test (proportions, difference between two proportions, means, difference between two (means, difference between means: for independent samples and dependent samples). F-test (ratio of two independent variances). Chi-squared-test. Meaning of p-values. Bivariate data: scatterplot, simple linear regression and correlation.</td>
<td>Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.</td>
<td>Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.</td>
</tr>
<tr>
<td>STA1007S</td>
<td>INTRODUCTORY STATISTICS FOR SCIENTISTS</td>
<td></td>
<td>This course aims to provide an introduction to statistics for Science students, and the topics covered include: exploratory data analysis and summary statistics. Set theory. Probability: conditional probabilities, independence, Bayes theorem. Random variables. Probability mass and density functions. Binomial, Poisson, exponential, normal and uniform distributions. Sampling distributions. Confidence intervals. Hypothesis testing: Z-test and t-test (means, difference between means for independent and dependent samples). Chi-square test for independence and for Goodness-of-fit. Meaning of p-values. Determining sample size. Simple linear regression and measures of correlation. Practical data analysis will be taught using R. The course is the equivalent of STA1000S, in a biological setting.</td>
<td>Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.</td>
<td>Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.</td>
</tr>
</tbody>
</table>
Lecture times: Five lectures per week, Monday - Friday, 1st period.

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

Assessment: Class record 40% and a 3-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

Second-Year Courses

STA2004F STATISTICAL THEORY & INference

A student cannot obtain credits for both STA2004F and STA2030S.
24 NQF credits at NQF level 6

Convener: M Mavuso

Course entry requirements: (MAM1000W or MAM1012S) and STA1006S

Course outline:
STA2004F is a rigorous introduction to the foundation of the mathematical statistics and aims to provide students with a deeper understanding of the statistical concepts covered in STA1006S. The course is intended for students studying Mathematical Statistics or Actuarial Science. STA2004F is divided into two broad sections: (1) Distribution theory and (2) Statistical Inference. During the first part of the course, students will learn to derive the distributions of random variables and their transformations, and explore the limiting behaviour of sequences of random variables. The last part of the course covers the estimation of population parameters and hypothesis testing based on a sample of data.

Lecture times: Five lectures per week, Monday to Friday, 1st period.

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

Assessment: Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

STA2005S LINEAR MODELS

A student cannot obtain credits for more than one of STA2020F/S, STA2007F/H/S, STA2005S.
24 NQF credits at NQF level 6

Convener: Dr B Erni

Course entry requirements: At least 45% for STA2004F.

Course outline:
This course gives an introduction to statistical modelling and the theory of linear statistical models. The material is presented from a parametric and non-parametric perspective. The course has two sections:
Regression: The multivariate normal distribution; quadratic forms; the linear model; maximum likelihood; estimates of parameters in the linear model; the Gauss-Markov theorem; variable selection procedures; analysis of residuals, bootstrap sampling; principal component analysis for dimension reduction and for regression.
Design and analysis of experiments: Introduction to the basic design principles, basic experimental designs (completely randomised design, the randomised block design, Latin square design) factorial experiments, analysis of variance, the problem of multiple comparisons, power and sample size calculations, introduction to random effects and repeated measures, permutation/randomization tests, nonparametric tests, bootstrapping.
The students are introduced to relevant statistical software and practical data analysis through weekly computer practicals and the exposure to many datasets.

Lecture times: Five lectures per week, Monday - Friday, 1st period.

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

Assessment: Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.
STA2007F/S/H  STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS
This course is offered in blended learning format. A student cannot obtain credits for more than one of STA2020F/S, STA2007F/H/S, STA2005S.
24 NQF credits at NQF level 6
Convener: Associate Professor R Altwegg
Course entry requirements: (STA1000F/S or STA1006S or STA1007S or STA1008F/S) and (MAM1000W or MAM1004F/S or MAM1005H or MAM1010F/S or MAM1020F/S)
Course outline:
The course aims to equip students with practical experience and skills in analysing data, using statistical techniques frequently used in the sciences. The skills include designing experiments, choosing appropriate statistical methods for visual display and statistical modelling of data, model checking, interpretation and reporting of statistical results, and understanding of limitations of statistical methods and data. By the end of the course the student should have gained enough confidence to transfer these skills to new problems or data sets in their own profession. Topics covered include: Introduction to statistical notation, linear regression, design and analysis of experiments, generalized linear models. There will be strong emphasis on the practical application of the above methods, using open-source statistical software such as R. There will be a one-day face-to-face workshop at the beginning of the first semester and a one-day face-to-face workshop at the beginning of the second semester.
DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.
Assessment: Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

STA2007P  STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS
This course is offered in blended learning format during summer term dependent on there being sufficient demand and dependent on capacity to offer course. Note that request for offering course in any one year should come from a UCT course convener. Students make use of online learning workshops.
24 NQF credits at NQF level 6
Convener: Associate Professor R Altwegg
Course entry requirements: (STA1007S (preferably), or STA1000F/S or STA1006S or STA1008F/S) and (MAM100W or MAM1004F/S or MAM1005H or MAM1010F/S or MAM1020F/S)
Course outline:
The course aims to equip students with practical experience and skills in analysing data and applying statistical techniques relevant to the natural sciences. Skills include designing experiments, choosing appropriate statistical methods for analysing data, visual display and statistical modelling of data, model checking, interpretation and reporting of statistical results, and understanding limitations of statistical methods and data. Topics include: introduction to statistical notation, linear regression, design and analysis of experiments, generalised linear models. There will be a strong emphasis on the practical application of these methods using the open-source statistical software R. There will be a one-day face-to-face workshop at the beginning of the first semester and a one-day face-to-face workshop at the beginning of the second semester.
DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.
Assessment: Class record 40% and a 2-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.
STA2020F APPLIED STATISTICS

A student cannot obtain credits for more than one of STA2020F/S, STA2007F/H/S, STA2005S.

24 NQF credits at NQF level 6

Convener: N Watson

Course entry requirements: STA1000S or STA1006S or STA1007S or STA1008F/S and MAM1000W or MAM1004F or MAM1010F/S or MAM1020F/S.

Course outline:
This is designed to extend the student’s basic knowledge acquired in STA1000F/S/P/L. The emphasis of the course is on applying statistical methods and modelling techniques to data rather than focusing on the mathematical rigour underpinning these methods. Topics covered include: Analysis of variance and experimental design; revision and extension of simple linear regression; multiple regression; time series analysis; and non-parametric statistics. Students will continue to analyse data using Excel.

Lecture times: Monday - Thursday, 1st or 5th period

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35% and at least 50% for Excel test.

Assessment: Class record 40% and a 3-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

STA2020S APPLIED STATISTICS

A student cannot obtain credits for more than one of STA2020F/S, STA2007F/H/S, STA2005S.

24 NQF credits at NQF level 6

Convener: N Watson

Course entry requirements: STA1000S or STA1006S or STA1007S or STA1008F/S and MAM1000W or MAM1004F or MAM1010F/S or MAM1020F/S.

Course outline:
This is designed to extend the student’s basic knowledge, acquired in STA1000F/S/P/L. The emphasis of the course is on applying statistical methods and modelling techniques to data rather than focusing on the mathematical rigour underpinning these methods. Topics covered include: Analysis of variance and experimental design; revision and extension of simple linear regression; multiple regression; time series analysis; and non-parametric statistics. Students will continue to analyse data using Excel.

Lecture times: Monday - Thursday, 7th period

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35% and at least 50% for Excel test.

Assessment: Class record 40% and a 3-hour exam counting 60%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

STA2030S STATISTICAL THEORY

A student cannot obtain credits for both STA2004F and STA2030S.

24 NQF credits at NQF level 6

Convener: S Britz

Course entry requirements: At least 45% for STA2020F/S or STA2007F/S/H or STA2005S.

Co-requisites: Concurrent registration for MAM1008S or MAM1006H or MAM1012S or MAM1021F/S.

Course outline:
This course introduces students to Statistical Theory and Inference. It explores aspects of probability theory that are particularly relevant to statistics, including the notions of random variables, joint probability distributions, expected values and moment generating functions. The course content includes univariate distributions and moments of univariate distributions, moments of bivariate distributions, distributions of sample statistics. It covers bias and efficiency of estimators. Students
are introduced to the use of computer simulation and data re-sampling techniques (bootstrap) to investigate the following problems: one and two sample tests of means and variances, one and two way analysis of variances, moments and other properties of distributions, theory of distributions derived from the normal distribution.

**Lecture times:** Monday - Thursday, 1st period

**DP requirements:** Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

**Assessment:** Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

### Third-Year Courses

**STA3022F**  **APPLIED MULTIVARIATE DATA ANALYSIS**  
36 NQF credits at NQF level 7  
**Convener:** Dr S Er  
**Course entry requirements:** STA2020F/S or STA2005S or STA2007F/S/H  
**Course outline:**  
The aim of the course is to create a practical working familiarity with the analysis of data, focusing on multivariate methods as applied in areas such as marketing, the social science and the sciences. Topics covered include item reliability analysis, multidimensional scaling, correspondence analysis, principal component and factor analysis, cluster analysis, discriminant analysis, classification trees and structural equation modelling.  
**Lecture times:** Monday - Thursday, 4th period

**DP requirements:** Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

**Assessment:** Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

**STA3030F**  **STATISTICAL INFERENCE & MODELLING**  
36 NQF credits at NQF level 7  
**Convener:** Dr G Distiller  
**Course entry requirements:** STA2030S and MAM1000W or (MAM1005H and MAM1006H) or (MAM1010F/S and MAM1012F/S) or (MAM1020F/S and MAM1021F/S) or (MAM1004F and MAM1008S)  
**Course outline:**  
This course forms part of the third-year major in Applied Statistics. The aim of the course is to provide students with the main intellectual and practical skills required in the use of inferential statistics and statistical modelling. The course consists of 4 modules: The simulation module introduces students to the use of computer simulation and data re-sampling techniques (bootstrap) to investigate the following problems: one and two sample tests of means and variances; one and two way analysis of variances; moments and other properties of distributions; theory of distributions derived from normal distribution. The Bayesian module introduces students to decision theory and Bayesian inference. The generalized linear models module introduces students to the exponential family of distributions and extends linear and logistic regression models to models for other non-normal response variables. The machine learning module cover a basic introduction to statistical learning paradigms, applications of regression and classification trees, and a primer on feedforward neural networks and backpropagation. Students will use the R programming language.  
**Lecture times:** Monday - Thursday, 1st period

**DP requirements:** Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

**Assessment:** Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.
STA3036S  OPERATIONAL RESEARCH TECHNIQUES
36 NQF credits at NQF level 7
Convener: Associate Professor S Silal
Course entry requirements: STA2030S or STA2005S; STA3030F is recommended
Course outline:
This course forms part of the third-year major in Applied Statistics. It is an introduction to the study of Operational Research (OR) and explores fundamental quantitative techniques in the OR armamentarium with a strong focus on computer-based application. The course is intended for students in the applied statistics stream but may be taken as an elective by students in the mathematical statistics stream. Topics covered include linear and non-linear programming where students will learn to find optimal solutions by characterising problems in terms of objectives, decision variables and constraints, Decision making under uncertainty through decision trees, decision rules and scenario planning, Queueing Theory simulation through modelling the operation of real world systems as they evolve over time.
Lecture times: Monday - Thursday, 3rd period
DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.
Assessment: Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

STA3041F  STOCHASTIC PROCESSES & TIME SERIES
A student cannot obtain credits for both STA3030F and STA3041F.
36 NQF credits at NQF level 7
Convener: D Katshunga
Course entry requirements: STA2004F and STA2005S; MAM2000W or MAM2004H is strongly recommended (linear algebra and advanced calculus modules)
Course outline:
This course forms part of the third-year major in Mathematical Statistics. It consists of two modules namely Stochastic Processes and Time Series Analysis. The Stochastic Processes module is aimed at providing introductory theory and basic applications of stochastic processes in financial modelling whilst the Time Series module introduces students to the foundations of the Box-Jenkins methodology with the intention of applying the methodology using statistical software. Details of the module content are as follows:
Stochastic processes: The module covers the general theory underlying stochastic processes and their classifications, definitions and applications of discrete Markov chains. Branching processes are examined with an emphasis on analysing probability of extinction/survival. The module also covers both discrete and continuous time counting processes for purposes constructing forecasts and backcasts. Finally, a detailed introduction to homogeneous and non-homogeneous Poisson processes is given.
Time series analysis: The module covers various topics including global and local models of dependence, stationary ARMA processes, unit root processes as well as a brief introduction to univariate Volatility models as well as cointegration.
Lecture times: Five lectures per week, Monday - Friday, 1st period
DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.
Assessment: Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.
STA3043S  STATISTICAL MODELLING, MACHINE LEARNING & BAYESIAN ANALYSIS

A student cannot obtain credits for both STA3043S and (STA3047S+STA3048S)

36 NQF credits at NQF level 7

Convener: Dr E Pienaar

Course entry requirements: STA2004F and STA2005S; MAM2000W or MAM2004H is strongly recommended (linear algebra and advanced calculus modules).

Course outline:
This course forms part of the third-year major in Mathematical Statistics. It consists of three modules: The first, Generalised Linear Models, introduces students to the theory and application of fitting linear models to various types of response variables with different underlying distributions. Subsequently, elementary concepts and methods in machine learning within the framework of statistical learning are explored. Finally, the Introduction to Bayesian Analysis module is dedicated to the Bayesian paradigm of statistical inference, analysis, and risk theory. The contents of the respective modules are outlined as follows:

Generalized linear models: Topics covered include: The exponential family of distributions, the GLM formulation, estimation and inference, models for continuous responses with skew distributions, logistic regression, log-linear models and Poisson regression.

Machine learning: Topics covered include: A basic introduction to statistical learning paradigms, applications of regression and classification trees, and a primer on feedforward neural networks and backpropagation.

Introduction to Bayesian Analysis: Topics covered include: use of Bayes’ theorem; Bayesian statistical analysis for Bernoulli and normal sampling; empirical Bayes and credibility theory; loss and extreme value distributions; Monte Carlo methods.

Students are assessed through formal written exam plus computer assignments done under exam conditions.

Lecture times: Five lectures per week, Monday - Friday, 1st period.

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

Assessment: Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.

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STA3045F  ADVANCED STOCHASTIC PROCESSES & DISTRIBUTION THEORY

36 NQF credits at NQF level 7

Convener: Associate Professor T Gebbie

Course entry requirements: STA2004F, STA2005S, MAM2000W and concurrent registration for STA3041F

Course outline:
This course is a third-year module for students studying Actuarial Science or Mathematical Statistics, though not a requirement for a major in Mathematical Statistics. The course begins by giving a brief introduction to copulas and extreme value theory, together with some applications to risk management. The rest of the course gives a theoretical overview of stochastic processes, with the models covered spanning both discrete and continuous time as well as discrete and continuous state-space. Though the emphasis is on the theoretical properties of the models, the application of the methods to real-world problems is also explored at length. Topics covered: copulas, an introduction to extreme value theory, homogenous and non-homogeneous continuous-time Markov chains, random walks, probability theory, martingales, Brownian motion, and diffusion processes.

Lecture times: Five lectures per week, Monday - Friday, 2nd period.

DP requirements: Satisfactory attendance of lectures, tutorials, practicals and tests and completion of assignments and/or class exercises as set out in course outline. Class record of at least 35%.

Assessment: Class record 30% and a 3-hour exam counting 70%. Weights will be adjusted in the case of missed assessments, as detailed in the course outline.
**Postgraduate Courses**

**STA4007W  STATISTICAL SCIENCES HONOURS**

*Since the code STA4007W will not carry a NQF credit value, students will be concurrently registered for STA4022W (coursework component of 120 NQF credits) and STA4023W (research project of 40 NQF credits).*

160 NQF credits at NQF level 8; the combined credit value of both components.

**Convener:** Dr G Distiller and Dr E Pienaar

**Course entry requirements:** The minimum requirements are MAM1000W, a first year semester module in Computer Science plus one of the following two sets of 3rd year courses: Applied Statistics stream: STA3030F + STA3036S/STA3022F; OR Mathematical Statistics Stream: STA3041F, STA3043S; Applicants fulfilling the minimum requirements above with an average of 65% or more for their 3rd year courses (at first attempt) can be confident of admission into the programme. Students who do not achieve the 65% level will be considered on a case-by-case basis, taking into consideration performance in other courses.

**Course outline:**

This Honours programme covers theoretical and applied statistics and operations research. It aims to give students a good theoretical basis and statistical computing skills through the teaching of core modules (81 NQF credits). It further exposes students to the practical application of statistics in different areas through the offering of elective modules (39 NQF credits). It provides training in research through supervised project work (40 NQF credits). Elective modules vary from year to year, but typically include Econometrics, Portfolio Theory, Time Series Analysis, Biostatistics, Decision Modelling, Spatial Statistics, Multivariate Analysis and Analytics.

**DP requirements:** Attendance of 85% of departmental seminars.

**Assessment:** Each coursework module comprises tests, assignments and a final examination. The relative weighting placed on the year work within different modules varies between 30% and 50%. The final grade for STA4007W as a whole is a weighted average (3 : 1) of the combined final marks for each coursework module (weighted by the number of credits), and the individual project. The student is required to obtain a mark of at least 50% in all core modules and for the individual project. The student may fail at most one elective module provided that a mark of at least 40% is obtained for that module. These component parts of the course will be combined in a final overall mark which will be reflected against the course code STA4007W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

**STA4019H  STATISTICAL SCIENCES FOR ACTUARIES**

*Since the code STA4019H will not carry a NQF credit value, students will be concurrently registered for STA4024W (coursework component of 64 NQF credits) and STA4025W (research project of 40 NQF credits).* Entrance is limited to 24 students for the combined Honours courses made up of STA4007W, STA4019H, STA4006W and STA4010W

104 NQF credits at NQF level 8; the combined credit value of both components.

**Convener:** Dr G Distiller

**Course entry requirements:** Completion of STA2004F, STA2005S, STA3041F, STA3043S, or their deemed equivalents, at a satisfactory level (an average of 65% or more in the 3rd year courses at first attempt), as well as a pass in MAM2000W. In addition, admission to STA4019H requires that the student is admitted by the Actuarial Science Division of the School of Management Studies to BUS4027W and BUS4028F. Acceptance will be at the discretion of the Head of Department who will consider quality of final year results, material covered in the undergraduate curriculum, and possibly referee reports. Preference may be given to UCT students who meet the course entry requirements.

**Course outline:**

This course covers theoretical and applied statistics and operations research. It constitutes 65% of the 160 HEQSF credit requirements for the BSc Hons in Actuarial Science. Students are required to
complete Statistical Computing and Matrix Methods (25 credits) and a research project (40 credits). The remaining 39 credits are obtained by selecting from the core and elective modules of STA4007W, which typically includes Theory of Statistics, Operations Research, Econometrics, Portfolio Theory, Time Series Analysis, Biostatistics, Decision Modelling, Spatial Statistics, Multivariate Analysis and Analytics.

**Assessment:** Each coursework module comprises tests, assignments and a final examination. The relative weighting placed on the year work within different modules varies between 30% and 50%. The final grade for STA4019H as a whole is a weighted average (5: 3) of the combined final marks for each coursework module (weighted by the number of credits), and the individual project. In addition, the student is required to obtain a mark of at least 50% in all core courses, at least 40% in best 39 credits for elective modules and at least 50% for the individual project. In addition the courses BUS4027W and BUS4028F must also be passed for the degree to be awarded. These component parts of the course will be combined in a final overall mark which will be reflected against the course code STA4019H, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

**STA4027Z  BAYESIAN COMPUTATIONAL METHODS**
12 NQF credits at NQF level 8
Convener: A Clark

**Course entry requirements:** Currently doing an honours or masters degree in statistics or at the discretion of the Head of Department.

**Course outline:**
The course aims to provide students with an introduction to the Bayesian method and the acquisition of the theory and methods required to apply Bayesian analysis to real world practical problems. Topics included in the course are as follows: Bayesian linear regression, variable selection, mixture modelling, Markov chain Monte Carlo methods (theory and practical applications).

**DP requirements:** Satisfactory completion of assignments

**Assessment:** Assignments and Exam

**STA4028Z  PORTFOLIO THEORY**
12 NQF credits at NQF level 8
Convener: Associate Professor T Gebbie

**Course entry requirements:** STA3041F, STA3043S or at the discretion of the Head of Department. STA3045F is strongly recommended.

**Course outline:**
The course introduces the historical development of idea’s from Economics, gambling and Finance with a South African perspective for portfolio control. Data-wrangling, portfolio optimization, sequential historic back-testing and simulation, and their attribution are developed in R. The static mean-variance theoretical foundations of portfolio choice, asset pricing and notions of market equilibrium are developed from first principles. Following an operations research approach tactical and strategic portfolios are formulated to admit short-term departures from long-term equilibrium for asset allocation. The theory is used to demonstrate the Generalised Fundamental Law of Asset Management, the Roll Critique and a Bayesian Black-Litterman portfolio choice framework. Active management and its complexities due to estimation and intrinsic uncertainties are demonstrated via case-studies. Various performance measures are derived from theoretical considerations. Performance attribution is used to measure the impact of information, return, risk and performance within a sequence of single-period portfolio control decisions. There is an emphasis on understanding the implications of back-test over-fitting. The course introduces indexation methods and the integration of the developed tools within a standard portfolio management workflow. Advanced topics such as cluster-based portfolio choice, risk-parity models and machine-learning extensions may be included.

**DP requirements:** Satisfactory completion of assignments

**Assessment:** Assignments and Exam
STA4029Z  ADVANCED PROBABILITY THEORY
12 NQF credits at NQF level 8
Convener: M Mavuso
Course entry requirements: Currently doing an honours or masters degree in statistics or at the discretion of the Head of Department.
Course outline:
The course aims to cover advanced concepts in probability and martingale theory, including products and conditioning, analysis, L2 theory of random variables, characteristic functions, convergence and uniform integrability, martingales, square integrable martingales, local martingales.
DP requirements: Class record of at least 40%
Assessment: Assignments, Class tests and Exam

STA5000W  STATISTICS DISSERTATION
180 NQF credits at NQF level 9
Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the beginning of the handbook.

STA5001W  OPERATIONAL RESEARCH DISSERTATION
180 NQF credits at NQF level 9
Course outline:
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the beginning of the handbook.

STA5004W  ADVANCED ANALYTICS MINOR DISSERTATION
90 NQF credits at NQF level 9
Convener: Dr B Erni
Course entry requirements: STA5003W
Course outline:
On successful completion of the coursework component, students will undertake an individual, supervised research project on a suitable topic, the results of which are to be written up as a minor dissertation.
**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

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**STA5010W  OPERATIONAL RESEARCH IN DEVELOPMENT COURSEWORK**  
*This course may not be offered in 2022*  
90 NQF credits at NQF level 9  
**Convener:** Associate Professor L Scott  
**Course entry requirements:** Entry to the course requires a good Honours degree including a strong quantitative component (normally at least two years of Mathematics at a tertiary level). In selecting candidates for admission to the course, consideration will also be given to recommendations from at least two referees who are able to attest to the applicants’ academic abilities and suitability.  
**Course outline:**  
The aim of this one year course is to provide a broad professional training in the principles and tools of operational research (OR), with particular emphasis on application in the context of development and the developing world. OR has been defined as the discipline of applying advanced analytical methods (system analysis, and computer and mathematical models) to help make better decisions. The OR in Development programme focuses on preparing graduates for a career in applying OR to the unique problems of the developing world, such as conflicting objectives in balancing, for example, socio-economic development and corrective actions, less reliable infrastructures, and a post-colonial need for community participation in all levels of planning. The first academic year is based primarily on coursework, supplemented by group discussions and case studies. The coursework includes the basic techniques of operational research and statistics, specific developmental issues, problem structuring and decision analysis.  
**Assessment:** This component will be assessed through class assessments and examinations. A pass for this coursework requires an average of 50% over all modules, as well as a minimum of 50% for certain modules designated as core material.

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**STA5011W  OPERATIONAL RESEARCH IN DEVELOPMENT MINOR DISSERTATION**  
*This course may not be offered in 2022*  
90 NQF credits at NQF level 9  
**Convener:** Associate Professor L Scott  
**Course entry requirements:** STA5010W  
**Course outline:**  
On successful completion of the coursework component, students will undertake an individual, supervised applied research project on a suitable topic, the results of which are to be written up as a minor dissertation. In some cases, the project might be undertaken on a local problem at the student's home base.  
**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each count 50% towards the degree; each must be passed separately for the award of the degree.

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**STA5013W  STATISTICAL ECOLOGY DISSERTATION**  
180 NQF credits at NQF level 9  
**Course outline:**  
This course consists of an investigation of an approved topic chosen for intensive study by the candidate (student), culminating in the submission of a dissertation. The dissertation shall demonstrate the successful completion of a programme of training in research methods, a thorough understanding of the scientific principles underlying the research and an appropriate acquaintance with the relevant literature. It must be clearly presented and conform to the standards of the department and faculty. The dissertation will usually consist of a report detailing the conduct, and analysis of the results of, research performed under the close guidance of a suitably qualified
supervisor/s. The dissertation should be well-conceived and acknowledge earlier research in the field. It should demonstrate the ability to undertake a substantial and informed piece of research, and to collect, organise and analyse material. General rules for this degree may be found in the beginning of the handbook.

STA5014Z  STATISTICAL METHODS
0 NQF credits at NQF level 9
**Convener:** Associate Professor R Altwegg
**Course entry requirements:** An honours degree in a relevant discipline such as Biology, Medicine, Actuarial Science, Finance and Engineering that involved a substantial component of quantitative training, as assessed by Head of Statistical Sciences Department.

**Course outline:**
The aim of this course is to allow students to take statistical modules that will prepare them for entry into a Master's program in Statistical Sciences. Modules may include training in Calculus for Statistics, Matrix Methods, Statistical Computing, Statistical Theory and Inference, Statistical Modelling.

**Assessment:** Assignments and tests count 50%; one 3-hour examination in November counts 50%. A sub-minimum of 40% is required for the examination.

STA5058W  BIOSTATISTICS MINOR DISSERTATION
90 NQF credits at NQF level 9
**Convener:** Professor F Little
**Course entry requirements:** Successful completion of the coursework component of the Master’s course in Biostatistics.

**Course outline:**
This course presents the research component of the Master's course in Biostatistics. The research component of the degree is based on a 90 credit dissertation. The topic of the research will be based on methodological or applied problems from the Health or Biological Sciences. Students may be based in a research unit from where the problem has originated for the duration of their research. On completion of the research component, and the preceding coursework component, students will be able to: (1) conduct collaborative research in the health sciences, (2) conduct independent research in statistical methodology for the health sciences, (3) act as statistical consultants for health sciences research, (4) be able to also work with researchers in the biological sciences.

**Assessment:** The minor dissertation must be presented for formal examination. The coursework and minor dissertation each counts 50% towards the degree; each must be passed separately for the award of the degree.

STA5059Z  TOPICS IN BIOSTATISTICS A
15 NQF credits at NQF level 9
**Convener:** Professor F Little
**Course entry requirements:** Previous exposure to quantitative training that will enable the student to cope with the material in the chosen module plus successful completion of pre-courses deemed necessary for the module, as assessed by Head of the Statistical Sciences Department and the module convener.

**Course outline:**
The aim of this module is to allow students to register for a single module that forms part of the Master’s course in Biostatistics. Possible modules include Multivariate Statistics, Longitudinal Data Analysis, Survival Analysis and Design and Analysis of Experiments in the Health Sciences, Advanced Topics in Regression, Simulation and Optimisation, Machine Learning, Bayesian Decision Analysis, Infectious Disease Modelling and Structural Equation Modelling. Students will acquire skills and knowledge of statistical methodology relevant to Health Sciences Research.

**Assessment:** Class assignments 50%; one 3-hour examination counts 50%. A sub-minimum of 40% is required for the examination and the class assignments.
STA5060Z  TOPICS IN BIOSTATISTICS B
15 NQF credits at NQF level 9
Convener: Professor F Little
Course entry requirements: Previous exposure to quantitative training that will enable the student to cope with the material in the chosen module plus successful completion of pre-courses deemed necessary for the module, as assessed by Head of the Statistical Sciences Department and the module convener.
Course outline:
The aim of this module is to allow students to register for a single module that forms part of the MSc in Biostatistics. Possible modules include Multivariate Statistics, Longitudinal Data Analysis, Survival Analysis and Design and Analysis of Experiments in the Health Sciences, Advanced Topics in Regression, Simulation and Optimisation, Machine Learning, Bayesian Decision Analysis, Infectious Disease Modelling and Structural Equation Modelling. Students will acquire skills and knowledge of statistical methodology relevant to Health Sciences Research.
Assessment: Class assignments 50%; one 3-hour examination counts 50%. A sub-minimum of 40% is required for the examination and the class assignments.

STA5061Z  BAYESIAN DECISION MODELLING
15 NQF credits at NQF level 9
Convener: Professor T Stewart
Course entry requirements: Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics subject and/ or statistical background deemed sufficient by the Head of Department.
Course outline:
This module develops the Bayesian approach to inference and decision making, starting from concepts of subjective probability and subjective expected utility, and moving on to structures of Bayesian modelling for inference, computational solution of such models, and representation of complex learning and decision making processed through Bayesian Networks.
DP requirements: Completion and submission of the assignment component at a satisfactory grade (40% minimum)
Assessment: Assignments 35%. Written examination 65%. A subminimum of 40% in each of the assignments and examination is required.

STA5062Z  CAUSAL MODELLING
15 NQF credits at NQF level 9
Convener: Professor F Little
Course entry requirements: Acceptance into Master's programs in Advanced Analytics, Data Science or Biostatistics, and/ or statistical background deemed sufficient by the Head of Department.
Course outline:
This course introduces students to the concept of causality, causal diagrams and causal modelling. Topics to be covered include Counterfactual Theory, Directed Acyclical Graphs, Propensity Scores, Inverse Probability Weighting, Marginal Structural Models, G-estimation, Path Analysis, Confirmatory Factor Analysis, Structural Equation Modeling (SEM), Multiple Group SEM, MIMIC (Multiple Indicators and Multiple Causes) Models, Multilevel SEM, and Latent Growth Curve SEM. The course covers both the theory and the application of the methods with computer software such as R, STATA and LISREL. The course may not be offered every year.
DP requirements: 40% for the assignment component
Assessment: Assignments 40%. Written exam 60%. Sub-minimum of 40% in each of assignment and examination component.
STA5063Z  DESIGN OF CLINICAL TRIALS
15 NQF credits at NQF level 9
Convener: Professor F Little
Course entry requirements: Acceptance into Master’s program in Biostatistics, or statistical background deemed sufficient by the Head of Department.
Course outline:
This module will look at the Design of Clinical Trials. Concepts of randomisation, replication and blocking will be discussed. Students will be introduced to the different phases, that is Phases I, II, III, and IV, of trial designs. Specific designs which will also be covered include, inter alia, randomised trials, dose-escalation studies, cross-over trials, PK/PD studies, designs for survival studies and multi-centre trials. The implications of the specific design for the analysis of the data will be discussed. the course may not be offered every year.
DP requirements: 40% for the assignment component
Assessment: Assignments 50%. Written exam 50%. Sub-minimum of 40% in each of assignment and examination component.

STA5064Z  ECOLOGICAL STATISTICS
15 NQF credits at NQF level 9
Convener: Associate Professor R Altwegg
Course outline:
This module covers the latest statistical methods particular to ecological statistics. Topics include 50 capture-mark-recapture models (closed and open populations, multi-state models), occupancy models, distance sampling, spatially explicit capture-recapture models, and state-space models in ecology. The course may not be offered every year.
DP requirements: 40% for the assignment component
Assessment: Assignments 50%. Examination 50%. A subminimum of 40% in both the assignment and examination component is required.

STA5065Z  FINANCIAL ECONOMETRICS
15 NQF credits at NQF level 9
Convener: To be advised
Course entry requirements: Acceptance into Master’s programs in Advanced Analytics, Data Science and/or statistical background deemed sufficient by the Head of Department.
Course outline:
This course examines from an advanced econometric and quantitative perspective the following key areas: Market efficiency in macro-economic markets including the JSE, bond market and short-term interest rate markets; Characteristics of the JSE and its sectors; appropriate return transformations, the notion of company specific, sector specific and market wide effects; Special focus on the R$ exchange rate; its effect on local markets (JSE and bond); causes of changes and modelling the impact on inflation; Technical modelling of bond market (Nelson-Siegel parameterisation) and the share market (Black Scholes; derivatives). The course may not be offered every year.
DP requirements: 40% for the assignment component
Assessment: Assignment - 30%. Examination, 3 hours 70%. A subminimum of 40% in each of the assignment and examination components.

STA5066Z  MATHEMATICAL MODELLING FOR INFECTIOUS DISEASES
15 NQF credits at NQF level 9
Convener: Associate Professor S Silal
Course entry requirements: Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background deemed sufficient by the Head of Department.
Course outline:
This course introduces students to mathematical modelling of infectious diseases. Topics include differential equation modelling, agent based modelling, computer simulation, statistical data fitting,
public health modelling, introduction to economic modelling. The course may not be offered every year.

**DP requirements:** 40% for the assignment component

**Assessment:** Assignments 40%. Written examination 60%. Sub-minimum of 40% for each of assignment and examination component.

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**STA5067Z  LONGITUDINAL DATA ANALYSIS**
15 NQF credits at NQF level 9

**Convener:** Professor F Little

**Course entry requirements:** Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background deemed sufficient by the Head of Department.

**Course outline:**
This course looks at advanced methods for the analysis of longitudinal data, including linear mixed effect models, generalized estimating equations, generalized linear mixed effect models, nonlinear mixed effect models, smoothing spline models, imputation methods for missing data and causal models. Both the underlying theory and the application of these models using appropriate statistical software are covered. The course may not be offered every year.

**DP requirements:** 40% for the assignment component

**Assessment:** Assignments 50%. Written exam 50%. Sub-minimum of 40% in each of assignment and examination component.

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**STA5068Z  MACHINE LEARNING**
15 NQF credits at NQF level 9

**Convener:** Dr E Pienaar

**Course entry requirements:** Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical and computing background deemed sufficient by the Head of Department.

**Course outline:**
This course serves as an overview of the increasingly important field of Machine Learning. Topics covered include the fundamentals of the Machine Learning Paradigm, the Vapnik-Chervonenkis Inequality, the Bias-Variance Tradeoff, Regularization, Cross-Validation, Linear and Nonlinear Dimension Reduction, Support Vector Machines, Neural Networks, Convolutional Neural Networks, and other contemporary topics in Machine Learning. The course may not be offered every year.

**DP requirements:** 40% for assignment and project component

**Assessment:** Assignments, making up the course mark, and two exams, one written and one computer-based exam. A subminimum of 40% is required for each component.

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**STA5069Z  MULTIVARIATE STATISTICS**
15 NQF credits at NQF level 9

**Convener:** Professor F Little

**Course entry requirements:** Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background deemed sufficient by the Head of Department.

**Course outline:**
In this module, multivariate statistical analysis methods with associated graphical representations will be discussed. Topics to be covered include Principal Component Analysis and PCA biplots, Simple and Multiple Correspondence Analysis, Multidimensional Scaling, Cluster Analysis, Discriminant Analysis, Canonical Variate Analysis, Analysis of Distance and Biadditive Models. The course may not be offered every year.

**DP requirements:** 40% for assignment component

**Assessment:** Assignments 40%. Written examination 60%. Sub-minimum of 40% in each of assignment and examination component.
STA5070Z  PROBLEM STRUCTURING AND SYSTEM DYNAMICS
15 NQF credits at NQF level 9
Convener: Associate Professor L Scott
Course entry requirements: Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background deemed sufficient by the Head of Department.
Course outline:
Problem Structuring: We explore a number of tools and methods which support the initial phases of a process of enquiry or analysis. Our interest is in understanding both the epistemological basis of different approaches as well as evaluating the extent to which they add rigour and promote insight. We will be critiquing the efficacy of different approaches through a variety of case studies. System Dynamics: We discuss features that result in complexity of systems, with case studies. These are then represented first qualitatively and then quantitatively in simulation studies using appropriate software (Vensim is proposed). The course may not be offered every year.
DP requirements: 40% for project work components.
Assessment: Problem Structuring section: project work (50%); written exam (50%). System Dynamics section: project work (40%); written exam (60%). The two sections count equally to the final grade. In each section a subminimum of 40% is required in both the project and written exam.

STA5071Z  SIMULATION AND OPTIMISATION
15 NQF credits at NQF level 9
Convener: Associate Professor S Silal
Course entry requirements: Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background as deemed sufficient by the Head of Department.
Course outline:
This module is split into three sections: Simulation (Random Number Generation, Monte Carlo Methods, Statistical Analysis of Simulated Data, Variance Reduction, Bootstrap Methods, Markov Chain Monte Carlo), Fundamentals of Linear and Nonlinear Optimization (Unconstrained and Constrained Optimization, Kuhn-Tucker Duality, Convexity, Quadratic Programming, Dynamic Programming, Stochastic Programming) and Stochastic Methods in Optimization ("No Free Lunch" Theorems, Metaheuristics, Random Search, Simulated Annealing, Evolutionary and Genetic Algorithms, Partition Algorithms). The course may not be offered every year.
DP requirements: 40% for assignment component
Assessment: Module is split into three sections. For each section, we have: Assignments: 50% Exam: 50%. A subminimum of 40% in each of the assignment and exam component is required.

STA5072Z  SURVIVAL ANALYSIS
15 NQF credits at NQF level 9
Convener: Associate Professor F Gumedze
Course entry requirements: Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background deemed sufficient by the Head of Department.
Course outline:
This module will look at advanced methods for the analysis of survival data. We will first review the Cox proportional hazards model. The advanced methods to be covered will include handling time-varying effects in the Cox proportional hazards model, parametric survival models, accelerated failure time model, frailty models and recurrent events models, competing risks models, extension of the Cox proportional hazards model for time-dependent variables and joint models for longitudinal and time-to-event outcomes.. Both the underlying theory and the application of these models using appropriate statistical software are covered. The course may not be offered every year.
DP requirements: 40% for the assignment component
**Assessment:** Assignments 50%. Written exam 50%. Sub-minimum of 40% in each of assignment and examination component.

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**STA5073Z  DATA SCIENCE FOR INDUSTRY**
15 NQF credits at NQF level 9  
**Convener:** S Britz  
**Course entry requirements:** Acceptance into the Master's course in Data Science or quantitative background deemed sufficient by Head of Department.  
**Course outline:** The goal of the module is to provide an applied, hands-on overview of selected topics useful in the working world of data science that are not covered by other modules in the program. Topics fall into two themes: workflow/productivity tools and skills; and modelling. Under the workflow theme we cover data wrangling (reading/writing data, web scraping, accessing APIs), version control with Git, and visualization and communication of data and results (ggplot2, R shiny). Under the modelling theme we cover recommender systems, text mining and basic natural language processing, and feedforward and convolutional neural networks.  
**DP requirements:** At least 40% for the assignments section  
**Assessment:** Assignments: 50%. Examination: 50%. A sub-minimum of 40% for each of the assignment and examination component will be required.

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**STA5074Z  DECISION MODELLING FOR PRESCRIPTIVE ANALYTICS**
12 NQF credits at NQF level 9  
**Convener:** Dr J C Nyirenda  
**Course entry requirements:** Acceptance into the Master’s course in Data Science or quantitative background deemed sufficient by Head of Department.  
**Course outline:** This course aims to develop an understanding of the role of formal (soft and hard; deterministic and stochastic) modelling in decision support and analyses, to develop understanding of the key technologies behind decision modelling for prescriptive analytics, and to introduce new tools and techniques for analysing data in new ways in order to improve decision making.  
**DP requirements:** None  
**Assessment:** Assignments and Exam

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**STA5075Z  STATISTICAL AND HIGH PERFORMANCE COMPUTING**
12 NQF credits at NQF level 9  
**Convener:** Associate Professor R Altwegg  
**Course entry requirements:** Acceptance into the Master’s course in Data Science or quantitative background deemed sufficient by Head of Department.  
**Course outline:** This course aims to provide students with a foundation in statistical computing for data science. The course is divided into three sections, namely Basic Programming, High Performance Computing and Simulation & Optimisation. In the first section, students will learn how to write computer programs to analyse data with the R Language and Environment for Statistical Computing. Students will then be taught how to run jobs in parallel on a remote computer cluster using a Linux command prompt. Finally, the course will introduce students to the fundamental principles and uses of simulation and optimisation.  
**DP requirements:** None  
**Assessment:** Assignments and Exam.
STA5076Z  SUPERVISED LEARNING
18 NQF credits at NQF level 9
Convener: Dr S Er
Course entry requirements: Acceptance into the Master’s course in Data Science or quantitative background deemed sufficient by Head of Department.
Course outline:
Supervised learning is a set of statistical modelling tools for predicting, or estimating the relationships between predictor and target variables in complex data sets. As part of the Masters in Data Science degree this course aims to familiarise students with the statistical methodology needed to analyse the relationships between predictor and target variables in a big data. The students should be able to apply the appropriate statistical methods such as Generalized Linear Models, Tree-Based Methods, Multivariate Methods, Feature Extraction, Support Vector Machines and Neural Networks to analyse a big data set and estimate the relationships between the predictor and target variables.
DP requirements: None
Assessment: Assignments and Exam.

STA5077Z  UNSUPERVISED LEARNING
12 NQF credits at NQF level 9
Convener: Dr J C Nyirenda
Course entry requirements: Acceptance into the Master’s course in Data Science or quantitative background deemed sufficient by Head of Department.
Course outline:
As part of the Master's in Data Science degree this course aims to familiarise students with the statistical methodology needed to analyse relationships between variables in big data without having causal relationships with predictor and response variables. Topics covered include association rules and market basket analysis, self-organising maps, multidimensional scaling, cluster analysis.
Assessment: Assignments and Exam.

STA5078Z  STOCHASTIC PROCESSES
This course may not be offered every year.
15 NQF credits at NQF level 9
Convener: M Mavuso
Course entry requirements: STA4029Z, Honours course in Advanced Probability Theory or at the discretion of the Head of Department.
Course outline:
The course aims to cover advanced concepts in stochastic processes and stochastic calculus, together with some financial applications. Topics included in the course are as follows: Semimartingales, stochastic integration, Ito's formula, Feyman-Kac theorem, martingale representation, discrete trading, continuous trading.
DP requirements: Class record of at least 40%
Assessment: Assignments, Class Test and Exam.

STA5079W  DATA SCIENCE MINOR DISSERTATION
90 NQF credits at NQF level 9
Convener: Dr S Er
Course entry requirements: Successful completion of the coursework component of the Masters course in Data Science.
Course outline:
The research component of the degree is based on a 90 credit dissertation. The topic of the research will be based on an analysis of large data sets from Physics, Astronomy, Medicine, Finance or other areas of application using the methodology learnt in coursework component. Alternatively, the
dissertation component may focus on methodological developments in Statistical Sciences or Computer Sciences required for the analysis of a large amount of data.

**STA5086Z  ADVANCED PORTFOLIO THEORY**  
*Fifth year status, second semester, two double lectures per week (24 lectures).*  
15 NQF credits at NQF level 9  
**Convener:** Associate Professor T Gebbie  
**Course entry requirements:** Acceptance into Master’s programs in Advanced Analytics or Data Science, and/or statistical background deemed sufficient by the Head of Department.  
**Course outline:**  
The course Advanced Portfolio Theory is intended to expose students to the more advanced topics in portfolio theory, portfolio management and risk management. Statistical techniques such as optimisation, simulation, spectral decomposition of the covariance matrix and robust optimisation are some of the techniques that will be utilised in the models. Notwithstanding the emphasis in this course is on the practical application of the models and theories. There will thus be an emphasis on the qualification of these measures and parameterisation of models in a South African (and African) setting. Furthermore there will be a focus on the interpretation and linkages between the concepts. Topics covered include: Interest rates; Equity evaluation; Portfolio risk components; risk in thinly-traded environments- the SA and African case; Advanced risk measures; systematic risk; eigenvectors; tail risk measures. Active management and the Generalised Fundamental Law. Absolute and Active Portfolio optimisation; the Black-Litterman Model; the Qualitative Model, Non-parametric Models, Robust Portfolio optimisation models including Bayesian shrinkage. Rebalancing of portfolios. Advanced performance measures. Asset pricing models. The course may not be offered every year.  
**Assessment:** Final examination counts 60% and the assignments count the remaining 40%

**STA5090Z  ADVANCED TOPICS IN REGRESSION**  
15 NQF credits at NQF level 9  
**Convener:** A Clark  
**Course entry requirements:** Acceptance into Master’s programs in Advanced Analytics, Data Science or Biostatistics, and/or statistical background deemed sufficient by the Head of Department.  
**Course outline:**  
Linear regression and generalised regression and generalised methods such as shrinkage, splines, kernel smoothing methods and wavelets. Model selection and model assessment. Principal component regression, partial least squares regression, mixture models and generalised additive models. The course may not be offered every year.

**STA5091Z  DATA-ANALYSIS FOR HIGH-FREQUENCY TRADING**  
*This course may not be offered every year.*  
15 NQF credits at NQF level 9  
**Convener:** Associate Professor T Gebbie  
**Course entry requirements:** Acceptance into Master’s programs in Advanced Analytics or Data Science, and/or statistical background deemed sufficient by the Head of Department.  
**Course outline:**  
The course aims to equip students with data-science skills required to manage and explore high-frequency financial market data. This includes managing large financial data-sets, carrying out statistical analysis of large data-sets and knowledge relating to the link between statistical analysis of fast large data-sets, the modeling thereof and how this can be used to understand and control real-time trading and risk systems in modern financial markets. The course aims to consolidate prior knowledge relating to the statistical properties of daily sampled financial data and to then extend this to the analysis, exploration and data-science of large data-sets relating to both limit-order data and real-time transaction data. Students will acquire skills in Understanding and Preparing Financial
Market Data; Data Science of Market Microstructure; Market Structure and Market Microstructure; Statistical Learning for Financial Market Data.

STA5092Z EXPLORATORY DATA ANALYSIS
12 NQF credits at NQF level 9
Convener: Dr S Er
Course entry requirements: Acceptance into Master's program in Data Science or Advanced Analytics and/or statistical background deemed sufficient by Head of Department.
Course outline:
As part of the MSc specializing in Data Science, this course aims to introduce the essential techniques for performing exploratory data analysis. These techniques are typically applied before formal modeling commences and allow the researcher to discover patterns, spot anomalies, test hypotheses and check assumptions with the help of summary statistics and graphical representations. Different types of data will be described and the appropriate exploratory data analysis techniques for each data type will be introduced. The course will distinguish between univariate non-graphical, multivariate non-graphical, univariate graphical, and multivariate graphical techniques and will teach the R syntax required for each. Special attention will focus on the visualization of large data sets.
Assessment: Assignments 70%, Exam 30%

STA5093W DATA SCIENCE MINOR DISSERTATION
60 NQF credits at NQF level 9
Convener: Dr S Er
Course entry requirements: Successful completion of the coursework component of the Masters course in Data Science.
Course outline:
The research component of the degree is based on a 60 credit dissertation. The topic of the research will be based on an analysis of large data sets from Physics, Astronomy, Medicine, Finance or other areas of application using the methodology learnt in coursework component.

STA6001W STATISTICAL SCIENCES THESIS
360 NQF credits at NQF level 10
Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative. Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in book 3, General Rules and Policies.

STA6002W STATISTICAL ECOLOGY THESIS
360 NQF credits at NQF level 10
Course outline:
The PhD is a research degree on an advanced topic under supervision which can be taken in any of the departments in the Faculty. Examination is by thesis alone. A candidate shall undertake doctoral research and advanced study under the guidance of a supervisor/s appointed by Senate. The thesis must constitute a substantial contribution to knowledge in the chosen subject, must show evidence of original investigation and give a full statement of the literature on the subject. The PhD degree demands that the candidate is able to conduct independent research on his/her own initiative.
Through the thesis the candidate must be able to demonstrate that he/she is at the academic forefront in the topic selected, that the work is original and that it advances our knowledge in the relevant field. Candidates are referred to the rules for this degree as set out in book 3, General Rules and Policies.
COURSES OFFERED BY DEPARTMENTS IN OTHER FACULTIES TOWARDS SCIENCE DEGREES

Departments in the Faculty of Commerce

COLLEGE OF ACCOUNTING

Head of College and Associate Professor:
J Kew, BCom HDE MBA Cape Town

ACC1006F/S FINANCIAL ACCOUNTING
18 NQF credits at NQF level 5
Convener: M Gajewski / N Daniels
Course entry requirements: Admission to degree. NSC level 5 in Mathematics and level 4 in English HL (or level 5 in English FAL).
Course outline:
Financial Accounting is predominantly an applied discipline that is based on broad conceptual principles. It starts with an understanding of the business cycle and various decisions taken in a business. Particular emphasis is placed on recording financial transactions in accounting records and interpreting financial transactions through the application of definitions and recognition criteria as set out in accounting framework. Students will also be required to prepare and present basic financial statements.
Lecture times: ACC1006F Tues, Wed, Thurs, Fri 13:00 – 14:00; 14:00 – 15:00; ACC1006S Tues, Wed, Thurs, Fri 14:00 – 15:00
DP requirements: Attendance at and submission of a minimum of 75% of tutorials AND a weighted average of 40% for class tests (excluding objective tests) AND an average of 40% for assignments.
Assessment: Coursework: 35% Exam: 65%

FINANCE AND TAX

Head of Department:
L Pitt, HDE Cape Town BCom (Hons) (Eco) Unisa BCom (Hons) (ES) UJ BB&A (Hons) MBA Stellenbosch MCom Cape Town DBL Unisa

FTX1005F/S MANAGERIAL FINANCE
18 NQF credits at NQF level 7
Convener: FTX1005F C Abdulla/ FTX1005S N Jwara
Course entry requirements: Matriculation mathematics or registration for the Post graduate diploma in Management in Entrepreneurship, Marketing Sport Management Tourism and Business Communication.
Objective: This course is designed to provide a general introduction to the study of the financial function in business, particularly in a South African environment. The course has two primary objectives: Firstly to expose students with little or no commercial or financial background to the fundamentals of the financial aspects of business and the environment in which businesses operate. The second objective is to afford the students with the opportunity of gaining as much practical experience as possible in key areas of Finance, Management Accounting and Accounting.
Course outline:
This course is designed to introduce students with little or no commercial or financial background to the fundamentals of managerial finance. Having completed the course students should have a basic
understanding of accounting concepts, be able to read financial statements and perform basic (ratio) analysis of key performance areas of the business, understand the concept of time value of money, employ basic steps toward efficient working capital management and have a basic understanding of capital budgeting and valuations. The course covers the following key topics: Introduction to basic accounting concepts, understanding annual financial statements, source of finance, basic financial ratio analysis, investments, risk & return, working capital management, cost volume profit analysis, budgeting, time value of money, basic valuations, cost of capital, discounted cash flow, and capital budgeting.

**Lecture times:** Monday, Wednesday, Thursday & Friday: 12h00 -12h45

**DP requirements:** Writing all class tests. Attendance and submission of 80% of tutorials. Satisfactory completion of all projects and assignments. 40% average year mark.

**Assessment:** Class tests, 1-10%; 2-10%; objective tests (10%); 2 group projects 20% (2 x 10%); final examination (50%).

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**INFORMATION SYSTEMS**

**Head of Department and Associate Professor:**
M Tanner BEng(Hons) Mauritius MCom PhD Cape Town

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**INF2006F BUSINESS INTELLIGENCE AND ANALYTICS**
6 NQF credits at NQF level 6

**Convener:** A. Budree

**Course entry requirements:** INF1002 OR equivalent.

**Course outline:**
The course introduces students to the main features of business intelligence and business analytics, including data warehousing and data marts, decision support systems, OLAP, data mining and analytics, corporate performance management, data visualisation, real-time BI, pervasive BI, mobile BI and big data analytics. Case studies and management approaches for implementation are covered and a hands-on project requires students to produce a management report after analysing data using commercial BI software.

**Lecture times:** Course runs only for 3 weeks: Monday to Wednesday, 5th period, Friday 4th and 5th period

**DP requirements:** Year mark of 45%.

**Assessment:** BI software project 30%, Classwork 30%, Final examination 40%. Sub-minimum of 40% for the final examination.

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**INF2009F SYSTEMS ANALYSIS**
18 NQF credits at NQF level 6

**Convener:** E Scott / A Pekane

**Course entry requirements:** INF1003F or equivalent or INF1003F as co-requisite.

**Course outline:**
This course explores the role of the Systems Analyst in business, different approaches used in the development of information systems, and the various tools and techniques used in the specification of system requirements. This course is intended to provide students with an in-depth knowledge of the systems development process, with particular emphasis on the analysis stage of the life cycle. There is a strong practical component to the course, where students will be taught to understand and use the common tools of object-oriented systems analysis. These tools and techniques include scoping, risk analysis, feasibility assessment, prototyping, JAD and techniques commonly used in object oriented systems. The course will also strongly focus on the design of UML models including package, activity, use case, class, interaction and state machine diagrams. INF2009F is closely linked with INF2011S and students will implement an information system in the second semester based on these user
requirements and in doing so will have completed the whole systems development life cycle (SDLC).

**Lectures & Practical Workshops:** Lecture material with relevant exercises, quizzes and workshop will be released every Monday morning. All exercises, quizzes and workshops of the previous week must be submitted before the new material is released. Online Help (Vula Q & A) and/or Low Density interactions will be scheduled every Thursday during periods 3rd, 4th, 5th & 8th for the Practical Workshops.

**Lecture times:** Monday to Wednesday, 4th period, Practical workshops: Thursday 3rd & 4th periods OR 4th & 5th OR 8th & 9th

**DP requirements:** 80% attendance at workshops, completion of all deliverables, sub-minimum of 45% for course year mark. Submitted at least 80% of the coursework.

**Assessment:** The final grade is derived from results of the Coursework (Formative Assessment: 35% + Summative Assessment 25%) and the Final Examination (40%). Sub-minimum of 40% for the final examination.

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### INF2011S  SYSTEMS DESIGN & DEVELOPMENT

18 NQF credits at NQF level 6

**Convener:** S Kabanda

**Course entry requirements:** Minimum 45% final mark for [INF2007 or INF2008 or CSC2001 or equivalent] and INF2009 and [INF1003 or CSC1016 or equivalent]

**Course outline:** This course is intended to provide students with an in-depth knowledge of the systems development process with particular emphasis on the design and implementation stages of the life cycle. There is a strong practical component to the course, where students will use object-oriented tools to design and construct a working system. This course is designed to build on the skills acquired in INF2009F Systems Analysis.

**Lecture times:** Monday, Tuesday and Wednesday, 4th period, Thursday: Weekly workshop sessions 3rd to 4th OR 4th to 5th periods. Friday: Practical workshops 5th – 7th

**DP requirements:** 80% attendance at workshops and practical’s completion of all deliverables, year-mark of 45%. Competed at least 80% of quizzes and tutorials. Submitted at least 80% of class exercises. Submitted all project work.

**Assessment:** The final grade is derived from the following deliverables: Practical Workshops (10%), Theory workshops (5%), Quizzes (10%), Mid-Semester Test (10%), System Development Project (25%), Final Examination (40%).

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### INF3011F  I.T. PROJECT MANAGEMENT

*Students cannot be credited for this course and for INF3003W.*

18 NQF credits at NQF level 7

**Convener:** G Mwalemba

**Course entry requirements:** INF2009F and at least 45% for INF2011S

**Course outline:** This is a first-semester capstone course for students majoring in Information Systems (IS) and either Computer Science, Finance or Informatics who wish not only to gain an understanding of project management issues but also experience the execution of such projects. The course thus combines the theoretical elements of project management (and people management) with the practical implementation of these concepts through the completion of a team project. The course integrates practical and theoretical elements obtained and developed in other undergraduate IS courses

**Lecture times:** 10h00-10h45 Monday - Thursday and 10h00-11h45 Friday

**DP requirements:** Submission of required project work and a sub-minimum of 45% for the year mark prior to writing the final examination. In addition, students must have satisfactory attendance at tutorials and lectures.

**Assessment:** Coursework counts 60% and includes weekly tutorials, reflection assignment and group project. Final examination counts 40%. Sub-minimum of 40% for the final examination.
INF3012S  BPM & ENTERPRISE SYSTEMS
18 NQF credits at NQF level 7
Convener: L Seymour
Course entry requirements: INF2009F and INF2011S
Course outline:
This course examines the role, relationship and effect IT Applications have on businesses and vice versa. It has a heavy emphasis on ERP systems, business processes and Business Process Management (BPM). Students will be exposed to methodologies and techniques to identify, model, measure and improve processes. Students will be introduced to technologies that can be used as part of process improvement initiatives as well as technologies such as ERP that impact on business processes. A group project will allow students to apply their analytical skills to improving an existing process. Students will be introduced to S/4 HANA, and will acquire a basic working knowledge of the Application.
Lecture times: 11h00-11h45 Tuesday- Friday and 10h00-10h45 Thursday and Friday
DP requirements: Submission of group project and a sub-minimum of 45% for the year mark prior to writing the final examination. In addition, students must attend 80% of workshops.
Assessment: Classwork 60% (workshops, class exercises, test and a group project), final examination 40%. Sub-minimum of 40% for the final examination.

INF3014F  ELECTRONIC COMMERCE
18 NQF credits at NQF level 7
Convener: G Mwalemba
Course entry requirements: INF2009F and at least 45% for INF2011S
Course outline:
INF3014F is a course for students majoring in Information Systems (IS) as well as any other student that wish to gain an understanding of electronic commerce (e-Commerce) technologies and their usage in society. The course covers both theoretical e-Commerce issues as well as the practical skills required to develop a basic e-Commerce system. The course plays a role in facilitating students ability to constructively develop integrated knowledge on e-Commerce, including an understanding of and the ability to apply and critically evaluate the key concepts, techniques and practices that form part of e-Commerce systems design, development, implementation and usage. The practical component includes planning, structuring, and developing e-Commerce related web applications as well as designing the user experience (UX). The practical component will culminate in a project that involves developing an e-Commerce application that addresses a real business or social need.
Lecture times: 12h00-13h45 Tuesday and Wednesday and either 13h00-14h45 or 14h00-15h45 Friday
DP requirements: Submission of tutorials, seminar, and project work as well as a sub-minimum of 45% for the year mark prior to writing the final examination.
Assessment: Coursework 60% (including tutorials, seminars, project, and a test). Exam 40%. Sub-minimum of 40% for the final examination.

Departments in the Faculty of Engineering and the Built Environment

ARCHITECTURE, PLANNING AND GEOMATICS

Director
P Tumubweinee, BSc(Arch) Hons Witwatersrand M.Arch Pret PhD Bloemfontein
APG5089S  CURATING URBAN REGULATION
23 NQF credits at NQF level 9
Convener: Dr A Selmeczi
Co-requisites: EGS5065W; EGS5062F or EGS5063F
Course outline:
This course aims to build on the practical and conceptual work focused on the challenges and urgencies of southern urbanism that students undertake in the first semester in the City Research Studio, Urban Everyday and/or Urban Theory, and zeroes in on the problem of adapting these lessons for the realm of urban governance and regulation. The central question then is this: What does critical policy look like from the vantage point of African cities? The course will seek to offer answers to this question primarily by adopting a design perspective: byapplying a design lens to think about space and politics and what alternative modes of regulation are possible (given, for instance, constant technological innovation) and necessary (given the multiple and intersecting crises of access to water, food, housing and other basic needs). The central aim of the course is to facilitate students' process to map, interpret and devise regulatory modes and practices of urban intervention that are capable of meaningfully addressing the most pressing problems of our cities and transform the places where people live.

Lecture times: Refer to departmental timetable
DP requirements: Written course work and participation.
Assessment: 3 short 'response' papers to engage literature and visual materials brought into the class (30%), one long paper (40%), weekly journal reflecting on literature and new learning (20%), course participation and seminar presentation (10%).

ELECTRICAL ENGINEERING

Associate Professor and Head of Department
F Nicolls, MSc(Eng) PhD Cape Town

EEE2049W  INTRODUCTION TO ELECTRICAL AND ELECTRONIC ENGINEERING: SCIENCE STUDENTS
24 NQF credits at NQF level 6
Convener: Mr S Jayalath
Course entry requirements: PHY1013F/S, MAM1021F/S
Course outline:
The course aims to help students understand: (a) DC networks including DC circuits, series and parallel connection, Kirchhoff’s laws, Mesh Analysis, DC network theorems, DC transients in R-L and R-C circuits; (b) Fundamentals of AC including generation, concepts of waveform, period, frequency, angular velocity, phase etc., average, peak and RMS values; (c) Single-phase AC circuit including AC through resistance (R), inductance (L) and capacitance (C), concept of reactance and impedance, phasors, single-phase AC series and parallel circuits, concept of active power, reactive power, apparent power and power factor; (d) Three-phase AC systems; (e) Magnetic circuits including definition of magnetic circuits, simple and composite magnetic circuits, magnetic circuit calculations, magnetic hysteresis, core loss, sinusoidal excitation of magnetic circuits and induced voltage; (f) Single-phase transformers including core construction, principle of operation, e.m.f. equation and transformation ratio, no-load and on-load operation, phasor diagram under no-load and full-load operation with lagging and leading loads, exact and approximate equivalent circuits, open and short circuit tests, losses and efficiency, voltage regulation. (g) DC motors.
DP requirements: Please refer to the official course handout document for detailed information regarding the DP requirements for this course.
Assessment: Please refer to the official course handout document regarding the assessment criteria for this course.
EEE2050F  EMBEDDED SYSTEMS I FOR SCIENCE STUDENTS
18 NQF credits at NQF level 6
Convener: RA Verrinder
Course entry requirements: EEE2049W and CSC1015F
Course outline:
This course aims to give Science students majoring in Computer Engineering a strong foundation in embedded systems by introducing them to digital system fundamentals, including: information representation, Boolean algebra, logic gate behaviour, combinational and sequential digital circuits, digital building blocks and algorithmic state machines; C programming with a focus on microcontroller applications; basic microcontroller usage, including an introduction to computer architecture, general purpose input/outputs, analogue to digital convertors and basic timers.
DP requirements: Please refer to the official course handout document for detailed information regarding the DP requirements for this course.
Assessment: Please refer to the official course handout document regarding the assessment criteria for this course.

EEE3095S  EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS
18 NQF credits at NQF level 7
Convener: Dr S Winberg
Course entry requirements: EEE2050F
Course outline:
This course focuses on embedded systems architectures, firmware and software tool stacks. This course builds on the Embedded Systems I course. Consideration for Internet of Things (IoT) is included in the form of design scenarios and project-based learning. The course is split into two parts. Part 1 (10 credits) covers: theory and practices of design and analysis through modeling and simulation of embedded systems; embedded operating systems, and methods for modelling and simulation of computer systems are studied. An introduction to Linux command line and source code version control are also taught. Part 2 (6 credits) introduces Hardware Description Language (HDL) programming and computer architecture fundamentals; and tools for developing gateware and simulating HDL designs. Part 1 practicals concern using a single board computer, deploying and using an embedded operating system, building applications using a cross-compiler tool stacks, and hardware software interfaces – the practical work culminates in Miniproject A, which requires the use of taught tools to design, analyse and implement an IoT application. Part2 practicals involve implementing a combination logic design and developing a small HDL testbench to analyse its behavior. Those completing the course for 18 credits (Computer Science students) are required to complete a more demanding Miniproject B which adds software features to the Miniproject A baseline and requires additional performance and throughput testing.
DP requirements: Please refer to the official course handout document for detailed information regarding the DP requirements for this course.
Assessment: Please refer to the official course handout document regarding the assessment criteria for this course.

Departments in the Faculty of Health Sciences

HUMAN BIOLOGY

Professor and Head of Department:
S Prince, BSc Hons HDE PhD Cape Town
HUB2019F  INTEGRATED ANATOMICAL AND PHYSIOLOGICAL SCIENCES
PART A

Entrance is limited to 80 students.
24 NQF credits at NQF level 6; 60 lectures, 10 practicals.
Convener: Dr J Harbron and Associate Professor D Lang
Course entry requirements: BIO1000F, BIO1004S and CEM1000W (or equivalent courses).
Co-requisites: An average grade of 60% or more for these two courses is recommended.
Course outline:
The course introduces the concept of integrating human physiology, anatomy, cell biology and histology. It includes the study of cells and tissues, the basic anatomy and histology of the musculoskeletal, endocrine and digestive systems, and an introduction to embryology and osteology. Physiological concepts include fluid balance, cell signaling, hormone regulation, digestion, absorption and metabolism. The course consists of lectures, practical sessions and tutorials. In the practicals, students work in small groups using computers and specialised equipment to study the physiology and histology of the abovementioned organ systems. At the end of the course, students will be able to describe structure-function relationships of body systems covered in the course; apply concepts and principles taught in lectures and practical sessions to solve theoretical or real-life problems posed in tutorials, tests and examinations; follow and implement instructions in computer-simulated physiology experiments and interpret result; identify micro-anatomical organisation of organs under a microscope or in monographs; identify and name structures in anatomical specimens; and design simple experiments to determine physiological parameters such as blood type, fluid compartment volumes, enzyme activities etc.
Lecture times: Lectures: Monday to Friday (08h00-08h45); Practicals: Mondays or Tuesdays (14h00-17h00).
DP requirements: Attendance at all practical sessions, 40% average in class tests and an average of 50% for all assignments.
Assessment: The breakdown of course marks is as follows: Class tests 30%, practical write-up 15%, assignments or tutorials 5%. Final examinations (50%) as follows: Theory examination 30%, practical examination 20%. A subminimum of 40% is required for the theory and practical examination to pass this course. Supplementary examinations, in the form of written, practical or oral assessment, may be offered to students whose overall score is 45-49%. An oral examination may be required in the case of selected students.

HUB2021S  INTEGRATED ANATOMICAL AND PHYSIOLOGICAL SCIENCES
PART B

Entrance is limited to 80 students
24 NQF credits at NQF level 6; 60 lectures; 10 practicals.
Convener: Associate Professor A Gwanyanya
Course entry requirements: HUB2019F (or approved equivalent) and CEM1000W (or approved equivalent).
Course outline:
The course integrates aspects of human physiology, anatomy and histology of organ systems, including cardiovascular, respiratory, nervous, reproductive, urinary and immune systems. The concept of integrating homeostasis and regulation forms the golden thread throughout this course. Homeostatic concepts covered include thermoregulation, acid-base balance, neural transduction, cardiac output and regulation, and respiration. Students are introduced to anthropology and to concepts of ageing and disease. In the practicals, students work in small groups using computers and specialised equipment to study the physiology of the nervous system, the electrical events in the contraction of cardiac muscle and the mechanics of the respiratory system. Students also examine human anatomical specimens of various organs and examine the histology of the organ systems. At the end of the course, students will have a thorough grounding in the physiological mechanisms of the nervous, urinary, cardiovascular, respiratory, reproductive, and immune systems. They will have an understanding of the basic anatomy and microanatomical organisation (histology) of key organs within the above bodily systems; will be able to integrate the concepts above in terms of
understanding structure-function relationships, so as to understand the basic key elements that impact on the physiology of organs during ageing which leads to disease processes; and will be able to interpret data obtained from the various practicals.

**Lecture times:** Lectures: Monday to Friday (08h00-08h45); Practicals Mondays or Tuesdays (14h00-17h00).

**DP requirements:** Attendance at all practicals, 40% average in class tests and an average of 50% for all assignments.

**Assessment:** The final mark comprises class tests (30%); practicals, assignments and tutorials (20%); and final examinations (50%), consisting of a written theory exam (30%) and a practical (20%). A subminimum of 40% is required for the theory and practical examination to pass this course. Supplementary examinations, in the form of written, practical or oral assessment, may be offered to students whose overall score is between 45% and 49%. An oral examination may be required in the case of selected students.

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**HUB3006F  APPLIED HUMAN BIOLOGY**
36 NQF credits at NQF level 7  
**Convener:** Assoc Prof A Bosch  
**Course entry requirements:** HUB2019F; and HUB2021S or equivalent. Entry into this course requires a subminimum of 40% average for the Physiology component of HUB2017H andPTY2000S.  
**Objective:** Understanding the physiology pertaining to exercise and performance with a view to furthering study at the Honours level.  
**Course outline:**  
The semester theme is “Living, working and playing”. Topics dealt with include metabolism and homeostasis, sports nutrition and metabolism, obesity and diabetes, muscle physiology, cardio-respiratory physiology, sporting performance, exercise physiology, thermoregulation, and physiology in extreme environments. At the end of the course students should have a good understanding of the physiology related to movement, sport and exercise. They should understand physiological control, the basics of the physiological components underlying athletic performance, and energy balance and key components of sports nutrition. In addition, they should have a good understanding of the cardiovascular system, muscle function, and the effect of exercise on health, particularly diabetes and obesity. Students will prepare a seminar topic which will be presented as a PowerPoint presentation towards the end of the semester, during the “practical” time slot.

**DP requirements:** Attendance at all practicals, (including tutorials and seminar presentations held during the “practical” time slot), 40% average in class tests and an average of 50% for all assignments.

**Assessment:** Class tests (30%); assignments/seminar presentation (5%); practicals (15%); and examinations (written theory and practical theory) (50%). A subminimum of 40% is required for the theory and practical examinations to pass this course. An oral examination may be required in the case of selected students.

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**HUB3007S  HUMAN NEUROSCIENCES**
36 NQF credits at NQF level 7  
**Convener:** Dr A Gwanyanya  
**Course entry requirements:** HUB3006F (or approved equivalent). Exceptions are at the discretion of the convener.  
**Objective:** To obtain a good grasp of core theoretical and practical concepts of human neurophysiological function.  
**Course outline:**  
This course offers theoretical and practical instructions on advanced concepts in neuroscience, such as embryological development and repair of the nervous system, histological and gross anatomical appearances of the brain, electrophysiology, principles of electrical and morphological brain imaging, neuronal signalling, signal transduction in sensory, motor and autonomic nervous systems, vision and pain perception, eating disorders, mechanisms of learning and the development of
memory. At the end of the course, students should be able to apply knowledge gained and practical skills acquired to solve problems in neurophysiology; read and critically evaluate neuroscience literature; apply knowledge of human physiology in medical fields in the general market place; use acquired skills in assisting with undergraduate practical demonstrations; and teach the basics of human physiology.

**Lecture times:** Five 45-minute lectures per week, 1st period, Monday to Friday.

**DP requirements:** Attendance at all practicals, 40% average mark for class tests and an average of 50% for all assignments.

**Assessment:** Class tests (30%); tutorial project assignments (5%); practical experiments (15%); and examinations (theory and practical) (50%). An oral examination may be offered in case of selected students. A subminimum of 40% is required for the theory and practical examinations to pass this course.

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**INTEGRATIVE BIOMEDICAL SCIENCES**

**Associate Professor and Head of Department:**
DT Hendricks, BScHons (Medicine) PhD Cape Town

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**IBS5004Z**  **BIOINFORMATICS FOR HIGH-THROUGHPUT BIOLOGY**
15 NQF credits at NQF level 9

**Course outline:**
This course is aimed to introduce students to bioinformatics techniques related to processing, analysis and interpretation of high-throughput biological data. It will cover the analysis of next generation sequence data of different types (metagenomic, RNA-Seq and full genome); statistical analysis of NGS in relation to metadata associated with it; phylogenetic analysis of sequence data; and medical population genetics from NGS or array data. The students who complete the course will be skilled both in handling big biological data sets, and in their downstream interpretation.

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**IBS5005W**  **DATA SCIENCE MINOR DISSERTATION**
90 NQF credits at NQF level 9

**Course outline:**
The research component of the degree is based on a 90 credit dissertation. The topic of the research will be based on an analysis of large data sets from Computational Biology.

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**PATHOLOGY**

**Professor and Head (UCT/NHLS joint staff):**
RS Ramesar, BScHons MSc UKZN PhD MBA Cape Town

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**PTY2001S**  **INFECTIOUS DISEASE AND VACCINES**

*Entrance is limited to 30 students.*

24 NQF credits at NQF level 6

**Convener:** A/Prof W Burgers and Dr S Hadebe

**Course entry requirements:** BIO1000F, BIO1004S, CEM1000W, MAM1004F and STA1007S or MAM1000W (or equivalent)

**Course outline:**
The course aims to introduce students to the burden of infectious disease in South Africa and Africa, foundational epidemiological concepts (including epidemics and outbreaks) and public health, the micro-organisms (including bacteria, viruses, fungi and parasites) of importance to human health and disease, and their classification, as well as the prevention, control and treatment of infectious disease, with a focus on vaccines, integrated with an introduction to the human immune system.
Lecture times: Lectures: Monday to Friday, 2nd period; Practical’s: Fridays (14h00-17h00)
DP requirements: Attendance at all practical and tutorial sessions, 40% average in class tests and an average of 50% for all assignments.
Assessment: The breakdown of course marks is as follows: the class record counts 60% (consisting of practical’s, tutorials and assignments; and one 3-hour final examination written in November (40%). The class record consists of class tests (30%), practical write-ups, tutorials and assignments (30%). Supplementary examinations, in the form of written assessment, may be offered to students whose overall score is 45-49%.

Department in the Faculty of Law

PUBLIC LAW

Professor and Head of Department:
   P de Vos, BCom LLB LLM Stell LLM Columbia LLD UWC (Claude Leon Foundation Chair in Constitutional Governance)

PBL5045S ENVIRONMENTAL LAW FOR NON-LAWYERS
(Not offered in 2022) Higher postgraduate course, second semester.
15 NQF credits at NQF level 9
Convener: Professor A Paterson
Course entry requirements: Successful completion of any undergraduate degree. Not available to students undertaking an LLB or LLM degree or Postgraduate Diploma.
Course outline:
The inclusion of an environmental right in South Africa's Constitution has led to the emergence of many environmental laws and court decisions in the past 15 years. These developments are of key relevance to those working in the environmental sector including developers, consultants, biologists, zoologists, planners, sociologists and anthropologists. This course provides students undertaking postgraduate studies relevant to the environment with an insight into relevant principles of international and domestic environmental law. Key content covered in the course includes: an introduction to basic legal principles and resources; constitutional aspects (environmental rights, access to information, administrative justice and access to courts); framework environmental laws; land-use planning laws (planning law, environmental impact assessment and protected areas); natural resource laws (biodiversity, water and marine living resources); and pollution laws (fresh water, land and air pollution).
DP requirements: Satisfactory attendance of lectures and completion of essay.
Assessment: Coursework 50% (Short assignment 10%, Long assignment 40%), Examination 50%.
The African Centre for Cities (ACC) was established in 2007 as a UCT signature research theme cutting across three Faculties (Engineering & the Built Environment, Science and Humanities). The mission of ACC is to facilitate critical urban research and policy discourse for the promotion of vibrant, democratic and sustainable urban development in the global South. ACC researchers undertake research and policy work on a wide range of urban issues in Cape Town, South Africa, Africa and the global South, and collaborate with a number of other institutions across the globe (for example, as part of the Mistra Urban Futures network). Over the past decade, ACC has established an impressive international profile and reputation as a dynamic home for analysis of urban issues and policies. ACC also runs an interdisciplinary urban studies teaching programme (MPhil in Southern Urbanism) to help build a new generation of urbanists who are able to deal with the challenges faced by cities in the global South.
AFRICAN CLIMATE AND DEVELOPMENT INITIATIVE (ACDI)

Professor, Director, AXA Research Chair in African Climate Risk:
M New, PhD Cantab

Professor and Deputy Director:
S Shackleton, PhD Rhodes

Lecturer and Course Convener:
M Norton, PhD Cape Town

Honorary Research Associates/Affiliates:
J Cullis, PhD Colorado at Boulder
J Enqvist, PhD Stockholm
B King, PhD Colorado at Boulder
E Tyler, PhD Cape Town

Associated Researchers:
R Altwegg, PhD Zurich
B Hewitson, PhD Penn State
K Lawal, PhD Cape Town
A Marquard PhD Cape Town
J Thorn, PhD Oxon
M Visser, PhD Gothenburg
P Wolski, PhD ITC
G Ziervogel, PhD Oxon

Senior Research Fellows:
J de Groot, PhD Plymouth
B Rennkamp, PhD Twente
D Sparks, PhD Cape Town
C Trisos, PhD Oxon

Research Fellows:
P Holden, PhD Cape Town
N Methner, PhD Cape Town
R Odoulami, PhD Akure
A Taylor, PhD Cape Town

Postdoctoral Fellows:
F Atkins, PhD Cape Town
J Bentley, PhD Cape Town
H Garekai, PhD Rhodes
E Kruger, PhD Witwatersrand
R Lama, PhD Reading
M Lukas, PhD Cape Town
M Mbiba, PhD Witwatersrand
A Meyer, PhD Federal do Paraná
C Onyeagoziri, PhD Stell
D Shumba, PhD Massey
D Sibanda, PhD UWC
N Simpson, PhD Cape Town

Portfolio Managers:
K Fosseus, BNur Cape Town
K Keatimilwe, MSc British Columbia

Administrators:
A Floris
R Karriem

ACDI is an inter- and transdisciplinary research and training institute that brings together academics across UCT, NGOs, business, civil society and government to co-produce and test new insights,
ACDI’s transdisciplinary focus provides a multi-layered perspective on climate change and development that merges interdisciplinary expertise from specialists working in collaboration with society to solve complex problems within these fields.

ACDI convenes a one-year coursework Master’s in Climate Change & Sustainable Development, which provides students with interdisciplinary training in climate change and sustainable development, with a specific focus on the issues of relevance to African development. The Master’s includes core modules focusing on Climate and Development, Mitigation and Adaptation, and optional courses across a spectrum of disciplines, including Business Sustainability, Biodiversity, Climate Prediction and Environmental Law.

ACDI provides students with access to a network of associated and affiliated climate change researchers and academics. ACDI supports doctoral and master’s students through its Early Career Researcher Network, a forum for students from different departments to interact across disciplinary boundaries and to explore innovative approaches to their research.

For more information on ACDI and its activities, see http://acdi.uct.ac.za/.

The Department of Environmental & Geographical Sciences section in this Handbook may be referred to for detailed course outlines.

**ELECTRON MICROSCOPE UNIT**

**Professor and Director:**
R D Knutsen, BSc PhD Cape Town

**Chief Scientific Officer:**
J D Woodward, BSc Hons Cape Town MSc UWC PhD Cape Town

**Principal Technical Officers:**
M A Jaffer, BSc Hons Cape Town
M A Woodward, BSc(Eng) Cape Town

**Principal Scientific Officer:**
M E Waldron, BSc Hons Swansea MSc Cape Town

**Chief Scientific Officer:**
N Hanief, BSc Hons MSc(Eng) Cape Town

**Technical Officer:**
S Karriem

The Electron Microscope Unit is housed in the New Engineering Building, Madiba Circle and provides scanning, transmission and light microscopy facilities for staff and research students in all faculties. The Unit has two Scanning Electron Microscopes: the ultra-high resolution Thermo Fisher Scientific Nova NanoSEM with accessories including X-ray analyser and electron backscattered diffraction pattern analysis, and a TESCAN Mira Raman integrated SEM that supports EBSD and Electron Beam Lithography. The Unit has two Transmission Electron Microscopes namely the 200 kV Tecnai TF20 FEGTEM equipped with a direct electron detector and the Tecnai G²20 energy-filter (EF)TEM equipped with a LaB6 filament and a CCD camera. Both instruments are equipped for Cryo-EM. The Unit also houses a FEI QEMSCAN, an X-Ray diffractometer and a nanolitre pipetting robot for crystallization trials. Light microscopy facilities include a WiTec Raman confocal microscope. There are preparative facilities for molecular and cellular biology and for hard materials as well as computers and software for data analysis.

Enquiries regarding the use of these facilities are welcome. The Unit is able to provide information and training on a wide range of microscopy related topics. More information is available at www.emu.uct.ac.za.
MARINE AND ANTARCTIC RESEARCH CENTRE FOR INNOVATION AND SUSTAINABILITY (MARIS)

This inter-faculty Centre is hosted in the Department of Biological Sciences.

**Director:**
M Vichi, MSc Bologna PhD Oldenburg

**Deputy Directors:**
A Jarre, MSc Kiel PhD Bremen (AWI)
S Skatulla, Dipl-Ing Karlsruhe PhD Adelaide

**Scientific Steering Committee:**
S Fawcett, MA PhD Princeton
T Rampai, MSc Cape Town PhD Witwatersrand
E Rocke (Chair), MSc Vienna PhD Hong Kong

**Early Career Researchers' Representative:**
L Gammage, MSc PhD Cape Town

**Communications:**
A Lebêhot, PhD Exeter

**Administrator:**
S Bosma, MSc Cape Town

**UCT academic participants (in alphabetical order)**
Department of Biological Sciences: Louise Gammage, Astrid Jarre, Natasha Karenyi, Coleen Moloney, Marieke Norton, Cecile Reed, Lynne Shannon
Department of Chemical Engineering: Tokoloho Rampai
Department of Civil Engineering: Keith MacHutchon, Sebastian Skatulla
Department of Electrical Engineering: Amit Mishra, Robyn Verrinder
Department of Oceanography: Katye Altieri, Sarah Fawcett, Marcello Vichi

The Centre is an aggregator of competence and expertise which considers academic and technological knowledge in relation to societal benefits, with the overarching aim of enhancing the production of knowledge and human capacity in marine and Antarctic research. This is achieved through collaborative national and international research projects generated by the academic participants and various partners; support of students and their integration into the academic environment, particularly supporting interdisciplinarity to address complex problems in interconnected marine systems; the development of technological and innovative solutions for interdisciplinary marine problems; the promotion and maintenance of post-graduate training courses including interdisciplinary curricula. The Centre is structured around inter-related science foci: Antarctic and Southern Ocean Research, Marine Research on the southern African margin, and Innovation in Chemical, Materials and Observational Engineering.

MARIS convenes a one-year coursework Master’s in Applied Ocean Sciences, which is joint between the Department of Biological Sciences and the Department of Oceanography. This course provides interdisciplinary training in treating the most applied aspects of oceanography and marine biology, with the aim to become future ocean professionals. It is designed for both recent graduates as well as those with some years’ experience and who wish to gain skills to operate in the ocean services sector, with a focus on operational and conservational activities, food, water quality and recreation, preservation and other aspects of the Blue Economy. The Department of Biological Sciences’ section in this Handbook can also be referred to for detailed course outlines.
Partnerships
Internal and external partnerships are under development.
For more information on MARIS and the AOS Master’s course, please see the website www.maris.uct.ac.za; email info.maris@uct.ac.za
SCHEDULE OF COURSES

LECTURE PERIODS
The academic day is divided into lecture periods as follows:

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<th>PRACTICAL/TUTORIAL TIMES</th>
<th>COURSE ENTRY REQUIREMENTS</th>
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<td>5 M to Th</td>
<td>By arrangement; F 5th</td>
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<td>AGE2011S</td>
<td>HUMAN EVOLUTION</td>
<td>2 M to Th</td>
<td>One per week, by arrangement</td>
<td>See departmental entry</td>
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<td>2 M to Th</td>
<td>One per week, by arrangement</td>
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<td>DIRECTED READING &amp; RESEARCH</td>
<td>By arrangement</td>
<td>None</td>
<td>See departmental entry</td>
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<td>AGE3011F</td>
<td>THE ROOTS OF RECENT AFRICAN IDENTITY</td>
<td>4 M to Th</td>
<td>One per week, by arrangement</td>
<td>See departmental entry</td>
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<tr>
<td>AGE3012S</td>
<td>GLOBAL DIASPORAS &amp; THE ARCHAEOLOGY OF THE HISTORICAL PAST</td>
<td>4 M to Th</td>
<td>One 2-hour prac per week, by arrangement</td>
<td>See departmental entry</td>
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<tr>
<td>AGE3013H</td>
<td>ARCHAEOLOGY IN PRACTICE</td>
<td>See departmental entry</td>
<td>None</td>
<td>See departmental entry</td>
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<tr>
<td>AST1000S</td>
<td>INTRODUCTION TO ASTRONOMY</td>
<td>5 M to F</td>
<td>W 14h00-17h00</td>
<td>None</td>
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<td>AST2002H</td>
<td>ASTROPHYSICS</td>
<td>2 M to F (Term 2 &amp; 4)</td>
<td>W 14h00-16h30</td>
<td>See departmental entry</td>
</tr>
<tr>
<td>AST2003H</td>
<td>ASTRONOMICAL TECHNIQUES</td>
<td>2 M, T, Th (Term 1 &amp; 3)</td>
<td>W 14h00-16h30</td>
<td>See departmental entry</td>
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<tr>
<td>AST3002F</td>
<td>STELLAR ASTROPHYSICS</td>
<td>2 M to F</td>
<td>W 14h00-16h30</td>
<td>See departmental entry</td>
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<tr>
<td>AST3003S</td>
<td>GALACTIC &amp; EXTRAGALACTIC ASTROPHYSICS</td>
<td>2 M to F</td>
<td>W 14h00-16h30</td>
<td>See departmental entry</td>
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<tr>
<td>BIO1000F</td>
<td>CELL BIOLOGY</td>
<td>5 M to F</td>
<td>One prac a week, M, Tu, W or Th 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Days</td>
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<td>BIO1000H</td>
<td>CELL BIOLOGY</td>
<td>2 M</td>
<td>14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>BIO1004S</td>
<td>BIOLOGICAL DIVERSITY</td>
<td>5 M</td>
<td>One prac a week, M,Tu,W, Th or F 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>BIO2014F</td>
<td>PRINCIPLES OF ECOLOGY &amp; EVOLUTION</td>
<td>2 M</td>
<td>M 14h00-17h00</td>
<td>BIO1000F/H, BIO1004F/S, DP for STA1007S</td>
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<tr>
<td>BIO2015F</td>
<td>VERTEBRATE DIVERSITY &amp; FUNCTIONAL BIOLOGY</td>
<td>3 M</td>
<td>W 14h00-17h00</td>
<td>BIO1000F/H, BIO1004F/S</td>
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<td>BIO2016S</td>
<td>INVERTEBRATE DIVERSITY &amp; FUNCTIONAL BIOLOGY</td>
<td>3 M</td>
<td>W 14h00-17h00</td>
<td>BIO1000F/H, BIO1004F/S</td>
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<td>BIO2017S</td>
<td>PLANT DIVERSITY &amp; FUNCTIONAL BIOLOGY</td>
<td>2 M</td>
<td>Th 14h00-17h00</td>
<td>BIO1000F/H, BIO1004F/S</td>
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<td>BIO3002F</td>
<td>MARINE ECOSYSTEMS</td>
<td>1 M</td>
<td>W 14h00-17h00</td>
<td>See departmental entry</td>
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<td>BIO3013F</td>
<td>GLOBAL CHANGE ECOLOGY</td>
<td>2 M</td>
<td>M 14h00-17h00</td>
<td>BIO1000F or BIO1000H, BIO1004F/S, approved 2000-level semester Science course.</td>
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<tr>
<td>BIO3014S</td>
<td>CONSERVATION: GENES, POPULATIONS &amp; BIODIVERSITY</td>
<td>2 M</td>
<td>M 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>BIO3017S</td>
<td>MARINE RESOURCES</td>
<td>3 M</td>
<td>Th 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>BIO3018F</td>
<td>ECOLOGY AND EVOLUTION</td>
<td>5 M</td>
<td>Tu 14h00-17h00</td>
<td>BIO2014F</td>
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<td>BIO3019S</td>
<td>QUANTITATIVE BIOLOGY</td>
<td>5 M</td>
<td>Tu 14h00-17h00</td>
<td>BIO2014F, approved 2000-level Science STA or MAM course</td>
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<tr>
<td>CEM1000W</td>
<td>CHEMISTRY 1000</td>
<td>2 or 4 M to W, F</td>
<td>Prac: Tu or Th or F, 14h00-17h00/Tut: 2 or 4 Thu</td>
<td>See departmental entry</td>
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<tr>
<td>CEM1009H</td>
<td>CHEMISTRY 1009</td>
<td>4 W</td>
<td>Prac: W 14h00-17h00/ Tut: 4 M &amp; Tu</td>
<td>See departmental entry</td>
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<td>Course Title</td>
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<td>Days</td>
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<td>CEM1010H</td>
<td>CHEMISTRY 1010</td>
<td>5</td>
<td>M to W, F (Term 1-3); 4 M to W, F (Term 4)</td>
<td>Prac: Tu 14h00-17h00/ Tut: 4 Th</td>
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<td>CEM2005W</td>
<td>INTERMEDIATE CHEMISTRY</td>
<td>3</td>
<td>M to F</td>
<td>Prac: Th 14h00-17h00 EBE Tu 14h00-17h00/ Tut: 6 by arrangement</td>
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<td>CEM3005W</td>
<td>CHEMISTRY 3005</td>
<td>3</td>
<td>M to F</td>
<td>Two pracs per week W and F, 14h00-17h00</td>
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<tr>
<td>CSC1010H</td>
<td>COMPUTER SCIENCE 1010</td>
<td>5</td>
<td>M to F</td>
<td>Th 14h00-17h30</td>
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<tr>
<td>CSC1011H</td>
<td>COMPUTER SCIENCE 1011</td>
<td>4</td>
<td>M to Th</td>
<td>M 14h00-16h00</td>
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<tr>
<td>CSC1015F/S</td>
<td>COMPUTER SCIENCE 1015</td>
<td>4 or 5</td>
<td>M, Tu, W or Th 14h00-16h00 or 16h00-18h00</td>
<td>See departmental entry</td>
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<tr>
<td>CSC1016S</td>
<td>COMPUTER SCIENCE 1016</td>
<td>4 or 5</td>
<td>M, Tu or W, 14h00-16h00 or 16h00-18h00</td>
<td>CSC1015F</td>
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<tr>
<td>CSC2001F</td>
<td>COMPUTER SCIENCE 2001</td>
<td>2</td>
<td>M to F</td>
<td>One prac per week, M,Tu,W,Th or F 14h00-18h00</td>
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<td>CSC2002S</td>
<td>COMPUTER SCIENCE 2002</td>
<td>2</td>
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<td>One prac per week, M,Tu,W,Th or F 14h00-18h00</td>
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<td>CSC3002F</td>
<td>COMPUTER SCIENCE 3002</td>
<td>2</td>
<td>M to F</td>
<td>Two pracs per week, M,Tu,W,Th or F 14h00-18h00</td>
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<td>CSC3003S</td>
<td>COMPUTER SCIENCE 3003</td>
<td>2</td>
<td>M to F</td>
<td>Two pracs per week, M,Tu,W,Th or F 14h00-18h00</td>
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<tr>
<td>CSC3022F</td>
<td>C++ AND MACHINE LEARNING</td>
<td>3</td>
<td>M to F</td>
<td>Two pracs per week, by arrangement</td>
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<tr>
<td>EEE3095S</td>
<td>EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS</td>
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<td>Prerequisites</td>
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<td>EGS1003S</td>
<td>GEOGRAPHY, DEVELOPMENT &amp; ENVIRONMENT</td>
<td>2 M to F</td>
<td>M or Tu or Th, 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>EGS2013F</td>
<td>THE PHYSICAL ENVIRONMENT</td>
<td>5 M to F</td>
<td>F 14h00-17h00</td>
<td>GEO1009F or EGS1004S</td>
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<tr>
<td>EGS2015S</td>
<td>SOCIETY &amp; SPACE</td>
<td>5 M to F</td>
<td>M 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>EGS3012S</td>
<td>ATMOSPHERIC SCIENCE</td>
<td>1 M to F</td>
<td>Tu or W, 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>EGS3021F</td>
<td>SUSTAINABILITY &amp; ENVIRONMENT</td>
<td>3 M to F</td>
<td>W 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>EGS3022S</td>
<td>GEOGRAPHIC THOUGHT</td>
<td>4 M to F</td>
<td>W 14h00-17h00</td>
<td>EGS2014S</td>
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<tr>
<td>EGS3023F</td>
<td>ANTHROPOCENE ENVIRONMENTS IN PERSPECTIVE</td>
<td>5 M to F</td>
<td>Th 14h00-17h00</td>
<td>EGS2013F</td>
</tr>
<tr>
<td>GEO1006S</td>
<td>INTRO TO MINERALS, ROCKS &amp; STRUCTURE</td>
<td>5 M to F</td>
<td>F 14h00-17h00</td>
<td>See departmental entry</td>
</tr>
<tr>
<td>GEO1009F</td>
<td>INTRO TO EARTH &amp; ENVIRONMENTAL SCIENCES</td>
<td>2 M to F</td>
<td>One prac a week, M or Tu or Th or F, 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>GEO2001F</td>
<td>MINERALOGY &amp; CRYSTALLOGRAPHY</td>
<td>2 M to F</td>
<td>W 14h00-17h00</td>
<td>See departmental entry</td>
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<tr>
<td>GEO2004S</td>
<td>PHYSICAL GEOLOGY</td>
<td>2 M to F</td>
<td>W 14h00-17h00</td>
<td>GEO2001F, PHY1031F or equivalent</td>
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<tr>
<td>GEO2005X</td>
<td>FIELD GEOLOGY &amp; GEOLOGICAL MAPPING</td>
<td>None</td>
<td>See departmental entry</td>
<td>GEO1006S, GEO2004S (co-requisite)</td>
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<td>GEO3001S</td>
<td>STRATIGRAPHY &amp; ECONOMIC GEOLOGY</td>
<td>2 M to F</td>
<td>Two pracs per week Tu and Th 14h00-17h00</td>
<td>GEO2004S, DP in GEO3005F</td>
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<td>GEO3005F</td>
<td>PETROLOGY &amp; STRUCTURAL GEOLOGY</td>
<td>2 M to F</td>
<td>Two pracs per week Tu and Th 14h00-17h00</td>
<td>GEO2001F, GEO2004S,</td>
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<tr>
<td>HUB2019F</td>
<td>INTEGRATED ANAT &amp; PHYSIO SCIENCES A</td>
<td>1 M to F</td>
<td>M or Tu, 14h00-17h00</td>
<td>CEM1000W (or equivalent), BIO1000W</td>
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<tr>
<td>HUB2021S</td>
<td>INTEGRATED ANAT &amp; PHYSIO SCIENCES B</td>
<td>1 M to F</td>
<td>M or Tu, 14h00-17h00</td>
<td>HUB2019F or equivalent</td>
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<tr>
<td>HUB3006F</td>
<td>APPLIED HUMAN BIOLOGY</td>
<td>1 M to F</td>
<td>W or Th, 14h00-17h00</td>
<td>HUB2021S</td>
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<td>Course Title</td>
<td>Schedule Details</td>
<td>Equivalent Course</td>
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<td>HUB3007S</td>
<td>HUMAN NEUROSCIENCES</td>
<td>1 M to F W or Th, 14h00-17h00</td>
<td>HUB3006F or equivalent</td>
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<tr>
<td>MAM1000W</td>
<td>MATHEMATICS 1000</td>
<td>1 or 3, M to F One 2-hour tutorial per week</td>
<td>See departmental entry</td>
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<tr>
<td>MAM1004F</td>
<td>MATHEMATICS 1004</td>
<td>1 M to F M or W 14h00-16h00</td>
<td>See departmental entry</td>
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<td>MAM1004S</td>
<td>MATHEMATICS 1004</td>
<td>Meridian M to F By arrangement M or W</td>
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<td>MAM1005H</td>
<td>MATHEMATICS 1005</td>
<td>1 or 3 M to F F 8h00-9h00, M 14h00-16h00</td>
<td>See departmental entry</td>
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<tr>
<td>MAM1006H</td>
<td>MATHEMATICS 1006</td>
<td>1, three days per week 1, two days per week</td>
<td>See departmental entry</td>
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<tr>
<td>MAM1008S</td>
<td>INTRODUCTION TO DISCRETE MATHEMATICS</td>
<td>1 or 3 M and W By arrangement</td>
<td>See departmental entry</td>
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<td>MAM1019H</td>
<td>FUNDAMENTALS OF MATHEMATICS</td>
<td>Meridian M, W 13h00-14h00</td>
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<tr>
<td>MAM1043H</td>
<td>MODELLING &amp; APPLIED COMPUTING</td>
<td>2 M to F One hour per week</td>
<td>See departmental entry</td>
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<td>MAM1044H</td>
<td>DYNAMICS</td>
<td>2 M to F Every second F 14h00-16h00</td>
<td>See departmental entry</td>
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<tr>
<td>MAM2000W</td>
<td>MATHEMATICS 2000</td>
<td>5 M to F with options in 4th Th or F 14h00-16h00</td>
<td>MAM1000W or equivalent</td>
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<tr>
<td>MAM2004H</td>
<td>MATHEMATICS 2004</td>
<td>5 M to F with options in 4th Th or F 14h00-16h00</td>
<td>MAM1000W or equivalent</td>
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<tr>
<td>MAM2002S</td>
<td>MATHEMATICS 2002 &amp; 2002</td>
<td>5 M to F with options in 4th Th or F 14h00-16h00</td>
<td>MAM1000W or equivalent</td>
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<tr>
<td>MAM2046W</td>
<td>APPLIED MATHEMATICS 2046</td>
<td>3 M to F Th 14h00-16h00</td>
<td>See departmental entry</td>
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<td>MAM2047H</td>
<td>APPLIED MATHEMATICS 2047</td>
<td>See departmental entry Th 14h00-16h00</td>
<td>MAM1043H, MAM1044H and MAM1000W</td>
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<td>MAM2048H</td>
<td>APPLIED MATHEMATICS 2048</td>
<td>See departmental entry Th 14h00-16h00</td>
<td>MAM2047H</td>
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<td>MAM3000W</td>
<td>MATHEMATICS 3000</td>
<td>5 M to F with options in 4th M 13h00-15h00</td>
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<tr>
<td>MAM3001W</td>
<td>MATHEMATICS 3001</td>
<td>5 M to F with options in 4th Tu 13h00-16h00</td>
<td>MAM2000W</td>
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<tr>
<td>MAM3002H</td>
<td>MATHEMATICS 3002</td>
<td>5 M to Th with options in 4th Th 13h00-15h00</td>
<td>MAM2000W</td>
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<tr>
<td>MAM3003S</td>
<td>MATHEMATICS 3003</td>
<td>5 M to Th with options in 4th Th 13h00-15h00</td>
<td>MAM2000W</td>
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<tr>
<td>MAM3040W</td>
<td>APPLIED MATHEMATICS 3040</td>
<td>4 M to F W 14h00-16h00</td>
<td>See departmental entry</td>
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<td>MAM3041H</td>
<td>APPLIED MATHEMATICS 3041</td>
<td>See departmental entry Th 14h00-16h00</td>
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<td>Credit Hours</td>
<td>Days</td>
<td>Time</td>
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<td>MAM3048H</td>
<td>APPLIED MATHEMATICS 3048</td>
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<td>Th 14h00-16h00</td>
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<td>MCB2020F</td>
<td>BIOLOGICAL INFORMATION TRANSFER</td>
<td>4 M to F</td>
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<td>Th or F 14h00-17h00</td>
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<td>MCB2021F</td>
<td>MOLECULAR BIOSCIENCE</td>
<td>5 M to F</td>
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<td>M or Tu 14h00-17h00</td>
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<td>MCB2022S</td>
<td>METABOLISM AND BIOENGINEERING</td>
<td>5 M to F</td>
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<td>M or Tu 14h00-17h00</td>
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<tr>
<td>MCB2023S</td>
<td>FUNCTIONAL GENETICS</td>
<td>4 M to F</td>
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<td>Th or F 14h00-17h00</td>
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<td>MCB3012Z</td>
<td>RESEARCH PROJECT IN MOLECULAR &amp; CELL BIOLOGY</td>
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<td>Two afternoons per week</td>
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<td>MCB3023S</td>
<td>MOLECULAR EVOLUTIONARY GENETICS &amp; DEVELOPMENT</td>
<td>4 M to F</td>
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<td>One per week by arrangement</td>
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<td>MCB3024S</td>
<td>DEFENCE &amp; DISEASE</td>
<td>5 M to F</td>
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<td>One per week by arrangement</td>
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<td>MCB3025F</td>
<td>STRUCTURAL &amp; CHEMICAL BIOLOGY</td>
<td>5 M to F</td>
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<td>M or Tu 14h00-17h00</td>
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<td>MCB3026F</td>
<td>MOLECULAR GENETICS &amp; GENOMICS</td>
<td>4 M to F</td>
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<td>Th or F 14h00-17h00</td>
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<tr>
<td>PHY1004W</td>
<td>MATTER &amp; INTERACTIONS</td>
<td>3 M to F</td>
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<td>Tu 14h00-17h00</td>
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<tr>
<td>PHY1023H</td>
<td>PRINCIPLES OF PHYSICS A</td>
<td>3 M to F</td>
<td></td>
<td>Tu 14h00-17h00</td>
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<tr>
<td>PHY1031F</td>
<td>GENERAL PHYSICS A</td>
<td>3 M to F</td>
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<td>M or W or Th, 14h00-17h00</td>
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<td>PHY1032F</td>
<td>GENERAL PHYSICS B</td>
<td>3 M to F</td>
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<td>W 14h00-17h00</td>
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<td>PHY1032S</td>
<td>GENERAL PHYSICS B</td>
<td>3 M to F</td>
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<td>M or W or Th, 14h00-17h00</td>
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<td>PHY2004W</td>
<td>INTERMEDIATE PHYSICS</td>
<td>4 M to F</td>
<td></td>
<td>Prac M 14h00-17h00 Tut Tu 14h00-16h00</td>
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<td>PHY3004W</td>
<td>ADVANCED PHYSICS</td>
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### SCIENCE FACULTY COURSES ARRANGED BY LECTURE PERIOD

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<td>PHY2004W</td>
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<td>BIO3018F</td>
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<td>CEM1010H</td>
<td>CHEMISTRY 1010</td>
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<td>CSC1010H</td>
<td>COMPUTER SCIENCE 1010</td>
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<td>Th 14h00-17h30</td>
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<td>CSC1015F</td>
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<td>MATHEMATICS 2000</td>
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<td>MCB3025F</td>
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<td>STA2020F</td>
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<td>THE HUMAN PLANET: PREHISTORY TO PRESENT</td>
<td>5</td>
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<td>AST1000S</td>
<td>INTRODUCTION TO ASTRONOMY</td>
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<td>BIO1004S</td>
<td>BIOLOGICAL DIVERSITY</td>
<td>5</td>
<td>M, Tu, W, Th or F 14h00-17h00</td>
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<td>BIO3019S</td>
<td>QUANTITATIVE BIOLOGY</td>
<td>5</td>
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<td>CHEMISTRY 1010</td>
<td>5</td>
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<td>CSC1015S</td>
<td>COMPUTER SCIENCE 1015</td>
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<td>CSC1016S</td>
<td>COMPUTER SCIENCE 1016</td>
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<td>EEE3095S</td>
<td>EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS</td>
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<td>EGS2015S</td>
<td>SOCIETY &amp; SPACE</td>
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<td>M 14h00-17h00</td>
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<td>GEO1006S</td>
<td>INTRODUCTION TO MINERALS, ROCKS &amp; STRUCTURE</td>
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<td>MAM2002S</td>
<td>MATHEMATICS 2002</td>
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<td>MATHEMATICS 3003</td>
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<td>MAM1019H</td>
<td>FUNDAMENTALS OF MATHEMATICS</td>
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<td>MAM1004S</td>
<td>MATHEMATICS 1004</td>
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<td>STA1000F/S</td>
<td>INTRODUCTORY STATISTICS</td>
<td>See departmental entry</td>
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<tr>
<td>STA2007F/S/H</td>
<td>STUDY DESIGN &amp; DATA ANALYSIS FOR SCIENTISTS</td>
<td>By arrangement</td>
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Distinguished Teachers in the Faculty

The University makes a Distinguished Teacher Award in recognition of the importance of excellence in teaching at all levels in the University. Up to three awards are made annually. The following members (or past members) of the Faculty are recipients of this award:

1983: G M Branch (Zoology)
1984: J H Webb (Mathematics)
1986: B R Davies (Zoology)
1990: H S T Driver (Physics)
1992: J J Conradie (Mathematics)
1992: J E Parkington (Archaeology)
1994: J R Moss (Chemistry)
1996: M J Hall (Archaeology)
1996: M D Picker (Zoology)
1997: N Morrison (Mathematics)
1998: A N Rynhoud (Mathematics)
1998: J A Thomson (Microbiology)
1998: I V Barashenkov (Mathematics)
1998: J U M Jarvis (Zoology)
1999: T Egan (Chemistry)
2000: D L Reid (Geological Sciences)
2001: V Abratt (Molecular & Cell Biology)
2002: J W Lutjeharms (Ocean & Atmosphere Science)
2002: S Oldfield (Environmental & Geographical Science)
2002: A Buffler (CHED/Physics)
2003: D W Gammon (Chemistry)
2004: B Davidowitz (CHED/Chemistry)
2004: S Mundree (Molecular & Cell Biology)
2006: R R Ackermann (Archaeology)
2008: J O'Riain (Zoology)
2009: G Marsden (Computer Science)
2011: G Smith (Chemistry)
2012: Z Woodman (Molecular & Cell Biology)
2014: J Gain (Computer Science)
2014: S Wheaton (Physics)
2015: A West (Biological Sciences)
2016: D Erwin (Mathematics & Applied Mathematics)
2016: J Shock (Mathematics & Applied Mathematics)
2016: M Lacerda (Statistical Sciences)
2017: G Leigh (Physics)
2018: J Murugan (Mathematics & Applied Mathematics)
2018: A Schauerte (Mathematics & Applied Mathematics)

UCT Book Award

The University makes a Book Award in recognition of the publication of books, written by University staff, that brings credit to the University.

Professor G M Branch

Professor G M Branch, Associate Professor C L Griffiths, Mrs M L Branch and Dr L E Beckley

Professor B Warner

The Living Shores of South Africa 1985
Two Oceans - A guide to the Marine life of Southern Africa 1995
Cataclysmic Variable Stars 1997
Prizes

(Further information regarding the value of prizes may be obtained from the Faculty Office.)

**Alistair Stephen Memorial Award**
Awarded for the best Honours project in Chemistry.

**Chemistry Prize**
Awarded to the best student in second-year Chemistry who will be proceeding to third-year Chemistry.

**Computer Science BSG Prizes**
Awarded to the best student in each of Computer Science second and third year courses, the best student in the Honours course and for the best Honours project.

**Computer Science ENTELECT Prizes**
Two prizes, one awarded for Social Responsiveness and another for Achievement.

**Dick & Dorothy Borchers Prize**
Awarded to the student achieving the highest standard at the end of the second year in Biological Sciences or Astronomy.

**Frank Schweitzer Memorial Prize**
Awarded to one or more outstanding senior students in Archaeology, at the discretion of the Head of Department.

**Gordon Percy Memorial Award**
Awarded to the best student in Chemistry Honours.

**J Barry Hawthorne Centennial Prize**
Awarded to the best student in third-year Geology who will be proceeding to Honours in the Department.

**Joseph Arenow Prize plus Science Faculty PhD medal**
Awarded at the discretion of the Dean for the best PhD thesis in the faculty.

**Merck Prize**
Best student in Molecular & Cell Biology Honours.

**Physics Departmental Prize**
Awarded to the SB016 student who achieved the best (passing) grade in PHY2004W.

**Purcell Memorial Prize**
Awarded for the best MSc or PhD dissertation dealing with a biological subject.

**Roberts Award**
Awarded to the best student in third-year Chemistry who will be proceeding to Honours in the Department.

**Sandy Perez Memorial Award**
Awarded to a third year Physics student who achieved the greatest improvement in the final grade between second-year and third-year Physics at UCT, and who intends to register for Physics Honours at UCT.

**Steve Driver Prize**
Awarded to the student producing the best laboratory work in a second-year Physics course.
The Mathematics & Applied Mathematics Webb-Ellis trophy
Awarded to the best student in first year with double majors in Applied Mathematics and Mathematics.

Scholarships

(Further information regarding the value of scholarships may be obtained from the Faculty Office.)

Dr Jacob Burlak Memorial Scholarship Tenure 1 year
Awarded to the best student in second-year Mathematics, registered in the Faculty of Science, who will be proceeding to third-year Mathematics.

Ivor Lewin Memorial Scholarship Tenure 1 year
Awarded to the best student in second-year Physics, registered in the Faculty of Science, who will be proceeding to third-year Physics.

Myer Levinson (Emdin) Scholarship Tenure 2 years
Awarded to candidates who have obtained the BSc Hons degree in the first class and who propose to pursue further study.

Twamley Undergraduate Scholarship Tenure 1 year
Awarded for the most outstanding academic performance at the end of the first year of study.

Class Medals

A class medal may be awarded to a student who has demonstrated special ability in a course, but an award shall not be made if there is no candidate of sufficient merit. Only one medal shall be awarded for each course. Students undertaking a course for a second time are not eligible.

Dean's Merit List

Students who obtain consistently good results may be included on the Dean's Merit List, issued annually, in recognition of their academic achievements. To qualify for the Dean's Merit List in a particular year, a student must normally:

(a) have taken the equivalent of the following minimum number of courses:
   For the regular BSc degree (SB001):
      first year: four full courses
      second year: three full courses, two of which must be senior courses
      third year: two full courses, of which at least 120 NQF credits must be at level 7
   For the extended BSc degree (SB016):
      first year: two full courses
      second year: two full courses
      third year: three full courses, two of which must be senior courses
      fourth year: two full courses, of which at least 120 NQF credits must be at level 7
(b) have passed all courses in the year;
(c) not be repeating courses;
(d) have obtained a weighted average of 70% or above for the courses taken.
**Minimum requirements for admission to an undergraduate degree**

A candidate for the degree of bachelor must have obtained a National Senior Certificate endorsed by Umalusi to state that he or she has met the minimum admission requirements for degree study, or a matriculation certificate or have obtained a Senior Certificate endorsed to state that he or she has met the matriculation requirements or an exemption certificate issued by the Matriculation Board. Council and Senate may, in addition, prescribe, as a prerequisite for admission to any programme or course, the attaining of a specified standard in specified subjects at the matriculation or equivalent examination. (Where these have been prescribed, they are set out in the Admission Policy.) The Matriculation Board's website address is https://mb.usaf.ac.za/

Further information on Faculty Course entry requirements can be found in Book 1, Information for Applicants for Undergraduate Degrees and Diplomas and in the Undergraduate Prospectus.

**Non-Science electives in the Bachelor of Science (BSc) degree**

Courses from other Faculties may be taken as electives, but subject to the following constraints and approval by a Student Advisor or Deputy Dean:

- Only courses with an NQF credit value of 18 or more will be counted (a first year half course in the Science Faculty has an NQF credit value of 18). Courses are not summed.
- If the equivalent of two or less full Science courses (maximum 72 level 6 NQF credits) are replaced by courses from another Faculty, then any courses not specifically excluded by Science Faculty rules (see below) can be chosen.
- If more than two full year Science courses are replaced with electives from another Faculty, then the further electives must form part of a hierarchical sequence linked to those already completed.

**Specific exclusions**

- AHS (Allied Health Services) courses do not count
- Architecture & Planning courses do not count (i.e. APG courses other than Geomatics)
- DOH1002F; DOH1004S; DOH1005F do not count
- HUB courses (other than those offered for Human Physiology major) do not count
- INF1002F/S/H; INF1003S do not count if credit is given for CSC1015F/1016S; nor do they give exemption from CSC1015/1016
- INF2004F, INF2008F and INF2010S do not count together with senior CSC courses
- STA1001F/S does not count
- Professional Communication courses do not count.
- CHE1004W/CHE1005W, CIV1004W, CON1004W, EEE1004W or MEC1004W counts as a half course for students transferring from the Faculty of EBE, but these courses may NOT be taken by students registered in the Science Faculty.

- DRM (Drama) courses which count towards the Academic Drama major (Humanities handbook) may be taken for credit. The list currently includes DRM1027F, DRM1028S, DRM2010F, DRM2011S, DRM3010F, DRM3018S.
- FIN (Fine Art) courses which are recognised as part of the BA and B SocSc degrees (Humanities handbook) may be taken for credit. The list currently includes FIN1006F, FIN1009S, FIN2027F, FIN2028S, FIN3026F, FIN3027S. Studiowork courses will not be recognised.

**Courses taught by the Science Faculty for students in other Faculties**

Courses taught by the Faculty of Science for other Faculties may not be taken by students registered in Science. However, students transferring into Science from other Faculties may be able to count such courses towards their Science curriculum as Science courses, with the credit weighting and equivalence established by the Departments concerned – see below.

**Transferring students**

CSC1017F counts as a half course if result is 70% or more (CX CSC1015F)
GEO1008F counts as a Science half credit, but credit will not be given for both GEO1008F and GEO1006S
MAM1010F/S counts as a half course credit (CX MAM1005H)
MAM1012F/S counts as a half course credit (CX MAM1006H)
MAM1017F/S counts as a half course if result is 70% or more (CX MAM1005H)
MAM1018F/S counts as a half course if result is 70% or more (CX MAM1006H)
MAM1017F/S plus MAM1018F/S count as full course credit if both are passed with an average mark for the two courses of 70% or more (CX MAM1000W)
MAM1017F/S plus MAM1018F/S count as a half course if the result is less than 70% (CX MAM1005H)
MAM1017F/S plus MAM1018F/S plus MAM2083F/S count as a full course credit if the average result is less than 70% (CX MAM1000W)
MAM1020F/S or MAM1023F/S counts as a half course credit (CX MAM1005H)
MAM1021F/S or MAM1024F/S counts as a half course credit (CR MAM1006H)
One of MAM1020F/S or MAM1023F/S plus one of MAM1021F/S or MAM1024F/S with an average of 60% or more is required for entry into MAM2000W (CX MAM1000W)
MAM2083F/S plus MAM2084F/S counts as a senior half course. Neither MAM2083 nor MAM2084 counts on their own, or if used to gain CX for MAM1000W together with MAM1017F/S plus MAM1018F/S. (Entry to MAM3000W will be decided on an individual basis, and will require a pass in both MAM2083 and MAM2084 plus registration for one or two MAM2000W modules).
PHY1012F/S (16 credits) counts as a half course if result is 70% or more; PHY1012F/S (18 credits) counts as a half course (CX PHY1031F)
PHY1013F/S (16 credits) counts as a half course if result is 70% or more; PHY1013F/S (18 credits) counts as a half course (CX PHY1032F)
PHY1012F/S plus PHY1013F/S (16 or 18 credits) count as full course credit if both are passed with an average mark for the two courses of 75% or more (CX PHY1004W)
PHY1012F/S (16 credits) plus PHY1013F/S (16 credits) count as half course credit if both are passed with an average mark for the two courses of less than 75%
STA1100S count as a full course (CX STA1000F/S)
STA1106H count as a full course (CX STA1006S)
STA3047S plus STA3048S count as a half course (CX STA3043S)
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