UNIVERSITY OF CAPE TOWN

FACULTY OF SCIENCE

2018

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Dean's & Faculty Offices: Room 6.43, P D Hahn Building
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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
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UCT's Home Page	http://www.uct.ac.za
Science Home Page	http://www.science.uct.ac.za
Dean's Office Faculty Office	sci-science@uct.ac.za
International Academic Programmes Office	int-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

CONTENTS

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.

GENERAL INFORMATION

Officers in the Faculty

Dean of the Faculty of Science (Interim): Professor S A Bourne, BSc Hons PhD *Cape Town*	Rm 6.46 P D Hahn Building sci-dean@uct.ac.za
Assistant Dean, Academic Support: Associate Professor D W Gammon, PhD HDE *Cape Town*	Rm 6.42 P D Hahn Building david.gammon@uct.ac.za
Deputy Dean, Operations: Professor M F Ramutsindela, MA *UNIN* PhD *London*	Rm 4.13 Environmental & Geographical Sciences Building maano.ramutsindela@uct.ac.za
Deputy Dean, Undergraduate Studies: Professor J E Gain, MSc *Rhodes* PhD *Cantab*	Rm 315 Computer Science Building james.gain@uct.ac.za
Deputy Dean, Postgraduate Studies: Professor N Illing, MSc *Cape Town* DPhil *Oxon*	Rm 426 Molecular Biology Building nicola.illing@uct.ac.za
Personal Assistant to the Dean: E Taladia	Rm 6.46 P D Hahn Building elhaam.taladia@uct.ac.za
Faculty Manager (Academic): K T Wienand, MSc Adv Cert HE Management *Cape Town*	Rm 6.56 P D Hahn Building karen.wienand@uct.ac.za
Deputy Faculty Manager (Academic): A Rooks-Smith, BA PGCE PG Dipl Educ *Cape Town*	Rm 6.53 P D Hahn Building amy.rooks@uct.ac.za
Senior Administrative Officer, Undergraduate: T Mohamed, BSc BCom (Hons) *UWC*	Rm 6.54 P D Hahn Building tasneem.mohamed@uct.ac.za
Administrative Officer: P Beziek, Cert Bus Admin *Stell*	Rm 6.54 P D Hahn Building pedro.beziek@uct.ac.za
Administrative Officer, Postgraduate: A Shaik, BSc *Cape Town*	Rm 6.54 P D Hahn Building ayesha.shaik@uct.ac.za
Administrative Assistant, Postgraduate: S Samsodien	Rm 6.54 P D Hahn Building shahieda.samsodien@uct.ac.za
Senior Secretary/Receptionist: T Pretorius	Rm 6.54 P D Hahn Building tara.pretorius@uct.ac.za
Administrative Officer: S Smith, BCom (Hons) *UWC*	Rm 6.51 P D Hahn Building shanaaz.smith@uct.ac.za
Faculty Communications & Marketing Manager: K Wilson, BA HDE *Cape Town*	Rm 6.51 P D Hahn Building katherine.wilson@uct.ac.za

Faculty Manager (Finance):
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Senior Faculty Finance Officer:
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Assistant Faculty Finance Officer:
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Human Resource Practitioner:
N Maharaj, BCom *Natal* Dipl HR Management *Natal*
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Senior Student Advisers in the Faculty

Computer Science & Statistics
Associate Professor S Berman
Rm 310 Computer Science Building
sonia@cs.uct.ac.za

Biology, Earth & Environmental Sciences
Associate Professor G A Verboom
Rm 3.11 H W Pearson Building
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Chemical, Molecular & Cellular Sciences
Dr P Meyers
Rm 202 Molecular Biology Building
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Mathematics, Physics & Astronomy
Dr S Wheaton
Rm 4T4 R W James Building
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Extended Degree Programme (EDP)
Dr D Taylor
Rm 4.05 R W James Building
dl.taylor@uct.ac.za

Student Advisers in the Faculty

Computer Science & Statistics

Dr B Erni
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Dr F Gumedze
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freedom.gumedze@uct.ac.za

Associate Professor D Moodley
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Mr A Safla
Rm 307 Computer Science Building
student-advisors@cs.uct.ac.za

Biology, Earth & Environmental Sciences

Professor M Meadows (1st Semester)	Rm 4.06.1 Environmental & Geographical Sciences Building
Associate Professor B Abiodun (2nd Semester)	Rm 4.03 Environmental & Geographical Sciences Building babatunde.abiodun@uct.ac.za
Dr S Chimphango	Rm 4.13 H W Pearson Building samson.chimphango@uct.ac.za
Dr C Reed	Rm 3.16 John Day Zoology Building cecile.reed@uct.ac.za
Dr E Bordy	Room 501 Geological Sciences Building emese.bordy@uct.ac.za

Chemical, Molecular & Cellular Sciences

Associate Professor R Ingle	Rm 430 Molecular Biology Building robert.ingle@uct.ac.za
Associate Professor G Smith	Rm 7.08 P D Hahn Building gregory.smith@uct.ac.za

Mathematics, Physics & Astronomy

Dr S Peterson	Rm 5.14 R W James Building steve.peterson@uct.ac.za
Dr N R C Robertson	Rm M108 Mathematics Building neill.robertson@uct.ac.za

Extended Degree Programme (EDP)

Dr R Sithaldeen	Rm 3.18 Beattie Building riashna.sithaldeen@uct.ac.za

Departments in the Faculty

Department:	Location:	Telephone:
Archaeology	Beattie Building	(021) 650 2353
Astronomy	R W James Building	(021) 650 5830
Biological Sciences	H W Pearson Building & J Day Building	(021) 650 3603
Chemistry	P D Hahn Building	(021) 650 2525
Computer Science	Computer Science Building	(021) 650 2663
Environmental & Geographical Science	EGS Building	(021) 650 2874
Geological Sciences	Geological Sciences Building	(021) 650 2931
Human Biology (Faculty of Health Sciences)	Anatomy Building, Health Sciences campus	(021) 406 6235
Mathematics & Applied Mathematics	Mathematics Building	(021) 650 3191
Molecular & Cell Biology	Molecular Biology Building	(021) 650 3270
Oceanography	R W James Building	(021) 650 3277
Physics	R W James Building	(021) 650 3326
Statistical Sciences	P D Hahn Building	(021) 650 3219

Administrative offices dealing with student matters

Query:	Whom to approach:	Telephone:
Academic transcripts/degree certificates, deferred examinations	Student Records Office, Masingene Building, Middle Campus	(021) 650 3595
Admission queries, curriculum matters, registration issues	Academic Administration, Science Faculty Office, Room 6.54, P D Hahn Building	(021) 650 3023
Fee problems/accounts	Central Fees Office, Kramer Law Building	(021) 650 2142
Fee payments	Cashier's Office, Kramer Law Building (09h30 to 15h30)	(021) 650 2207/2146
Financial assistance	Student Financial Aid Office, Kramer Law Building	(021) 650 2125
Computer laboratory queries	P D Hahn extension, Scilab D	(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 PD 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 or visited at www.pgfo.uct.ac.za.

Term dates for 2018

1st Semester

1st Quarter	19 February to 29 March
Mid-term break	30 March to 08 April
2nd Quarter	09 April to 15 June
Mid-year break	16 June to 22 July

2nd Semester

3rd Quarter	23 July to 07 September
Mid-term break	08 September to 16 September
4th Quarter	17 September to 21 December

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; ie 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 GB 9
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 subminimum 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 FB 4.1-4.2 and General Rules G 23

Deferred examinations
Refer to General Rules G 27 & 28

DEGREES OFFERED IN THE FACULTY

All qualifications offered in the Faculty are HEQSF (Higher Education Qualifications Sub-Framework) aligned but SAQA (South African Qualifications Authority) registration numbers are still awaited for some qualifications.

i) Bachelor of Science (BSc) degree
ii) Bachelor of Science Honours (BSc Hons) degree
iii) Master of Science (MSc) degree
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 Progamme, 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, (ie. 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, he/she 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, he/she 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 he or she has completed:

(a) one and a half courses or the equivalent, including one and a half courses specific to a major, by the end of the first year;

(b) three and a half courses or the equivalent, including all required first-year courses, by the end of the second year;

(c) five and a half courses or equivalent, including one and a half senior courses, by the end of the third year;

(d) seven and a half courses, including three senior courses, by the end of the fourth year;

(e) Students are expected to complete all the requirements of the degree by the end of the fifth year.

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

Extended Degree Programme (EDP)

Extended Degree Programme (EDP)

FB5.3 Except by permission of Senate, a student who is registered on the EDP shall not be permitted to reregister in the Faculty unless he or she has completed:

(a) one full-year course, or the equivalent in half courses, by the end of the first year;

(b) three full-year courses or the equivalent, including two and a half courses specific to the majors, by the end of the second year;

(c) five full-year courses or the equivalent, of which at least one shall be a senior course, by the end of the third year;

(d) seven full-year courses, of which at least two and a half shall be senior courses, by the end of the fourth year.

General

FB5.4 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.

FB5.5 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 his or her registration in the Faculty in the following year.

FB5.6 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.

FB5.7 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.

FB5.8 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

FB6 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.

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
Business Computing*	Mathematical Statistics
Chemistry	Mathematics
Computer Science	Ocean & Atmosphere Science
Computer Engineering*	Physics
Computer Games Development*	

* These majors may only be taken in conjunction with a major in Computer Science.

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 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, the curriculum must contain at least two distinct third-year 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
[BIO01]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO1000F	Cell Biology	18	5
BIO1004F/S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
or			
MAM1000W	Mathematics 1000	36	5
STA1007S	Introductory Statistics for Scientists	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO2010F	Principles of Ecology & Evolution	24	6
Two of:			
BIO2011S	Life on Land: Animals	24	6
BIO2012S	Life on Land: Plants,	24	6
BIO2013F	Life in the Sea	24	6
Recommended:			
STA2007F/H/S	Study Design & Data Analysis for Scientists	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO3013F	Global Change Ecology	36	7
BIO3014S	Conservation: Genes, Populations & Biodiversity	36	7

Major in Applied Mathematics
[MAM01]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM1000W	Mathematics 1000	36	5
MAM1043H	Modelling & Applied Computing	18	5
MAM1044H	Dynamics	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM2000W	Mathematics 2000	48	6
MAM2046W	Applied Mathematics 2046	48	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM3040W	Applied Mathematics 3040	72	7

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 1

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM1004F	Mathematics 1004	18	5
and			
MAM1008S	Introduction to Discrete Mathematics	18	5
or			
MAM1000W	Mathematics 1000 or equivalent	36	5
STA1007S	Introductory Statistics for Scientists	18	5
or			
STA1000S	Introductory Statistics	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
STA2007H	Study Design & Data Analysis for Scientists	24	6
or			
STA2020F	Applied Statistics	24	6
STA2030S	Theory of Statistics	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
STA3022F	Research & Survey Statistics	36	7
or			
STA3036S	Operational Research Techniques	36	7
STA3030F	Inferential Statistics	36	7

Major in Archaeology
[AGE01]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
GEO1009F	Intro to Earth and Environmental Sciences	18	5
or			
EGS1004S	Intro to Earth and Environmental Sciences	18	5
AGE1002S	Africa & World Archaeology	18	5
MAM1004F	Mathematics 1004	18	5
and			
STA1000/7S	Introductory Statistics / Introductory Statistics for Scientists	18	5
or			
MAM1000W	Mathematics 1000	36	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
AGE2011S	Human Evolution	24	6
AGE2012F	Southern African Hunters & Herders	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
AGE3013H	Archaeology in Practice	36	7
and one of:			
AGE3011F	Roots of Black Identity	36	7
AGE3012S	Global Interaction & the transformation of SA Society	36	7

Major in Astrophysics
[AST02]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM1000W	Mathematics 1000	36	5
PHY1004W	Matter & Interactions	36	5
Recommended:			
AST1000F	Introduction to Astronomy	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
AST2002H	Astrophysics	24	6
AST2003H	Astronomical Techniques	24	6
MAM2000W	Mathematics 2000	48	6
or			
MAM2004H	Mathematics 2004	24	6
and			
MAM2047H	Applied Mathematics 2047	24	6
PHY2004W	Intermediate Physics	48	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
AST3002F	Stellar Astrophysics	36	7
AST3003S	Galactic & Extragalactic Astrophysics	36	7

Major in Biochemistry
[MCB01]

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

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO1000F	Cell Biology	18	5
BIO1004S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
or			
MAM1000W	Mathematics 1000	36	5
STA1007S	Introductory Statistics for Scientists	18	5
or			
STA1000F/S	Introductory Statistics	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MCB2020F	Biological Information Transfer	24	6
MCB2021F	Molecular Bioscience	24	6
MCB2022S	Metabolism and Bioengineering	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MCB3012Z	Research Project in Molecular and Cell Biology	0	7
MCB3024S	Defence & Disease	36	7
MCB3025F	Structural and Chemical Biology	36	7

Major in Business Computing
[CSC02]

Must be taken concurrently with a Computer Science major

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC1015F	Computer Science 1015	18	5
CSC1016S	Computer Science 1016	18	5
MAM1004F	Mathematics 1004	18	5
and			
MAM1008S	Introduction to Discrete Mathematics	18	5
or			
MAM1000W	Mathematics 1000	36	5
ACC1006F/S	Financial Accounting	18	5
or			
FTX1004S	Introduction to Financial Management	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
INF2009F	Systems Analysis	18	6
INF2006F	Business Intelligence Analysis	6	6
INF2011S	System Design and Development	18	7

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
INF3011F	I.T. Project Management	18	7
INF3012S	BPM and Enterprise Systems	18	7
INF3014F	Electronic Commerce	18	7

Major in Chemistry
[CEM01]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CEM1000W	Chemistry 1000	36	5
MAM1000W	Mathematics 1000	36	5
PHY1031F	General Physics A	18	5
PHY1032S	General Physics B	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CEM2005W	Intermediate Chemistry	48	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CEM3005W	Chemistry 3005	72	7

Major in Computer Engineering
[CSC03]

(Must be taken concurrently with a Computer Science major)

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC1015F	Computer Science 1015	18	5
CSC1016S	Computer Science 1016	18	5
MAM1004F	Mathematics 1004	18	5
and			
MAM1008S	Introduction to Discrete Mathematics	18	5
or			
MAM1000W	Mathematics 1000	36	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
EEE2049W	Introduction to Electrical & Electronic Engineering	24	6
EEE2050F	Embedded Systems 1	18	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC3022H	C++ With Applications	36	7
EEE3095S	Embedded Systems II for Science Students	18	7

Major in Computer Games Development (for students registered before 2018 only) [CSC07]

Must be taken concurrently with a Computer Science major

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC1015F	Computer Science 1015	18	5
CSC1016S	Computer Science 1016	18	5
MAM1004F	Mathematics 1004	18	5
and			
MAM1008S	Introduction to Discrete Mathematics	18	5
or			
MAM1000W	Mathematics 1000	36	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC2003S	Computer Games	24	6
INF2009F	Systems Analysis	18	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC3020H	Three Dimensional & Distributed Games Design	36	7
CSC3022H	C++ With Applications	36	7

Major in Computer Science [CSC05]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC1015F	Computer Science 1015	18	5
CSC1016S	Computer Science 1016	18	5
MAM1004F	Mathematics 1004	18	5
and			
MAM1008S	Introduction to Discrete Mathematics	18	5
or			
MAM1000W	Mathematics 1000	36	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC2001F	Computer Science 2001	24	6
CSC2002S	Computer Science 2002	24	6
CSC2004Z	Programming Assessment	0	6
INF2009F	Systems Analysis	18	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
CSC3002F	Computer Science 3002	36	7
CSC3003S	Computer Science 3003	36	7

Major in Ecology & Evolution
[BIO04]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO1000F	Cell Biology	18	5
BIO1004S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
or			
MAM1000W	Mathematics 1000	36	5
STA1007S	Introductory Statistics for Scientists	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO2010F	Principles of Ecology & Evolution	24	6
Two of:			
BIO2011S	Life on Land: Animals	24	6
BIO2012S	Life on Land: Plants	24	6
BIO2013F	Life in the Sea	24	6
Recommended:			
STA2007F/H/S	Study Design & Data Analysis for Scientists	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO3015F	Ecosystem Ecology	36	7
BIO3016S	Systematics & Macroevolution	36	7

Major in Environmental & Geographical Science
[EGS02]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
EGS1003S	Geography, Development & Environment	18	5
GEO1009F	Intro to Earth and Environmental Sciences	18	5
MAM1004F	Mathematics 1004	18	5
and			
STA1000/7S	Introductory Statistics / Introductory Statistics for Scientists	18	5
or			
MAM1000W	Mathematics 1000	36	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
EGS2013F	The Physical Environment	24	6
EGS2014S	Contemporary Urban Challenges	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
Two of:			
EGS3012S	Atmospheric Sciences	36	7
EGS3021F	Sustainability & Environment	36	7
EGS3022S	Geographic Thought	36	7
EGS3023F	Anthropocene Environments In Perspective	36	7

Major in Genetics
[MCB04]

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

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO1000F	Cell Biology	18	5
BIO1004S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
or			
MAM1000W	Mathematics 1000	36	5
STA1007S	Introductory Statistics for Scientists	18	5
or			
STA1000F/S	Introductory Statistics	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MCB2020F	Biological Information transfer	24	6
MCB2021F	Molecular Bioscience	24	6
MCB2023S	Functional Genetics	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MCB3012Z	Research Project in Molecular & Cell Biology	0	7
MCB3023S	Molecular Evolutionary Genetics & Development	36	7
MCB3026F	Molecular Genetics & Genomics	36	7

Major in Geology
[GEO02]

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

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
GEO1009F	Intro to Earth and Environmental Sciences	18	5
GEO1006S	Intro to Minerals, Rocks & Structure	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
and			
STA1000/7S	Introductory Statistics / Introductory Statistics for Scientists	18	5
or			
MAM1000W	Mathematics 1000	36	5
PHY1031F	General Physics A	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
GEO2001F	Mineralogy & Crystallography	24	6
GEO2004S	Physical Geology	24	6
GEO2005X*	Field Geology and Geological Mapping	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
GEO3005F	Petrology & Structural Geology	36	7
GEO3001S	Stratigraphy & Economic Geology	36	7
GEO2005X*	Field Geology and Geological Mapping	24	6

* 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

Code	Course	NQF Credits	HEQSF Level
BIO1000F	Cell Biology	18	5
BIO1004S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
and			
STA1007S	Introductory Statistics for Scientists	18	5
or			
MAM1000W	Mathematics 1000	36	5
Recommended:	1000-level Physics		

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
HUB2019F	Integrated Anat & Physio Sciences A	24	6
HUB2021S	Integrated Anat & Physio Sciences B	24	6
	One full senior Science course	48	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
HUB3006F	Applied Human Biology	36	7
HUB3007S	Human Neurosciences	36	7

Major in Marine Biology
[BIO05]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO1000F	Cell Biology	18	5
BIO1004S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
or			
MAM1000W	Mathematics 1000	36	5
STA1007S	Introductory Statistics for Scientists	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO2013F	Life in the Sea	24	6
SEA2004F	Principles of Oceanography	24	6
Recommended:			
BIO2010F	Principles of Ecology & Evolution	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
BIO3002F	Marine Ecosystems	36	7
BIO3017S	Marine Resources	36	7

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

Code	Course	NQF Credits	HEQSF Level
MAM1000W	Mathematics 1000	36	5
STA1006S	Mathematical Statistics I	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
STA2004F	Statistical Theory & Inference	24	6
STA2005S	Linear Models	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
STA3041F	Markov Processes & Time Series	36	7
STA3043S	Decision Theory & GLM	36	7

Major in Mathematics
[MAM02]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM1000W	Mathematics 1000	36	5
MAM1019H	Fundamentals of Mathematics	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM2000W	Mathematics 2000	48	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM3000W	Mathematics 3000	72	7

Major in Ocean & Atmosphere Science
[SEA03]

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
GEO1009F	Intro to Earth & Environmental Sciences	18	5
or			
BIO1004F/S	Biological Diversity	18	5
CEM1000W	Chemistry 1000	36	5
MAM1004F	Mathematics 1004	18	5
and			
STA1000/7S	Introductory Statistics / Introductory Statistics for Scientists	18	5
or			
MAM1000W	Mathematics 1000	36	5
PHY1031F	General Physics A (or equivalent)	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
SEA2004F	Principles of Oceanography	24	6

Code	Course	NQF Credits	HEQSF Level
SEA2005S	Marine Systems	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
SEA3004F	Ocean & Atmosphere Dynamics	36	7
EGS3012S	Atmospheric Science	36	7

Major in Physics
[PHY01]

Courses marked with an asterisk (*) will not be offered from 2016

First Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM1000W	Mathematics 1000	36	5
PHY1004W	Matter and Interactions	36	5
Recommended:			
MAM1043H	Modelling & Applied Computing	18	5
and			
MAM1044H	Dynamics	18	5

Second Year Core Courses

Code	Course	NQF Credits	HEQSF Level
MAM2000W	Mathematics 2000	48	6
or			
MAM2047H	Applied Mathematics 2047	24	6
and			
MAM2004H	Mathematics 2004	24	6
PHY2004W	Intermediate Physics	48	6
or			
PHY2014F*	Waves, Vibrations and Electromagnetism	24	6
PHY2015S*	Classical and Quantum Mechanics	24	6

Third Year Core Courses

Code	Course	NQF Credits	HEQSF Level
PHY3004W	Advanced Physics	72	7
or			
PHY3021F*	Advanced Physics A	36	7
PHY3022S*	Advanced Physics B	36	7

Distinction

The Bachelor of Science (BSc) degree may be awarded with distinction, and with distinction in one or more majors. See Rules FB8.1 and FB8.2 for distinctions in specialisations.

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 Biology:	BIO2010F; any one of BIO2011S, BIO2012S, BIO2013F, plus BIO3013F, BIO3014S
Applied Mathematics:	MAM2046W (or two of MAM2047H, MAM2048H and MAM2043S) and MAM3040W

Applied Statistics:	STA2007H/STA2020S, STA2030S, STA3030F, STA3022F/STA3036S
Archaeology:	Four senior half-courses in Archaeology
Astrophysics:	AST2002H, AST2003H, AST3002F, AST3003S
Biochemistry:	MCB2020F/MCB2021F, MCB2022S, MCB3024S, MCB3025F
Business Computing:	INF2009F, INF2011S; any two of INF3011F, INF3012S and INF3014F
Ecology & Evolution:	BIO2010F; any one of BIO2011S, BIO2012S, BIO2013F, plus BIO3015F, BIO3016S
Chemistry:	CEM2005W, CEM3005W
Computer Engineering:	EEE2040F, EEE2026S, EEE3095S
Computer Games Development:	CSC2003S; CSC3020H, CSC3022H and any one of CSC2001F, CSC2002S, INF2009F
Computer Science:	CSC2001F, CSC2002S, CSC3002F, CSC3003S
Environmental & Geographical Science:	EGS2013F and EGS2014S; any two of EGS3012S, EGS3020F, EGS3021F, EGS3022S, EGS3023F
Genetics:	MCB2020F/MCB2021F, MCB2023S, MCB3023S, MCB3026F
Geology:	GEO2001F, GEO2004S, GEO3005F, GEO3001S
Human Anatomy & Physiology:	HUB2019F, HUB2021S, HUB3006F, HUB3007S
Marine Biology:	SEA2004F, BIO2013F, BIO3002F, BIO3017S
Mathematics:	MAM2000W, MAM3000W
Mathematical Statistics:	STA2004F, STA2005S, STA3041F, STA3043S
Ocean & Atmosphere Science:	SEA2004F, SEA2005S, SEA3004F, EGS3012S
Physics:	PHY2004W (or PHY2014F and PHY2015S), PHY3004W (or PHY3021F and PHY3022S)

(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 he or she

(a) is a graduate of the Faculty of Science who has been awarded a Bachelor's degree in the discipline in which he or she proposes to proceed to Honours, or has subsequently met the conditions which would have enabled him or her to be awarded the degree in the Faculty with that subject as a discipline; or

(b) is 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) is 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.

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, he/she may, with permission of the Head of Department, register as an occasional student to complete preparatory courses. On satisfactory completion of such courses, he/she 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:

Qualification	Degree and Plan Code	Specialisations
BSc Hons	SH001MAM01	Applied Mathematics
BSc Hons	SH001AGE01	Archaeology
BSc Hons	SH001AGE02	Archaeology & Environmental Science
BSc Hons	SH001AST03	Astrophysics & Space Science
BSc Hons	SH001EGS07	Atmospheric Science
BSc Hons	SH001BIO07	Biological Sciences
BSc Hons	SH001CEM01	Chemistry
BSc Hons	SH001CSC05	Computer Science
BSc Hons	SH001EGS02	Environmental & Geographical Science
BSc Hons	SH001GEO01	Geochemistry
BSc Hons	SH001GEO02	Geology
BSc Hons	SH001CSC05	Information Technology
BSc Hons	SH001BIO05	Marine Biology
BSc Hons	SH001MAM02	Mathematics
BSc Hons	SH001MAM04	Mathematics of Computer Science
BSc Hons	SH001MCB02	Molecular & Cell Biology
BSc Hons	SH001SEA03	Ocean & Atmosphere Science
BSc Hons	SH001PHY01	Physics
BSc Hons	SH001STA04	Statistical Sciences
BSc Hons	SH001BUS01	Statistical Sciences for Actuaries

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 he or she is 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 examinations) being passed separately with a minimum of 50%.

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 he or she

(a) is the holder of an Honours degree or four year equivalent of the University or of any other university recognised by Senate for the purpose; or

(b) is 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 he or she has reached the current level in the subject or discipline equivalent to an Honours degree; or

(c) has 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 he or she is

(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 he or she has 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. Only upon acceptance by a prospective supervisor should the candidate then submit their application to the Head of the Department for approval, and an online application for admission via the Admissions Office. 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 credits, or as a coursework and minor dissertation, each 90 NQF credits.

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

Qualification	Degree and Plan Code	Specialisations
MSc/MPhil	SM001/2 MAM01	Applied Mathematics
MSc/MPhil	SM001/2 AGE01	Archaeology
MSc/MPhil	SM001/2 AST01	Astronomy
MSc/MPhil	SM001/2 BIO07	Biological Sciences
MSc/MPhil	SM001/2 CEM01	Chemistry
MSc/MPhil	SM001/2 CSC05	Computer Science
MSc/MPhil	SM001/2 CEM03	Computational Science
MSc/MPhil	SM001/2 BIO09	Conservation Biology
MSc/MPhil	SM001/2 EGS02	Environmental & Geographical Science
MSc/MPhil	SM001/2 GEO01	Geochemistry
MSc/MPhil	SM001/2 GEO02	Geology
MSc/MPhil	SM001/2 STA02	Mathematical Statistics
MSc/MPhil	SM001/2 MAM02	Mathematics
MSc/MPhil	SM001/2 MCB02	Molecular & Cell Biology
MSc/MPhil	SM001/2 SEA03	Ocean & Atmosphere Science
MSc/MPhil	SM001/2 STA03	Operational Research
MSc/MPhil	SM001/2 SEA05	Physical Oceanography
MSc/MPhil	SM001/2 PHY01	Physics
MSc/MPhil	SM001/2 STA09	Statistical Ecology
MSc/MPhil	SM001/2 PHY02	Theoretical Physics
MSc/MPhil	SM001/2 CEM02	Tertiary Chemistry Education
MSc/MPhil	SM001/2 PHY03	Tertiary Physics Education
MSc/MPhil	SM004/5 BIO11	Applied Ocean Sciences (Marine Biology)
MSc/MPhil	SM004/5 SEA07	Applied Ocean Sciences (Operational Oceanography)
MSc/MPhil	SM004/5 AST03	Astrophysics & Space Science
MSc/MPhil	SM004/5 STA10	Biostatistics
MSc/MPhil	SM004/5 EGS06	Climate Change & Sustainable Development
MSc/MPhil	SM004/5 CSC05	Computer Science
MSc/MPhil	SM004/5 BIO09	Conservation Biology
MSc/MPhil	SM004/5 STA11	Data Science
MSc/MPhil	SM004/5 STA08	Advanced Analytics
MSc/MPhil	SM004/5 EGS05	Environment, Society & Sustainability
MSc/MPhil	SM004/5 CSC06	Information Technology
MSc/MPhil	SM004/5 SEA06	Ocean & Climate Science
MPhil	SM005 EGS08	Urban Studies
MSc/MPhil	SM007/8 MAM06	Mathematical Sciences
MPhil	SM008 STA12	Data Science of Financial Technology

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 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.

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

Climate Change & Sustainable Development (African Climate & Development Initiative) [ACDI]

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 (core) courses:

Code	Course	NQF Credits	HEQSF Level
EGS5031F	Introduction to Climate Change & Sustainable Development	23	9
EGS5032F	Climate Change Adaptation & Mitigation	23	9

(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):

Code	Course	NQF Credits	HEQSF Level
AXL5408F	Tradition, Science and Environment	24	9
BIO5003Z	Biodiversity and climate change	15	9
ECO4025S	Environmental Economics	20	9
EGS5016F	Capital, Politics and Nature	23	9
EGS5023F	Research Methods for Natural Scientists	23	9
EGS5024F	Managing Complex Human Ecosystems	23	9
EGS5030S	Climate Modelling	23	9
EGS5038F	Climate Change and Predictability	23	9
EGS5039F	Urban Food Security	23	9
EGS5040F	Topics in Human and Environment Interaction	23	9
EGS5043F	Living with Global Change	23	9
EGS5045F	Geomorphology	23	9
EGS5046F	Water Resource Management	23	9
END5042Z	Sustainable Urban Systems	20	9
MEC5075Z	New and Renewable Technologies	20	9
MEC5088Z	Energy, Poverty & Development	20	9
PBL5045S	Environmental Law for Non-Lawyers	15	9

Code	Course	NQF Credits	HEQSF Level
PBL5046S	Climate, Law and Governance	15	9

(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:

Code	Course	NQF Credits	HEQSF Level
EGS5029H	Minor Dissertation (Science)	90	9
GEO5005H	Minor Dissertation (Science)	90	9
END5069W	Minor Dissertation (Engineering & Built Environment)	90	9

Urban Studies – Southern Urbanism (African Centre for Cities) [ACC]

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, at least one elective course, and a minor dissertation.

Compulsory course:

Code	Course	NQF Credits	HEQSF Level
APG5090W	City Research Studio	23	9

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

Code	Course	NQF Credits	HEQSF Level
EGS5063F	Urban Theory	23	9
EGS5062F	The Urban Everyday	23	9
APG5089S	The Arts of Space	23	9

(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 by June. 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:

Code	Course	NQF Credits	HEQSF Level
EGS5061W	Urban Studies Minor Dissertation (Science)	90	9
END5128W	Urban Studies Minor Dissertation (EBE)	90	9
	Urban Studies Minor Dissertation in the Humanities Faculty	96	9

(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.)

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 Faculty of Science Memorandum of Understanding (MoU) to be signed 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 and skills, equipment and resources required to achieve the goals stated in the research proposal. The MoU is subject to approval by the Head and Dean. Before the start of the second and subsequent years of registration, a Progress & Planned Activity (P&PA) form needs to be completed and signed 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 P&PA 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. In this context progress is relative to the stated objectives within the MoU or P&PA 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 P&PA.

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 P&PA 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 DVC 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 students will be assigned a progress of *'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 P&PA 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 students 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 DVC 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: (1) The letter of intention to submit should include the name of the supervisor(s) and the title of the dissertation. (2) 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. 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 his/her 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 <u>all</u> Master's dissertations. If a candidate contemplates doing this, he/she must note this in his/her MoU with his/her supervisor each year. In addition the candidate and supervisor are advised to seek the advice of the Faculty's Higher Degrees Committee about his/her 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 dissertation, a distinction must be obtained in both components.

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 his or her thesis for examination in the hope of the award of the degree at either the June or December graduation ceremonies, he or she must inform the Doctoral Degrees Board Office in writing of his or her intention to do so 4-6 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 Doctoral Degrees Board 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 Doctoral Degrees Board 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 his/her 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 Doctoral Degrees Board or Faculty Office. If a

candidate contemplates doing this, he/she must note this in his/her MoU with his/her supervisor each year. In addition the candidate and supervisor are advised to seek the advice of the Faculty's Higher Degrees Committee about his/her 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 his/her 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 he or she has 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 his or her fitness for the degree;

(c) must be registered for the degree for a minimum of two academic years, and for the duration of the period of examination, whichever is longer.

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 him/herself 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 three copies of all publications he or she wishes 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.*

DEPARTMENTS IN THE FACULTY

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:
S L Hall, MA *Witwatersrand* DPhil *Stell*
Professor and South African Research Chair in Stable Isotopes in Archaeology and Paleo-environments:
J C Sealy, MSc PhD *Cape Town*
Senior Scholar:
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*
Associate Professor:

Emeritus Associate Professor:
A B Smith, PhD *Berkeley*
Senior Lecturers:
R Sithaldeen, BSc Hons PhD *Cape Town* (CHED)
D D Stynder, MA PhD *Cape Town*
Lecturer:
J Wilkins, PhD *Toronto*
Senior Scientific Officer:
L Hutten, BSc Hons MSc *Pret*
Administrative Officer:
L J Cable
Laboratory Assistant:
D H Jacobs
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 palaeoecology, 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 ARCHAEOLOGY & OUR COMMON HERITAGE
18 NQF credits at HEQSF level 5
Convener: To be advised
Course entry requirements: None
Course outline:
Archaeology is the study of physical evidence left by people, from the first use of stone tools in Africa, around 3 million years ago to the complex civilizations of the more recent past. It studies our ancestor's daily lives using the physical evidence that they discarded and left behind: their tools, their houses, the remains of the meals they ate and much more. Archaeology is the only discipline that provides insight into our common heritage before written evidence. The course gives a general introduction to how archaeologists work with physical evidence by outlining some of the methods and theories they use and apply. It then summarises how this evidence contributes to our understanding of world archaeology by outlining our early physical and cultural evolution, the development of hunting and gathering, our spread around the world, the shift to farming, the innovation of writing and the rise of complex societies. The course highlights why this heritage is significant and the consequences of this significance for its management, conservation and protection.
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.

AGE1004S INTRODUCTION TO EARTH & ENVIRONMENTAL SCIENCES
18 NQF credits at HEQSF level 5
Convener: Dr R Sithaldeen
Course entry requirements: Permission of the Dean or Head of Department is required prior to registration for this course. Attendance and satisfactory performance in the practical course and each of the three fieldtrips and reports in GEO1009F. *NOTES: 1) This course is intended for students who have failed GEO1009F (see entry in Department of Geological Sciences) and have therefore been advised to register for AGE1004S. 2) The course reviews material covered in GEO1009F with sound approaches to effective learning and focuses on strengthening foundational concepts and skills. 3) AGE1004S is equivalent to GEO1009F in level, credit value towards the degree and as prerequisite for certain other courses.*
Course outline:
This course will introduce students to the structure and geological history of Earth as well as the interactions between the abiotic and biotic systems that shape the surface of the world. Human interactions with the environment are also discussed. Topics covered are solar system evolution, plate tectonics, the structure of the earth, climate-land interactions, the evolution of landscapes, biogeography, human adaptation and interaction with the natural environment.
Lecture times: Friday, 14h00 - 17h00
DP requirements: A class record of at least 40%; attendance at 80% of lectures.
Assessment: Assignments, tests and field report count 50%; one 2-hour examination written in November counts 50%. A sub-minimum of 40% is required for the final exam.

Second-Year Courses

AGE2011S HUMAN EVOLUTION

24 NQF credits at HEQSF 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 HEQSF level 6
Convener: Dr J Wilkins
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 Khoisan 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 Khoisan, 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 HEQSF level 7
Course entry requirements: 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 HEQSF level 7
Convener: Professor S Chirikure
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 use 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 HEQSF level 7
Convener: Associate Professor S Hall
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 ARCHAEOLOGY 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 HEQSF level 7
Convener: Dr 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 ARCHAEOLOGY 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 HEQSF level 8
Convener: Dr R Sithaldeen
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 AGE4005W (coursework component of 112 NQF credits) and AGE4006W (research project of 48 NQF credits).

160 NQF credits at HEQSF level 8

Convener: Dr R Sithaldeen

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 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 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 HEQSF 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 HEQSF 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:
C Carignan, MSc *Montréal* PhD *Canberra* MASSAf
UCT-UWC-SKA Chair in Radio Astronomy:
R Taylor, MSc PhD *Vancouver*
Professor:
R C Kraan-Korteweg, Diplom (MSc) *Basle* PhD Phil II *Basle* FRSSAf, MASSAf
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*
Honorary Professors:
W J G de Blok, MSc PhD *Groningen*
M W Feast, BSc Hons PhD *London* DSc (h.c) *Cape Town* ARCS DIC Assoc.RAS FRSSAf MASSAf FSAIP
P A Whitelock, DIC PhD *London* Assoc RAS FRSSAf MASSAf
SKA Visiting Professor:
R Fender, PhD *OU Milton Keynes*
Senior Lecturers:
S-L Blyth, MSc PhD *Cape Town*
K J van der Heyden, BSc Hons MSc *Cape Town* PhD *Utrecht*
Adjunct Senior Lecturer:
S Mohamed, DPhil *Oxon*
Lecturers:
B Frank, BSc Hons *Witwatersrand* PhD *Cape Town*
M L Pretorius, MSc *Cape Town* PhD *Soton*
Honorary Research Associate:
V McBride, MSc *Cape Town* PhD *Soton*
Computer System Manager:
S Funani
Administrative Officer:
C Marsh
IDIA Administrator:
N Walker
NASSP Administrator:

Administrative Assistant:
R Daniels

INTER-UNIVERSITY INSTITUTE FOR DATA INTENSIVE ASTROPHYSICS (IDIA)

The Institute, hosted in the Department of Astronomy, is a partnership between the University of Cape Town, the University of the Western Cape, North-West University and the University of Pretoria. It involves researchers in astronomy, physics, statistics and computer science at the four partner universities and the UCT eResearch Centre.

Core Members:

B Bassett (MAM), MSc *Cape Town* PhD *Trieste*
S-L Blyth (AST), MSc PhD *Cape Town*
M Bottcher (PHY-NWU), PhD *Bonn*
C Carignan (AST), MSc *Montréal* PhD *Canberra*
J W A Cleymans (PHY), MSc D en Sc *Louvain* FRSSAf
M Cluver (PHY-UWC), BSc Hons, MSc PhD *Cape Town*
R Davé (PHY-UWC), MSc *California* PhD *Santa Cruz*
T Dietel (PHY), Dipl Phys *Heidelberg* Dr phil nat *Frankfurt am Main*
M W Feast (AST; UCT/SAAO), BSc Hons PhD *London* DSc (h.c) *Cape Town* ARCS DIC Hon FRAS FRSSAf MASSAf FSAIP
R Fender (AST), PhD *OU Milton Keynes*
B Frank, BSc Hons *Witwatersrand* PhD *Cape Town*
J E Gain (CSC), MSc *Rhodes* PhD *Cantab*
T Jarrett (AST), PhD *Amherst*
R C Kraan-Korteweg (AST), Diplom (MSc) *Basle* PhD Phil II *Basle* FRSSAf, MASSAf
M Kuttel (CSC), MSc PhD *Cape Town*
M J P Lacerda (STA), MSc *Cape Town* PhD *Galway*
S Lubbe (STA), MCom PhD *Stell*
R Maartens (PHY-UWC), BSc Hons PhD *Cape Town*
P Marais (CSC), MSc *Cape Town* DPhil *Oxon*
M Santos (PHY-UWC), MSc *Cantab* PhD *Oxon*
R Simmonds (CSC), PhD *Bath*
R Taylor (AST; PHY-UWC:Director), MSc PhD *Vancouver*
C Theron (PHY-UP), PhD *Stell*
M Vaccari (PHY-UWC), MSc PhD *Padova*
K J van der Heyden (AST), BSc Hons MSc *Cape Town* PhD *Utrecht*
M Varughese (STA), BSc Hons MSc *Witwatersrand* DipAc&Tech *Edinburgh* PhD *Cape Town*
B Warner (AST), BSc Hons PhD DSc *London* MA DSc *Oxon* DSc (h.c) *Cape Town* Hon FRAS Hon FRSSAf Hon Fell *UCL*
P A Whitelock (AST; UCT/SAAO), DIC PhD *London* Hon FRAS FRSSAf MASSf
P A Woudt (AST), MSc *Groningen* PhD *Cape Town*

RESEARCH IN ASTRONOMY

Research at the Astronomy Department covers a number of distinct themes, ranging from *Galactic Composition and Stellar Evolution* (Professors Feast and Whitelock) and *Accretion Physics in Compact Stellar Binaries* (Professors Woudt, Warner and Fender and Dr Mohamed) to *Neutral Hydrogen and Dark Matter Content of Nearby Galaxies* (Professors Carignan, Jarrett, de Blok, Williams and Drs Blyth and Frank), *Star Formation and Galaxy Evolution* (Professor Kraan-Korteweg, Drs Blyth and van der Heyden) and *Large-Scale Structures of Galaxies and the Zone of Avoidance* (Professors Kraan-Korteweg and Jarrett and Dr Blyth). A new research theme in the Astronomy Department is *Cosmic Magnetism* (Professor Taylor). The department hosts numerous postdoctoral fellows working in these research themes: Drs Armstrong, Comrie, Deg, Elson, Kapala, Marchetti, Randiamanakoto,Townsend, and Zwart.

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 (e.g. electron-multiplying

CCDs). Besides leading many research projects on SALT, members of the Department of Astronomy lead four of the ten MeerKAT Large Survey Projects.

Undergraduate Courses

First-Year Courses

AST1000F INTRODUCTION TO ASTRONOMY

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

18 NQF credits at HEQSF level 5

Convener: Dr 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 HEQSF level 6

Convener: Dr B Frank

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, Wednesday and Friday, 2nd period (no Friday lecture in second semester), Tutorials: 10 Compulsory tutorial/practical sessions over the year, Wednesday, 14h00 -17h00

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

Assessment: Three class tests count 25%; 10 compulsory tutorials/practicals including a virtual observatory project, an essay and one presentation count 25%. 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 HEQSF level 6

Convener: Dr K van der Heyden

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: Tuesday and Thursday, 2nd period (no Thursday lectures in second semester), 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 HEQSF level 7

Convener: Dr M L Pretorius

Course entry requirements: AST2002H and AST2003H (or AST2002S), PHY2004W (or PHY2014F and PHY2015S), MAM2000W (or MAM2004H and MAM2047H).

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 HEQSF level 7

Convener: Professor R C Kraan-Korteweg

Course entry requirements: AST2002H and AST2003H (or AST2002S), PHY2004W (or PHY2014F and PHY2015S), 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 HEQSF level 8

Convener: Dr S L Blyth

Course entry requirements: AST3002F and AST3003S or PHY3004W (or PHY3021F and PHY3022S) 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 HEQSF 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 HEQSF 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 HEQSF level 9
Convener: Dr S L Blyth
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 HEQSF level 9
Convener: Dr B Frank
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 HEQSF 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 HEQSF 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 Animal Demography Unit may be reached on telephone (021) 650-2423
The Percy Fitzpatrick Institute for 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:
A M Muasya, MPhil *Moi* PhD *Reading*
Leslie Hill Professor of Plant Conservation:
M T Hoffman, BSc Hons PhD *Cape Town*
Pola Pazvolsky 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*
T A Hedderson, MSc *Memorial* PhD *Reading*
J J Midgley, BSc Hons PhD *Cape Town*
M J O'Riain, BSc Hons PhD *Cape Town*
P G Ryan, MSc PhD *Cape Town*
Senior Scholars:
J J Bolton, BSc Hons PhD *Liverpool*
G M Branch, BSc Hons PhD *Cape Town* FRSSAf
G Gäde, MSc PhD *Munster*
C L Griffiths, BSc Hons *Soton* PhD *Cape Town*
L G Underhill, MSc PhD *Cape Town*
Emeritus Professors:
W J Bond, BSc Hons *Exeter* MSc *Cape Town*
T M Crowe, MSc *Chicago* PhD *Cape Town*
W R Siegfried, PhD *Cape Town*
Honorary Professors:
R M Cowling, BSc Hons PhD *Cape Town*
D H M Cumming, BSc Hons PhD *Rhodes*
L Hutchings, BSc Hons PhD *Cape Town*
H P Linder, BSc Hons PhD *Cape Town*
Associate Professors:
A D Amar, BSc Hons *Newcastle* PhD *Aberdeen*
C Attwood, BSc Hons PhD *Cape Town*
M D Cramer, MSc *Witwatersrand* PhD *Cape Town*
E C February, BA (Hons) PhD *Cape Town*
L Gillson, MSc *Imperial* DPhil *Oxon*
C L Moloney, BSc Hons PhD *Cape Town*
M D Picker, BSc Hons PhD *Witwatersrand*
G A Verboom, BSc Hons PhD *Cape Town*
A G West, MSc *Cape Town* PhD *Utah*
South African Research Chair in Animal Evolution and Systematics:
D S Jacobs, BSc Hons *Cape Town* PhD *Hawaii*
South African Research Chair in Marine Ecology & Fisheries:
A Jarre, MSc *Kiel* PhD *Bremen*

Emeritus Associate Professors:
J A Day, BSc Hons PhD *Cape Town*
J H Hoffmann, MSc PhD *Rhodes*
J U M Jarvis, MSc *Cape Town* PhD *East Africa* FRSSAf
Honorary Associate Professor:
R J Anderson, BSc Hons *Witwatersrand* PhD *Cape Town*
Senior Lecturers:
J M Bishop, BSc Hons *King's College London* PhD *Cape Town*
G N Bronner, MSc PhD *Natal*
S B M Chimphango, MSc *Malawi* PhD *Cape Town*
R Kelly-Laubscher, BSc PhD *UCC*
H Marco, BSc Hons PhD *Cape Town*
D Pillay, BSc Hons PhD *UKZN*
C C Reed, MSc PhD *UFS*
R L Thomson, MSc PhD *Oulu*
Lecturers:
S J Cunningham, BSc *Victoria* PhD *Massey*
M C Lewis, PhD *Cape Town*
Honorary Research Associates:
R G Barlow, PhD *Cape Town*
N G Bergh, BSc Hons PhD *Cape Town*
P J Carrick, PhD *Cantab*
O E Curtis, PhD *Cape Town*
H Dallas, BSc Hons *Rhodes* MSc PhD *Cape Town*
D Ghebrehiwet, MSc PhD *Cape Town*
R Govender, PhD *Witwatersrand*
H J Hawkins, BSc Hons MSc *Cape Town* PhD *Germany*
J A Huggett, PhD *Cape Town*
S E Kerwath, MSc *Erlangen* PhD *Rhodes*
C Klak, BSc Hons PhD *Cape Town*
K Ludynia, PhD *Germany*
C L Lyons, PhD *Stellenbosch*
B M Macey, PhD *Cape Town*
H Malan, PhD *Cape Town*
L Mattio, BSc Hons *Napier* MSc PhD *Marseille*
B M C J Paterson, MA *Aachen* PhD *Cape Town*
M Pfaff, PhD *Cape Town*
G C Pitcher, PhD *Cape Town*
T Samaai, PhD *UWC*
C Savage, BSc Hons *Cape Town* PhD *Stockholm*
A H W Seydack, BSc Hons PhD *Stell*
K J Sink, PhD *Cape Town*
J A Slingsby, BSc Hons PhD *Cape Town*
C H Stirton, PhD *Cape Town*
C D van der Lingen, PhD *Cape Town*
H Van der Merwe, PhD *Pret*
H M S M Verheye, PhD *Cape Town*
Honorary Research Affiliates:
A C Bastian, PhD *doctor rerum naturaliumGermany*
M D Cyrus, PhD *Cape Town*
M D Rothman, PhD *Cape Town*
Postdoctoral Fellows:
D Bolopo, PhD *Valladolid Spain*
A Coetzee, PhD *Stell*

T Elliott, PhD *Montreal*
P Laver, PhD *Virginia*
S. Miller, PhD *Tshwane*
S Moyo, PhD *Rhodes*
S M Murgatroyd, PhD *Cape Town*
S T Osinubi, PhD *Canterbury*
R Powell, PhD *UWC*
M Rat, PhD *Cape Town*
C Reynolds, PhD *Cape Town*
E L Rocke, PhD *Hong Kong*
P Sumasgutner, PhD *Vienna*
M Tafani, PhD *Lyon*
F G Weller, PhD *Munich*
Director: Organisation for Tropical Studies South Africa Programmes
L Kruger, MSc PhD *Cape Town*
Principal Scientific Officer:
D Hattas, B Tech *Cape Tech* MSc *UWC* PhD *Cape Town*
Principal Technical Officers:
G A Aguilar, MSc *Chile*
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:
N Jodamus
A Stain
Senior Secretaries:
S Abrahams
J Cupido
Departmental Assistants:
Z Jikumlambo
B Marope, BSc Hons *North-West*
B Tom

BOLUS HERBARIUM
Director:
A M Muasya, MPhil *Moi* PhD *Reading*
Keeper:
J J Midgley, BSc Hons PhD *Cape Town*
Curator/Principal Scienctific Officer:
T H Trinder-Smith, BSc Hons MSc *Cape Town*
Principal Scientific Officer (part-time):
C Klak, BSc Hons PhD *Cape Town*
Librarian:
A K Gebregziabher, BSc *Asmara* MSc *Stell*
Bolus Herbarium Administrative Assistant:
C J Christians

THE PERCY FITZPATRICK INSTITUTE OF AFRICAN ORNITHOLOGY

Professor and Director:
P G Ryan, MSc PhD *Cape Town*
Pola Pazvolsky Chair of Conservation Biology:
C Spottiswoode, BSc Hons *Cape Town* PhD *Cantab*
Emeritus Professors:
T M Crowe, MSc *Chicago* PhD *Cape Town*
W R Siegfried, PhD *Cape Town*
Honorary Professor:
D H M Cumming, BSc Hons PhD *Rhodes*
Associate Professor:
A D Amar, BSc Hons *Newcastle* PhD *Aberdeen*
Senior Lecturer:
R L Thomson, MSc PhD *Oulu*
Lecturer:
S J Cunningham, BSc *Victoria* BSc Hons PhD *Massey*
Manager, Centre of Excellence:
R M Little, PhD *Cape Town*
Honorary Research Associates:
P Barnard, MSc *Witwatersrand* PhD *Upsala*
R Covas, MSc *Lisbon* PhD *Cape Town*
G S Cumming, PhD *Oxford*
T Flower, PhD *Cantab*
D Grémillet, PhD *Kiel*
K Maciejewski, PhD *NMMU*
A R Ridley, PhD *Cantab*
R Simmons, MSc *Acadia* PhD *Witwatersrand*
R Wanless, PhD *Cape Town*
Research Affiliates:
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*
A Jenkins, PhD *Cape Town*
M G Jones, PhD *Cape Town*
G Joseph, PhD *Cape Town*
A T K Lee, PhD *Manchester*
I T Little, PhD *Cape Town*
A Makhado, PhD *Cape Town*
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*
L Pichegru, PhD *Strasbourg*
P Pistorius, PhD *NMMU*
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*

J K Turpie, PhD *Cape Town*
Principal Technical Officer:
G A Aguilar, MSc *Chile*
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S Mvungi, BEng *Lesotho* MLib&InfoSci *Cape Town*
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H Buchanan, BA HDip Lib *Cape Town*
A Links
Senior Secretary:

PLANT CONSERVATION UNIT
Professor and Director:
M T Hoffman, BSc Hons PhD *Cape Town*
Associate Professor and Deputy Director:
L Gillson, BA *Oxon* MSc *Imperial* DPhil *Oxon*

ANIMAL DEMOGRAPHY UNIT
Director:
L G Underhill, MSc PhD *Cape Town*
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R J M Crawford, MSc PhD *Cape Town*
Honorary Research Associates:
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R J M Crawford, PhD *Cape Town*
M de Villiers, PhD *Pret*
S Kirkman, PhD *Cape Town*
M Remisiewicz, PhD *Gdansk Poland*
Senior Scientific Officer:
R A Navarro, MSc *Austral de Chile* PhD *Cape Town*
Research Assistants:
M Brooks, Nat. Dipl in Conservation *Cape Tech*
H D Oschadleus, MSc PhD *Cape Town*
Administrative Assistant:
S Kuyper, BA *Natal* HDLS *Unisa*

INSTITUTE FOR COMMUNITIES AND WILDLIFE IN AFRICA
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Professor N Nattrass, PhD *Oxford*
Associate Professor:
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B Conradie, PhD *Colorado*
Senior Lecturers:
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Honorary Research Associates:
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C Barichievy, PhD *Wits*
A Kock, PhD Cape Town
G Mann, PhD *Rhodes*
R Pitman, PhD *UKZN*
P Richardson, PhD *Oxford*

SEAWEED RESEARCH UNIT
DEPARTMENT OF AGRICULTURE, FORESTRY & FISHERIES (DAFF)
Honorary Associate Professor and Head:
R J Anderson, BSc Hons *Witwatersrand* PhD *Cape Town*
Oceanographic Researcher:
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: Dr SBM Chimphango (nitrogen fixation and agriculture), Associate Professor MD Cramer (carbon-nitrogen interactions, nutritional physiology), Associate Professor EC February (plant water relations, anthropogenic impacts), Dr HG Marco (crustacean neuroendocrinology) Dr AG West (impacts of climate change, drought), Emeritus Professor G Gäde (invertebrates, neuropeptides).
Evolution and Systematics: Dr JM Bishop (evolutionary genetics, phylogeography), Dr G Bronner (micromammal systematics, conservation biology), Professor A Chinsamy-Turan (palaeobiology, vertebrate bone & teeth histology), Associate Professor D Jacobs (SARChI Chair, animal evolution and systematics, biology & behaviour of bats), Professor TA Hedderson (molecular ecology, bryophytes), Associate Professors AM Muasya (wetlands and Cyperaceae, Fabaceae) and GA Verboom (evolutionary ecology, speciation, Cape flora).
Ecology and Behaviour: Emeritus Associate Professor JA Day (fresh water ecology & conservation), Associate Professor EC February (savannas, Cape flora), Associate Professor L Gillson (long-term ecology, conservation), Associate Professor JH Hoffmann (bio-control, plant-insect interactions), Professor MT Hoffman (historical ecology, rangelands), Professor JJ Midgley (ecosystem dynamics, plant-animal interactions), Professor MJ O'Riain (behavioural ecology, human-wildlife conflict solutions), Associate Professor MD Picker (insect ecology & biodiversity), 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).
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, fisheries), Dr 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, marine mammals), Professor C Spottiswoode (evolution, ecology and conservation), Dr RL Thomson (behavioural ecology).

The department is also home to the following research entities:

The Animal Demography Unit*:* Animal population dynamics, distributions and conservation with a focus on long-term monitoring and statistical modelling (Director: Emeritus Professor LG Underhill)
The Bolus Herbarium: Taxonomy of the Cape Flora (Curator: T Trinder-Smith)
The Institute for Communities and Wildlife in Africa (Director: Professor MJ O'Riain)
The Percy FitzPatrick Institute of African Ornithology*:* Avian Conservation Biology and Evolutionary Ecology (Director: Professor PG Ryan)
The Plant Conservation Unit: Plant ecology and conservation with an emphasis on long-term ecology and the Cape Flora (Director: Professor MT Hoffman, Leslie Hill Chair of Plant Conservation)
The Seaweed Research Unit of the Department of Agriculture, Forestry & Fisheries (Head: Associate Professor RJ Anderson)

Undergraduate Courses

First-Year Courses

BIO1000F CELL BIOLOGY
18 NQF credits at HEQSF level 5
Convener: Professor T A Hedderson
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 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.
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 at 70% of the practicals and a minimum of 35% for the class record.
Assessment: Class record counts 45% (three class tests count 27% and a practical book mark of 18%); one practical paper counts 15%; one 2-hour examination paper written in June counts 40%. A subminimum of 40% is required in the June examination.

BIO1000H CELL BIOLOGY
18 NQF credits at HEQSF level 5
Convener: Dr R Kelly-Laubscher
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 forBIO1000F). 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 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.

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

DP requirements: Attendance of all lectures and practicals, completion of the project and a minimum of 35% for the class record.

Assessment: Class record counts 45% (four class tests count 27% and a practical book mark of 18%); one practical examination counts 15%; one 2-hour examination paper written in November counts 40%. A subminimum of 40% is required in the November examination.

BIO1004F/S 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 HEQSF level 5

Convener: Professor A Chinsamy-Turan and Associate Professor E C February

Course entry requirements: BIO1000F or BIO1000H, 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: BIO1004F, one practical per week, Thursday, 14h00 - 17h00, BIO1004S, 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, an average of 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%), practicals (10%), field trip report (group mark, 6%) Examination 60%. One 2-hour theory examination (written in June for BIO1004F, written in November for BIO1004S) counts 40% (subminimum of 40% applies); one 1.5-hour practical examination (written in June for BIO1004F, written in November for BIO1004S) counts 20%.

Second-Year Courses

BIO2010F PRINCIPLES OF ECOLOGY AND EVOLUTION
A compulsory weekend fieldtrip
24 NQF credits at HEQSF level 6
Convener: Associate Professor G A Verboom
Course entry requirements: BIO1000F or BIO1000H, BIO1004F/S, DP for STA1007S
Course outline:
This course examines how species evolved and adapted to the environments in which they live. Topics include an introduction to evolution; natural selection; inheritance and genetics; ecology at the community, population and individual levels; and an introduction to plant-animal interactions. The formal lectures and practicals are supported by a two-day compulsory field camp.
Lecture times: Monday - Friday, 1st period, Practicals: One per week, Monday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: 40% for class record, submission of assignments on schedule, and attendance at a weekend field camp.
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 20%; project based on field camp data collection counts 10%; two class tests count 20%.

BIO2011S LIFE ON LAND: ANIMALS
A compulsory fieldtrip during the September vacation.
24 NQF credits at HEQSF level 6
Convener: Dr G Bronner
Course entry requirements: BIO1000F or BIO1000H, BIO1004F/S.
Course outline:
This course familiarises students with the evolution, functional biology and physiology of invertebrates and vertebrate animals living in terrestrial environments. It covers the diversity and life styles of land animals (particularly myriapods, arachnids, insects and tetrapod vertebrates), and pays special attention to the major adaptations required for life on land.
Lecture times: Monday - Friday, 3rd period, Practicals: One per week, Monday, 14h00 - 17h00 (some repeated Tuesday, 14h00 - 17h00). Attendance is compulsory for all lectures and practicals.
DP requirements: Attendance of at least 80% of lectures and 100% of practicals; 40% for class record; submission of assignments on schedule and attendance at a 4 day field camp held during the September vacation.
Assessment: A 3-hour theory and practical examination written in November, with a subminimum of 40% will count 50% of the course mark. Coursework marks will be allocated as follows: Practical classes (assessed weekly) count 15%; project based on field camp data counts 15%; two class tests together count 20%.

BIO2012S LIFE ON LAND: PLANTS
A compulsory five-day field excursion.
24 NQF credits at HEQSF level 6
Convener: Dr S B M Chimphango
Course entry requirements: BIO1000F or BIO1000H, BIO1004F/S
Course outline:
Terrestrial plants inhabit a broad range of environments, that are distinguished by their abiotic (e.g. light, temperature, water, nutrients) and biotic (e.g. animals, plants, microbes) features. Adaptation to contrasting habitats has generated a diversity of form in plants, as well as a fascinating array of ecophysiological and ecological strategies. Starting with roots, stems and leaves, and finishing with reproductive structures (flowers and seeds) and life-histories, this course explores plant structure and function, and the manner in which this has changed through the course of evolutionary history. This

is followed by an introduction to the diversity of vascular plants, with an emphasis on flowering plants, particularly those that typify the Cape flora. Finally, the biology of bryophytes (mosses and relatives) is considered, highlighting the very different solutions they employ for a life on land.
Lecture times: Monday - Friday, 2nd period, Practicals: One per week, Thursday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: Minimum of 40% for class record and attendance at practicals and five-day field camp.
Assessment: A 3-hour examination written in November, with a subminimum of 40%, will count 50% of the course. Coursework marks will be allocated as follows: Practical classes (assessed weekly) count 20%, project based on field camp data collection counts 10%; two class tests count 20%.

BIO2013F LIFE IN THE SEA
A compulsory four-day fieldtrip during the April vacation.
24 NQF credits at HEQSF level 6
Convener: Dr D Pillay
Course entry requirements: BIO1000F or BIO1000H, BIO1004F/S, DP for STA1007S
Course outline:
The Life in the Sea course is intended to introduce students to the diversity of life present in oceans, including the invertebrates, vertebrates and plants. It will focus on adaptations of form to function (locomotion, reproduction, feeding) and to habitat (rocky shore, open ocean, sedimentary). The course is also intended to familiarise students with biophysical processes that influence life in the oceans.
Lecture times: Monday - Friday, 3rd period, Practicals: Wednesday, 14h00 - 17h00. Attendance is compulsory for all lectures and practicals.
DP requirements: 50% for class record; submission of assignments on schedule; attendance at field camp.
Assessment: A 3-hour examination, written in June, with a subminimum of 40% will count for 50% of the course. Coursework marks will be allocated as follows: Practical classes (assessed weekly) count 20%; project counts 10%; two class tests count 20%.

Third-Year Courses

BIO3002F MARINE ECOSYSTEMS
A compulsory five-day field camp during first semester
36 NQF credits at HEQSF level 7
Convener: Associate Professor C L Moloney
Course entry requirements: SEA2004F, BIO2013F
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; 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: 40% for class record; submission of assignments on schedule and attendance at field camp.
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 20%; research project counts 15%; two class tests count 15%.

BIO3013F GLOBAL CHANGE ECOLOGY
36 NQF credits at HEQSF level 7
Convener: Associate Professor A G West
Course entry requirements: BIO1000F or BIO1000H, 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: 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%.

BIO3014S CONSERVATION: GENES, POPULATION & BIODIVERSITY
36 NQF credits at HEQSF level 7
Convener: Associate Professor L Gillson
Course entry requirements: BIO2010F
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, the role of life history, behaviour in the management of populations in the real world is covered. 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: Submission of assignments by due date and 50% subminimum.
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%.

BIO3015F ECOLOGY

This course is a residential two week field course, occurring before term starts. During term time further lectures and various assignments need to be completed.

36 NQF credits at HEQSF level 7

Convener: Associate Professor M D Cramer

Course entry requirements: BIO2010F

Course outline:

This course concerns advanced topics in African terrestrial ecology. We span variation in scale, from local community ecology (such as of freshwaters) to ecosystem ecology (such as the dynamics of fynbos, forest and savanna). We focus on plants and animals, as well as their interactions. Important environmental factors (such as soil, climate and water) are also considered. Some further topics that are dealt with are biogeochemistry (from geology and nutrients to plant and animal distributions), disturbance and succession (such as the role of fire and herbivory), patterns and causes of animal and plant distributions and of species richness. The course is fieldwork-orientated with a two-week fieldtrip before the first semester starts. This provides ample opportunity for lectures as well as studying plants, animals, their interactions and the role of local environments. During the rest of the semester emphasis is placed on completing practical assignments, with only a limited number of lectures/tutorials.

Lecture times: Monday - Friday, 5th period. Attendance is compulsory for all lectures and practicals.

DP requirements: A minimum of 40% for class record, attendance of two week field camp.

Assessment: A 3-hour examination written in June will count for 50% of the course with a sub-minimum of 40%. Coursework marks will be allocated as follows: Practical and project work counts 40%; one class test counts 10%.

BIO3016S EVOLUTIONARY BIOLOGY

A compulsory weekend fieldtrip.

36 NQF credits at HEQSF level 7

Convener: Professor J J Midgley

Course entry requirements: BIO2010F

Course outline:

This course deals with the description and analysis of biodiversity and evolution at the species level and above. The course begins by considering the nature and definition of species, the processes by which new species arise in nature (speciation), and the data and procedures employed in the practical discovery and description of previously-undescribed species. Thereafter, the focus shifts to the inference of evolutionary relationships amongst populations and species, with an emphasis on the types of data and the analytical methods employed. Following on from this, the course explores macroevolutionary approaches to the study of adaptation, key innovation and lineage diversification (radiation), and approaches employed in studying the genetic mechanisms that underpin adaptation and species radiation. The course concludes with an exploration of selected ‘big’ questions in evolutionary biology, such as the coevolution (mutualism, parasitism), evolution of sex and the evolution of cooperative behaviour.

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: Minimum of 40% for class record and attendance at weekend field camp.

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 based on field camp data collection counts 15%; two class tests count 15%.

BIO3017S MARINE RESOURCES
36 NQF credits at HEQSF level 7
Convener: Associate Professor C G Attwood
Course entry requirements: BIO2013F
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 theory and practise.
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: 50% for class record; attendance of 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 class tests count 20%.

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 HEQSF level 8
Convener: Associate Professor C G Attwood and Dr J M Bishop
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.
Assessment: Two 3-hour examinations written in November count 20%; project and research seminar counts 40%; compulsory coursework counts 20%; elective coursework counts 20%. The non-project component of the course carries a sub-minimum of 50% and the project component a sub-minimum of 50%. 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 HEQSF level 8
Convener: Associate Professor C G Attwood and Dr J M Bishop
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 undergrad 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.
Assessment: Two 3-hour examinations written in November count 20%; project and research seminar counts 40%; compulsory coursework counts 20%; elective coursework counts 20%. The non-project component of the course carries a sub-minimum of 50% and the project component a sub-minimum of 50%. 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.
90 NQF credits at HEQSF 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 accord with the normal pursuit of that degree at UCT. A handbook of postgraduate studies is available from the Percy Fitzpatrick Institute's website: www.fitzpatrick.uct.ac.za.
90 NQF credits at HEQSF 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 HEQSF 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 HEQSF 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 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.
0 NQF credits at HEQSF level 9
Convener: Associate 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: A 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. 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.
Assessment: To qualify for the Master's degree, 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 supplementary evaluation may be conceded if the aggregate mark is between 40% and 50%. A composite grade of the performance on the coursework component as a whole will be reflected against the assessment course 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 HEQSF 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 Research Institute).

BIO5014F APPLIED MARINE BIOLOGY
50 NQF credits at HEQSF 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 Research Institute).

BIO5015W APPLIED OCEAN SCIENCES MINOR DISSERTATION
Students will enrol (and pay fees) for both courses BIO5012Wand 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 HEQSF level 9
Convener: Associate 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.

BIO6002W CONSERVATION BIOLOGY THESIS
360 NQF credits at HEQSF 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 HEQSF 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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Jamison Professor of Inorganic Chemistry:
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S A Bourne, BSc Hons PhD *Cape Town* CChem FRSC MSACI
South African Research Chair in Drug Discovery:
K Chibale, BScEd *Zambia* PhD *Cantab* FRSC FRSSAf
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D C Brooks
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Departmental Assistants:
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N Ngqanya
K M Sigam
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Workshop Assistant:

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Administrative Officer:
K Badenhorst

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 glycobiology. 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 co-ordination 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 cocrystals. 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 glycobiology 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 HEQSF 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.

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 45% is required in the final examination.

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 HEQSF level 5

Convener: To be advised

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.

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 HEQSF level 5
Convener: Associate Professor A T Hutton
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, 4th period. Tutorials: Thursday, 4th period. 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 45% 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 HEQSF 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. Six tutorials by arrangement. Practicals, EBE: Tuesday, 14h00 - 17h00; Science: Thursday, 14h00 - 17h00.
DP requirements: Attendance and completion of practicals, tests and tutorial exercises; minimum 50% for the practicals and tutorial exercises; minimum average of 45% for class tests.
Assessment: The class record (comprising tests and practicals) counts 50%; one 3-hour examination written in November counts 50%. The class record consists of two class tests (2 x 5%), one 2-hour June test counts 15%, tutorials count 5% and practicals count 20%. A subminimum of 45% is required in the final examination.

Third-Year Courses
CEM3005W is the required course for students completing a major in Chemistry.

CEM3005W CHEMISTRY 3005
72 NQF credits at HEQSF level 7
Convener: Professor R Hunter
Course entry requirements: CEM2005W (or CEM2007F and CEM2008S), 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 of 45% is required in the final examination.

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 HEQSF level 8
Convener: Professor T J Egan
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.

CEM5000W CHEMISTRY DISSERTATION

180 NQF credits at HEQSF 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.

CEM5002W COMPUTATIONAL SCIENCE DISSERTATION
180 NQF credits at HEQSF 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.

CEM5004W TERTIARY CHEMISTRY EDUCATION DISSERTATION
180 NQF credits at HEQSF 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 HEQSF 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 HEQSF 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 HEQSF 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 Fax (021) 650-3551
The Departmental abbreviation for Computer Science is CSC.

Associate Professor and Head of Department:
H Suleman, MSc *UDW* PhD *Virginia Tech*
Professors:
J E Gain, MSc *Rhodes* PhD *Cantab*
T Meyer, MSc *RAU* PhD *Unisa*
R Simmonds, BSc PhD *Bath*
Adjunct Professor:
A C M Hutchison, MSc HDE (PG) Sec *Cape Town* PhD *Zurich*
Honorary Professors:
M Jones, BSc Hons *London* PhD *Cantab*
Y Rogers, BA (Hons) *Wales* MSc *London* PhD *Wales*
Associate Professors:
S Berman, BSc *Rhodes* MSc PhD *Cape Town*
M Kuttel, MSc PhD *Cape Town*
P C Marais, MSc *Cape Town* DPhil *Oxon*
D Moodley, MSc *UNP* PhD *UKZN*
Senior Lecturers:
M Densmore, BA *Cornell* MSc *UCL* PhD *Berkeley*
B DeRenzi, BS UC *Santa Barbara* MSc PhD *University of Washington*
M Keet, BSc Hons *OU* MSc *Wageningen* MA *Limerick* PhD *Bozen-Bolzano*
G Nitschke, BSc Hons *Curtin* PhD *VU Amsterdam*
G Stewart, BSc Hons *Cape Town*
Adjunct Senior Lecturer:
D Johnson, BEng *Cape Town* MEng *Pret* PhD *Santa Barbara*
Lecturer:
A Safla, MSc *UKZN*
Computer System Managers:
C Balfour, BSocSc *Cape Town* BA (SS) Hons *Unisa*
S Chetty, IT Management Cert *Cape Town*
Senior Scientific Officer:
S Jamieson, MSc *London*
Administrative Officer:
S Valley
Administrative Assistant:

Senior Secretary:
T Jenneker
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 by writing to the department or on the Departmental Web pages.
CENTRE FOR ARTIFICIAL INTELLIGENCE RESEARCH (Director: Professor T Meyer, Deputy 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 (Director: Professor Edwin Blake, Acting Director Dr Melissa Densmore). 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 will design, create and evaluate technologies that address the needs of the developing world and the people who live there.
COLLABORATIVE VISUAL COMPUTING (Co-ordinator: Professor J Gain). Topics of research include: Collaborative Virtual Environments; Usability and Human-Computer Interaction; Computer Graphics; Image Analysis applied to Medical Images; Virtual Reality and Behavioural Therapy; allowing end-users to create interesting virtual environments; Interaction with Mobile Computing Devices; Scalable Interfaces; and implications of these for Government Information Technology Policy. Special interests within the CVC lab include Socially Aware Computing, VR Methodology, Virtual Environments, Modelling and Procedural Graphics.
DIGITAL LIBRARIES (Co-ordinator: Associate Professor H Suleman). Research areas covered within digital libraries include information storage and retrieval; multilingual retrieval; Web-based systems; scalable and flexible repositories; interoperability and protocols; component-based systems; Open Access; and cultural heritage preservation.
HIGH PERFORMANCE COMPUTING (Co-ordinator: Associate Professor M Kuttel). This laboratory investigates aspects of high performance and high throughput computing, including: parallel algorithms; computational science; high performance visualisation; software optimisation; and multi-core and GPU programming.
HUMAN-COMPUTER INTERACTION (Co-ordinators: Dr Melissa Densmore and Dr Brian DeRenzi). 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, 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.
NETWORK AND INFORMATION SECURITY (Co-ordinator: Professor A Hutchison). Computer Network Security: 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-ordinator: Dr David L Johnson). This group focuses on Dynamic Spectrum Access and Wireless Mesh Networks for low-cost wireless back-haul infrastructure, and local cloudlet services to provide low cost, low latency access to local content. Our work involves a mix of creating solutions using network theory and systems combined with trial networks that provide tangible measurable results.

Undergraduate Courses

Credit will not be given for CSC1015F 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 HEQSF 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, Practicals: 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 HEQSF 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.

CSC1015F COMPUTER SCIENCE 1015

18 NQF credits at HEQSF level 5
Convener: To be advised
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.
Lecture times: 4th or 5th period daily, 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.

CSC1016S COMPUTER SCIENCE 1016
18 NQF credits at HEQSF level 5
Convener: To be advised
Course entry requirements: CSC1015F (or supplementary exam 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 HEQSF level 6
Convener: Associate Professor S Berman
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 HEQSF level 6

Convener: Associate Professor S Berman

Course entry requirements: CSC2001F (or supplementary exam for CSC2001F)

Course outline:

The goal of this course is to complete the basic education of a Computer Scientist. 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.

CSC2003S COMPUTER GAMES

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 HEQSF level 6

Convener: Associate Professor S Berman

Course entry requirements: CSC2001F (or supplementary exam for CSC2001F)

Course outline:

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 games. The course begins with a basic introduction to games and game genres for students unfamiliar with gaming, before exploring the game development process. Appropriate terminology, methods, and tools for computer game development are introduced. Fundamental algorithms for 2D game development and implementation are covered, including pathfinding algorithms suited to tile-based games. Text-based games are also briefly explored using Inform7. This is a practical course where students design and implement a game using LibGDX, a Java-based game engine. The final deliverable is a fully functional 2D game which implements many of the techniques explored in lectures.

Lecture times: Monday - Friday, 3rd period, 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, practical test and projects 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 HEQSF level 6

Convener: Associate Professor S Berman

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%

CSC2005Z INDEPENDENT RESEARCH IN COMPUTER SCIENCE
24 NQF credits at HEQSF level 6
Convener: Associate Professor H Suleman
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%

Third-Year Courses

CSC3002F COMPUTER SCIENCE 3002
36 NQF credits at HEQSF level 7
Convener: Professor T Meyer
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.

CSC3003S COMPUTER SCIENCE 3003
36 NQF credits at HEQSF level 7
Convener: Professor T Meyer
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 examination.

CSC3020H THREE DIMENSIONAL & DISTRIBUTED GAMES DESIGN
36 NQF credits at HEQSF level 7
Convener: Associate Professor D Moodley
Course entry requirements: CSC2001F, CSC2002S, CSC2003S and ((MAM1004F+MAM1008S) or MAM1000W). CSC2004Z is required if CSC2002S was passed after 2017.
Course outline:
This course covers design and development of simple 3D and networked games. The course describes the game development processes and introduces key terminology, methods, and tools of computer gaming. It includes Game Design, 3D Computer Graphics and software agents that can adapt to uncertain and constantly changing gaming environments, as well as techniques for multi-user and distributed games. This is a practical course: students collaborate with designers and artists to produce a full 3D multi-play game which builds on concepts covered in lectures.
Lecture times: CSC3020H and CSC3022H together occupy 3rd period daily, Practicals: 4 hours 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

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CSC3022H C++ WITH APPLICATIONS
36 NQF credits at HEQSF level 7
Convener: Associate Professor D Moodley
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 a practical exploration of topics in machine learning using C++. Students learn how to use features such as templates and basic concurrency, and a detailed treatment of the C++ memory model is also covered. A number of machine learning algorithms are introduced and students implement a subset of these in C++. By the end of the course, students should understand how to write efficient object oriented programs in C++, be familiar with major categories of learning algorithms, and be able to select and implement the most appropriate algorithm for a given problem.
Lecture times: CSC3020H and CSC3022H together occupy 3rd period daily, Practicals: 4 hours 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.

EEE3095S EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS
18 NQF credits at HEQSF level 7
Convener: Dr S Winberg
Course entry requirements: EEE2050F
Course outline:
This course focuses on embedded systems and computer architecture, covering embedded operating systems, theory and practices for the design and analysis of computer architecture and an

introduction to Hardware Description Language (HDL) programming. This course builds on Embedded Systems I course. The course is split into two parts. Part 1 (10 credits) concerns the design process, modelling and analysis of embedded systems designs, the structure of an operating systems, cross-compiling toolchains, and relevant related theories. Techniques for execution time analysis, resource control protocols, and methods for modelling and simulation of computer systems are studied. Practicals concern using and embedded operating system, cross-compiling applications, and using a single board computer embedded platform. Part 2 (6 credits) introduces HDL programming and techniques and tools for developing gateware and simulating designs. A mini-project (Project A) is performed which involves implementing a state machine and performing thorough analysis of its design and performance. A significant computer system design project (Project B) that counts 2 credits is to be completed by computer science students.
Lecture times: Mon, Tue, Wed, Thu 5th period
DP requirements: Completion of all practical assignments as well as both projects. Minimum 50% for the weighted sum of practicals and project marks.
Assessment: Practicals (14%); ProjectA (10%); ProjectB (11%); Tests (15%); Exam (50%)

Postgraduate Courses

CSC4000W COMPUTER SCIENCE HONOURS
Since the code CSC4000W will not carry a NQF credit value, students will be concurrently registered for CSC4001W (coursework component of 100 NQF credits) and CSC4002W (research project of 60 NQF credits). Combined entry to CSC4000W and CSC4016W is limited to 45 students and admission is on a competitive basis. 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.
160 NQF credits at HEQSF level 8
Convener: Associate Professor M Kuttel
Course entry requirements: Students must have a BSc degree in Computer Science from UCT, with an average of at least 60% in CSC3002F and CSC3003S
Course outline:
The modules offered may vary from year to year but will typically be a selection from: Research Methods (compulsory), New Venture Planning (compulsory), Functional Programming (compulsory), Compiler Construction 1 and 2 (compulsory), Big Data Management and Analysis, Human Computer Interaction, Artificial Intelligence, Network Security, Computer Game Design, High Performance Computing. Some courses may also be taken from other departments, with approval of the Honours course convener. A major research project makes up 60 credits and the remaining 100 credits is calculated from the coursework modules. A pamphlet outlying the year's programme is available from the Department (and at http://www.cs.uct.ac.za/teaching)
DP requirements: Students will only be allowed to proceed with the second semester if, by the end of the first semester, they have an overall average of 50% in their coursework having gained credit for at least 60 credits of coursework (including compulsory modules).
Assessment: Project mark counts 38% of the total (60 credits). The remaining 62% of the mark (100 credits) is calculated from the best modules taken. They must include Research Methods and New Venture Planning. No module will be considered for course credits unless a student has obtained at least 40% in that module. Subminima: At least 50% must be achieved in the Project. At least 40% must be achieved in the Research Methods and New Venture Planning modules. An average mark of at least 50% must be attained in the modules making up the best 100 course credits. The final mark, calculated as explained above, must not be less than 50%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code CSC4000W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

CSC4016W INFORMATION TECHNOLOGY HONOURS

Since the code CSC4016W will not carry a NQF credit value, students will be concurrently registered for CSC4017W (coursework component of 100 NQF credits) and CSC4018W (research project of 60 NQF credits). Combined entry to CSC4000W and CSC4016W is limited to 45 students

160 NQF credits at HEQSF level 8

Convener: Associate Professor M Kuttel

Course entry requirements: Entrance requirement is a Bachelor's degree with a major in Computer Science or related field. Students must have an average of at least 60% in the major. Priority will be given to students meeting the requirements for CSC4000W. 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. 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.

Course outline:

The modules offered may vary from year to year but will typically be a selection from: Research Methods (compulsory), New Venture Planning (compulsory), Functional Programming (compulsory), Compiler Construction 1 and 2 (compulsory), Big Data Management and Analysis, Human Computer Interaction, Artificial Intelligence, Network Security, Computer Game Design, High Performance Computing. Some courses may also be taken from other departments, with approval of the Honours course convener. A major research project makes up 60 credits and the remaining 100 credits is calculated from the coursework modules. A pamphlet outlining the year's programme is available from the Department (and at http://www.cs.uct.ac.za/teaching).

DP requirements: Students will only be allowed to proceed with the second semester if, by the end of the first semester, they have an overall average of 50% in their coursework having gained credit for at least 60 credits of coursework (including compulsory modules).

Assessment: Project mark counts 38% of the total (60 credits). The remaining 62% of the mark (100 credits) is calculated from the best modules taken. They must include Research Methods and New Venture Planning. No module will be considered for course credits unless a student has obtained at least 40% in that module. Subminima: At least 50% must be achieved in the Project. At least 40% must be achieved in the Research Methods and New Venture Planning modules. An average mark of at least 50% must be attained in the modules making up the best 100 course credits. The final mark, calculated as explained above, must not be less than 50%. These component parts of the course will be combined in a final overall mark which will be reflected against the course code CSC4016W, with PA (pass) entered against the coursework and project codes; each of these components must be passed separately for the award of the degree.

MAM4007W MATHEMATICS OF COMPUTER SCIENCE HONOURS

This course will not be offered in 2018. Students interested in Mathematics of Computer Science are encouraged to register for an Honours Degree in Applied Mathematics, which offers considerable flexibility in curriculum choice, including the possibility of taking modules offered by MAM's Laboratory for Discrete Mathematics and Theoretical Computer Science and electives in the Department of Computer Science.

160 NQF credits at HEQSF level 8

Course entry requirements: Normally a BSc degree with a major in either Computer Science or Mathematics and at least second-year level in the other, but in all cases subject to individual approval by the Heads of both departments.

Course outline:

This Honours degree is offered jointly by the Departments of Computer Science and Mathematics & Applied Mathematics. Its subject matter involves logical and mathematical theories and structures relevant to computer science, together with their applications. Students will be required to do approximately half their work in each department, including course work in both departments for the course. Courses that are offered typically include some of the following: Computational Complexity, Cryptography, Enumerative Combinatorics, and Graph Theory. Every syllabus must be approved by

the Heads of both departments. Each student will be required to do a research project. Completion of this degree could yield admission to Master's studies in either Mathematics or Computer Science.
Assessment: The project counts 18.75% of the final mark for the course and must be passed (with 50%). On average, the examination counts at least 50% of the balance of the final course mark.

CSC5000W COMPUTER SCIENCE DISSERTATION

Students will be expected to attend a research methods course in the first year.
180 NQF credits at HEQSF level 9
Convener: Dr B DeRenzi
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 CSC5001W+CSC5002W for a Computer Science Master's degree.
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.

CSC5001W COMPUTER SCIENCE COURSEWORK

90 NQF credits at HEQSF level 9
Convener: Dr B DeRenzi
Course entry requirements: A relevant Honours degree or four year equivalent
Course outline:
This coursework component starts with registration in January. The course aims to provide students with an overview of those fields of Computer Science in which the department undertakes research, from which the student selects coursework modules: Research Methods (compulsory), Computational Geometry for 3D Printing, Distributed Scientific Computing, Evolutionary Computation, Information Retrieval, Intelligent Systems, Introduction to ICT for Development, Logics for Artificial Intelligence, Introduction to Image Processing and Computer Vision, Ontology Engineering. At the end of the coursework students must sit formal examinations. Students may also take elective courses, with the prior approval of the course convener, from cognate departments, such as: Databases for Data Scientists and Data Visualization. Upon successful completion of the coursework component, students will be required to register for the minor dissertation component (CSC5002W).
Assessment: Coursework modules are assessed by a combination of practical work and examination. All modules contribute to the final coursework mark, which counts 50% of the final degree requirement.

CSC5002W COMPUTER SCIENCE MINOR DISSERTATION

90 NQF credits at HEQSF level 9
Convener: Dr B DeRenzi
Course entry requirements: CSC5001W
Course outline:
Upon successful completion of the coursework component (CSC5001W), 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.

CSC5004W INFORMATION TECHNOLOGY MINOR DISSERTATION
90 NQF credits at HEQSF level 9
Convener: Dr M Densmore
Course entry requirements: CSC5005H and CSC5006H or (CSC5010Z, CSC5011Z, CSC5012Z, CSC5013Z, CSC5014Z, CSC5015Z, CSC5016Z and CSC5017Z)
Course outline:
Upon successful completion of the coursework component (Two block modules (CSC5005H and CSC5006H) or all eight individual modules (CSC5010Z, CSC5011Z, CSC5012Z, CSC5013Z, 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.

CSC5005H INFORMATION TECHNOLOGY COURSEWORK PART 1
Not offered to new students in 2018.
45 NQF credits at HEQSF level 9
Convener: Dr 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 in 2018.
45 NQF credits at HEQSF level 9
Convener: Dr 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.

CSC5007Z DATABASES FOR DATA SCIENTISTS

12 NQF credits at HEQSF level 9
Convener: Associate Professor S Berman
Course entry requirements: Acceptance into Master's course in Data Science.
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.
DP requirements: 40% for assignment component.
Assessment: Students will be assessed by 2 assignments (25% each) and an exam (50%). A sub-minimum of 40% will be required for each of the assignment and exam components of the course.

CSC5008Z DATA VISUALISATION

12 NQF credits at HEQSF level 9
Convener: Associate Professor M Kuttel
Course entry requirements: Acceptance into Master's course in Data Science.
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.

CSC5009W DATA SCIENCE MINOR DISSERTATION

90 NQF credits at HEQSF level 9
Convener: Associate Professor M Kuttel
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 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.

CSC5010Z MIT: COMPUTER NETWORKS
12 NQF credits at HEQSF level 9
Convener: Dr M Densmore
Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.
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: PROGRAMMING IN PYTHON
12 NQF credits at HEQSF level 9
Convener: Dr M Densmore
Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.
Course outline:
This is a basic introduction to 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 HEQSF level 9
Convener: Dr 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.

CSC5013Z MIT: DATABASE SYSTEMS
12 NQF credits at HEQSF level 9
Convener: Dr M Densmore
Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.
Course outline:
A perspective on database management system structure and function is provided. Topics introduced include: architecture of databases; data models; normalisation; front-end systems; security, recovery and concurrency, data and database; administration; object-oriented database systems; client-server and distributed database systems and research topics in DBMS's.
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: CYBERLAW AND ETHICS
12 NQF credits at HEQSF level 9
Convener: Dr M Densmore
Course entry requirements: Admission into the Master's degree specialising in IT, or permission from the course convenor.
Course outline:
This module examines the regulations governing the Internet in order that students appreciate the constraints they will face in implementing electronic commerce. Problems concerning legally enforceable contracts, privacy, data protection and intellectual property are also investigated.
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 HEQSF level 9
Convener: Dr 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 HEQSF level 9
Convener: Dr 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.

CSC5017Z MIT: RESEARCH METHODS
12 NQF credits at HEQSF level 9
Convener: Dr 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.

CSC6000W COMPUTER SCIENCE THESIS
Students will be expected to attend a research methods course in the first year.
360 NQF credits at HEQSF 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
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The Departmental abbreviation for Environmental & Geographical Science is EGS.

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M New, BSc Hons *Cape Town* MPhil PhD *Cantab*
S M Parnell, MA PhD *Witwatersrand* FSSAG
M F Ramutsindela, MA *UNIN* PhD *London* FSSAG
Emeritus Professor:
R F Fuggle, BSc Hons UED *Natal* MSc *Louisiana* PhD *McGill*
Honorary Professor:
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Associate Professors:
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S Raemaekers, MSc *Ghent* PhD *Rhodes*
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Administrative Officer:
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M Rustin-Neft

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. 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. The Department houses a large reference collection of pollen slides and photographs which is used in reconstructing former vegetation types. 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

AGE1004S INTRODUCTION TO EARTH & ENVIRONMENTAL SCIENCES
18 NQF credits at HEQSF level 5
Convener: Dr R Sithaldeen
Course entry requirements: Permission of the Dean or Head of Department is required prior to registration for this course. Attendance and satisfactory performance in the practical course and each of the three fieldtrips and reports in GEO1009F. *NOTES: 1) This course is intended for students who have failed GEO1009F (see entry in Department of Geological Sciences) and have therefore been advised to register for AGE1004S. 2) The course reviews material covered in GEO1009F with sound approaches to effective learning and focuses on strengthening foundational concepts and skills. 3) AGE1004S is equivalent to GEO1009F in level, credit value towards the degree and as prerequisite for certain other courses.*
Course outline:
This course will introduce students to the structure and geological history of Earth as well as the interactions between the abiotic and biotic systems that shape the surface of the world. Human interactions with the environment are also discussed. Topics covered are solar system evolution, plate tectonics, the structure of the earth, climate-land interactions, the evolution of landscapes, biogeography, human adaptation and interaction with the natural environment.
Lecture times: Friday, 14h00 - 17h00
DP requirements: A class record of at least 40%; attendance at 80% of lectures.
Assessment: Assignments, tests and field report count 50%; one 2-hour examination written in November counts 50%. A sub-minimum of 40% is required for the final exam.

EGS1003S GEOGRAPHY, DEVELOPMENT & ENVIRONMENT
There is a compulsory fieldwork component involving half-day field excursions.
18 NQF credits at HEQSF level 5
Convener: Professor M F Ramutsindela
Course entry requirements: A 50% pass in NSC Geography or GEO1009F
Course outline:
The course introduces students to development and environment debates in geography, by exploring the geography of third world development, focusing on the historical roots and spatial patterns that underpin development
Lecture times: Monday - Friday, 2nd period
DP requirements: Attendance and satisfactory completion of practicals, including fieldwork, and tutorial assignments; students must attain an average mark of not less than 40% for the coursework component.
Assessment: Essays, a class test, practical assignments (including fieldwork) 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. Students who fail this course will be advised to register for AGE1004S (see entry in Department of Archaeology).

18 NQF credits at HEQSF level 5

Convener: Associate Professor J S Compton

Course entry requirements: At least 60% for NSC Physical Science, Life Sciences or Geography (or AGE1004S). 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 HEQSF 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 process as well as anthropogenic pressures. It covers in detail global circulation patterns, climate variability, soil formation, polar response to climate change, tropical deforestation, and desertification and earth observation technology. It concludes with a detailed study of local scale systems and applications covering stream catchments, estuaries, wetlands and coastlines. 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).

EGS2014S CONTEMPORARY URBAN CHALLENGES

There is a compulsory fieldwork component involving half-day field excursions.

24 NQF credits at HEQSF level 6

Convener: Dr S Daya

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:

This course focuses on urban change in South Africa, drawing together historical and contemporary analysis of social, political, economic and environmental dimensions of the South African city. The course includes a section on the historical geography of the South African city to contextualise contemporary challenges, and explores issues of race and gender politics in South African cities, as well as challenges of service delivery and natural systems. This conceptual material is grounded in field-based experiential learning in Cape Town.

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 HEQSF level 7

Convener: Associate Professor B J Abiodun

Course entry requirements: GEO1009F (or equivalent), EGS2013F (or SEA2004F or SEA2002S or SEA2003F or approved 2000-level Science course), and any 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 practicals and all written assignments, including essays, project reports and class tests.

Assessment: Essays and tests count 20%; project reports and practicals count 20%; one 3-hour examination in November counts 60% (subminimum of 40% required).

EGS3021F SUSTAINABILITY & ENVIRONMENT

There is a compulsory fieldwork component involving half-day field excursions.

36 NQF credits at HEQSF level 7

Convener: Associate Professor M Sowman

Course entry requirements: EGS2013F, EGS2014S

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 practicals (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).

EGS3022S GEOGRAPHIC THOUGHT
36 NQF credits at HEQSF level 7
Convener: Professor S Parnell
Course entry requirements: EGS2014S
Course outline:
The course focuses on international 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 assignments and class test; students must attain an average mark of not less than 40% for the coursework
Assessment: Essay and other assignments count 50%; one 3-hour written examination in November count 50% (subminimum of 40% required).

EGS3023F ANTHROPOCENE ENVIRONMENTS IN PERSPECTIVE
36 NQF credits at HEQSF level 7
Convener: Professor M E Meadows
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 HEQSF level 8
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 HEQSF level 8
Convener: Dr Z Patel
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 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.

EGS4011F/S ENVIRONMENTAL MANAGEMENT
30 NQF credits at HEQSF level 8
Convener: To be advised
Course entry requirements: Acceptance for an Honours programme.
Course outline:
EGS 4011 introduces students to recent developments in Environmental Management within the context of sustainable development. It provides students with the theoretical and conceptual underpinnings of environmental management, and exposure to tools and methods commonly used in the field including Strategic Environmental Assessment, Environmental Impact Assessment, Environmental Management Systems and corporate sustainability reporting. In addition it includes a number of sessions on understanding bio-physical systems in the context of planning and development.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS4016F/S CAPITAL, POLITICS AND NATURE
30 NQF credits at HEQSF level 8
Convener: Professor M Ramutsindela
Course entry requirements: Acceptance for an Honours or Master's programme.
Course outline:
The module focuses on ideas about nature and how these have influenced the ways in which we think of, and respond to, different aspects of nature. It places emphasis on the links between constructions of nature and power relations; the roles played by property regimes, the state, and local inhabitants; and the emergence of contested views on trans-frontier conservation areas in southern Africa.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS4021X RESEARCH PROJECT IN ENVIRONMENTAL AND GEOGRAPHICAL STUDIES (BA STREAM)
40 NQF credits at HEQSF level 8
Convener: Dr Z Patel
Course entry requirements: Acceptance for Honours specialising in EGS.
Course outline:
Students conduct a research project in a topic related to their Environmental Studies under the supervision of a member of the academic staff of the department. The course is examined through the submission of a dissertation.
DP requirements: Students must achieve a pass on their research project to pass the year.
Assessment: Research project: (5% proposal presentation; 5% proposal submission; 10% final project presentation; 80% final project submission).

EGS4023F/S RESEARCH METHODS FOR NATURAL SCIENTISTS
30 NQF credits at HEQSF 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 HEQSF level 8
Convener: Associate 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%.

EGS4027F/S QUATERNARY PALAEOENVIRONMENTS
30 NQF credits at HEQSF level 8
Convener: Professor M Meadows
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
The aim of this course is to foster an understanding of how environments and their characteristic organisms respond to Quaternary environmental change and how fossil evidence from such organisms may enable us to reconstruct Quaternary environments with increasing degrees of precision. This aim is achieved by developing an understanding of past environmental changes,

particularly those of the Quaternary, as exemplified by palaeoecological evidence. Attention is focused on the principal forms of palaeoecological evidence that have been useful in southern Africa, in particular pollen analysis, and other proxies for environmental conditions. The major features of environmental change and its impact are illustrated with examples drawn mainly from southern Africa. The aim is amplified with reference to the contemporary environmental changes that characterise southern Africa, coupled with their ecological and biogeographical implications for the future. There is a focus on practical methods and skills.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS4030F/S CLIMATE MODELLING
30 NQF credits at HEQSF 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 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.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS4034F/S GLOBALISATION AND THE ENVIRONMENT
NB: enrolment to this course is by invitation only
30 NQF credits at HEQSF level 8
Convener: Dr S Daya and Professor M Meadows
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
Globalization is a complex of processes influencing the interplay between environment and development. These processes manifest themselves in diverse ways, but southern Africa, with its diversity of natural environment settings and range of human development characteristics, represents an ideal laboratory in which to study this interplay. The course is founded on an understanding of relevant theory and its application to a number of case studies including, inter alia, the political, economic, social, cultural and biophysical background to globalization in the region, conservation and its impacts on local communities; environmental degradation; agriculture and globalization; urban development and nature conservation. These case studies are illustrated in relation to both the relevant literature and to direct experience through fieldwork.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 65%; examination 35%.

EGS4035F/S RISE, FALL AND RECONSTRUCTION OF THE SOUTH AFRICAN CITY
30 NQF credits at HEQSF level 8
Convener: Professor S Parnell
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
The aim of the course is to understand the structural basis of the contemporary South African city through an understanding of the urban past. The course surveys the secondary literature on the major social, legal and historical events that shaped the segregated form of the South African city in the twentieth century. The seminar component is divided between the period shaping the apartheid city form and its demise. An independent essay and reading exercise enables students to focus on post-apartheid issues.

DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS4038F/S CLIMATE CHANGE AND PREDICTABILITY
30 NQF credits at HEQSF 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 HEQSF level 8
Convener: Dr J Battersby-Lennard and Dr G Haysom
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 HIV/AIDS; managing urban food systems (ecological, regulatory and fiscal dynamics).
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS4040F/S SPECIAL TOPIC IN HUMAN/ENVIRONMENT INTERACTIONS
30 NQF credits at HEQSF level 8
Convener: Dr P Anderson
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 HEQSF level 8
Convener: Dr P Anderson
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 LIVING WITH GLOBAL CHANGE
(Not offered in 2018)
30 NQF credits at HEQSF level 8
Convener: Associate Professor G Ziervogel
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
This course aims to ground students in the core theoretical, policy and practice debates on global environmental change. Climate change adaptation will be explored as a means for responding to environmental change, at the local, national and international scale and from the perspective of individuals, organisations and government. Adaptation will be contextualised within the international climate policy arena and greenhouse gas mitigation responses. The communication of climate science and the frameworks for integrating this information into risk management will be another central theme.
Throughout the course there will be a focus on how science links to development and policy, demonstrated through case study examples, at the same time as placing global environmental change in its wider current, social/political/economic context. Students will gain experience in difference methods for assessing vulnerability and social impacts and developing risk communication and adaptation strategies.
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 HEQSF level 8
Convener: Dr 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 HEQSF 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 HEQSF 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 HEQSF 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 ie. 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 30%.

EGS4051F ENVIRONMENTAL SCIENCE METHODS
30 NQF credits at HEQSF level 8
Convener: Dr S Raemaekers
Course entry requirements: Acceptance for EGS Honours and coursework Master's degree as well as in any closely related discipline offered at UCT.
Course outline:
The course introduces students to the most common quantitative, qualitative and mixed research methods used by the scientists to study human-environmental interactions, as well as development issues and problems. This course focuses on the design of and methods for research in the empirical environmental social sciences. Knowledge that students gain will be directly applied in developing a proper design for a research project. The course considers questions of epistemology, and the implications of theory for the design of research. The course critically engages with the main features and methods for conducting quantitative and qualitative research. Understandings of the

ethics conducting and publishing scholarly research will be integrated throughout the course lectures and discussions. Active student participation in learning will be promoted through teaching methods that include lectures, class discussions, computer lab sessions, and weekly reaction papers. There are no statistical pre-requisites to attend the course. However, some knowledge of the basic concepts of statistics will be useful.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS4056F/S IMAGINING SOUTHERN CITIES
30 NQF credits at HEQSF level 8
Convener: Dr S Daya
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
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 HEQSF 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 60%; examination 40%.

EGS5000W ENVIRONMENTAL & GEOGRAPHICAL SCIENCE DISSERTATION
180 NQF credits at HEQSF 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 HEQSF 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
Students will enrol (and pay fees) for both courses EGS5008H and EGS5009W 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. Entrance is limited to 12 students
90 NQF credits at HEQSF level 9
Convener: Dr P Anderson
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 January. 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 second semester of the first 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 HEQSF level 9
Convener: Dr P Anderson
Course entry requirements: EGS5008H
Course outline:
Students will be required to register for this course in the second semester of the first year and complete a suitable research proposal in consultation with an appropriate supervisor. After approval of the proposal, 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.

EGS5011F/S ENVIRONMENTAL MANAGEMENT
23 NQF credits at HEQSF level 9
Convener: To be advised
Course outline:
EGS 5011 introduces students to recent developments in Environmental Management within the context of sustainable development. It provides students with the theoretical and conceptual underpinnings of environmental management, and exposure to tools and methods commonly used in the field including Strategic Environmental Assessment, Environmental Impact Assessment, Environmental Management Systems and corporate sustainability reporting. In addition it includes a number of sessions on understanding bio-physical systems in the context of planning and development. At this NQF 9 level students will be expected to answer a longer exam paper and express more advanced philosophical and theoretical responses in the examination.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

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 HEQSF 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: 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.

EGS5016F/S CAPITAL POLITICS AND NATURE
23 NQF credits at HEQSF level 9
Convener: Professor M Ramutsindela
Course entry requirements: Acceptance for an Honours or Master's programme.
Course outline:
The module focuses on ideas about nature and how these have influenced the ways in which we think of, and respond to, different aspects of nature. It places emphasis on the links between constructions of nature and power relations; the roles played by property regimes, the state, and local inhabitants; and the emergence of contested views on trans-frontier conservation areas in southern Africa. At the NQF level 9 students will be expected to engage with a greater number of journal articles in preparing their seminars and in developing essay submissions. The exam at this level will be longer.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS5023F/S RESEARCH METHODS FOR NATURAL SCIENTISTS
23 NQF credits at HEQSF 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.

EGS5023H SENIOR RESEARCH PROJECT IN ENVIRONMENTAL & GEOGRAPHICAL STUDIES (MA)
90 NQF credits at HEQSF level 9
Convener: To be advised
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.

EGS5024F/S MANAGING COMPLEX HUMAN ECOLOGICAL SYSTEMS
23 NQF credits at HEQSF level 9
Convener: Associate 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%.

EGS5027F/S QUATERNARY PALAEOENVIRONMENTS
23 NQF credits at HEQSF level 9
Convener: Professor M Meadows
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
The aim of this course is to foster an understanding of how environments and their characteristic organisms respond to Quaternary environmental change and how fossil evidence from such organisms may enable us to reconstruct Quaternary environments with increasing degrees of precision. This aim is achieved by developing an understanding of past environmental changes, particularly those of the Quaternary, as exemplified by palaeoecological evidence. Attention is focused on the principal forms of palaeoecological evidence that have been useful in southern Africa, in particular pollen analysis, and other proxies for environmental conditions. The major features of environmental change and its impact are illustrated with examples drawn mainly from southern Africa. The aim is amplified with reference to the contemporary environmental changes that characterise southern Africa, coupled with their ecological and biogeographical implications for the future. There is a focus on practical methods and skills. At the NQF level 9 students will be expected to apply theory in relation to several sub-fields of Quaternary Science for example demonstrating the ability to integrate past changes in the environment and their various possible drivers. This expectation will be assess in both the term papers an in the examination.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS5029H CLIMATE CHANGE MINOR DISSERTATION
90 NQF credits at HEQSF level 9
Convener: To be advised
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 HEQSF 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 HEQSF level 9
Convener: To be advised
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: Three essays count 20% each; one group-based student project counts 10%; one 3-hour examination counts 30%.

EGS5032F CLIMATE CHANGE ADAPTATION & MITIGATION
23 NQF credits at HEQSF level 9
Convener: To be advised
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: Four essays count 20% each; one 2 hour examination counts 20%.

EGS5035F/S RISE, FALL AND RECONSTRUCTION OF THE SOUTH AFRICAN CITY
23 NQF credits at HEQSF level 9
Convener: Professor S Parnell
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
The aim of the course is to understand the structural basis of the contemporary South African city through an understanding of the urban past. The course surveys the secondary literature on the major social, legal and historical events that shaped the segregated form of the South African city in the

twentieth century. The seminar component is divided between the period shaping the apartheid city form and its demise. An independent essay and reading exercise enables students to focus on post-apartheid issues. At the NQF 9 level students will be expected to be able to provide independent critiques of course readings, and a synopsis of two additional references. In the exam these students will be evaluated on their ability to incorporate course objectives, not only synthesising, but also independently evaluating, the core ideas of the course material.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 50%; examination 50%.

EGS5038F/S CLIMATE CHANGE & PREDICTABILITY
23 NQF credits at HEQSF 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 HEQSF level 9
Convener: Dr J Battersby-Lennard and Dr G Haysom
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 HIV/AIDS; 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 60%; examination 40%.

EGS5040F/S SPECIAL TOPIC IN HUMAN/ENVIRONMENT INTERACTIONS
23 NQF credits at HEQSF level 9
Convener: Dr P Anderson
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 HEQSF level 9
Convener: Dr P Anderson
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 LIVING WITH GLOBAL CHANGE
(Not offered in 2018)
23 NQF credits at HEQSF level 9
Convener: Associate Professor G Ziervogel
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
This course aims to ground students in the core theoretical, policy and practice debates on global environmental change. Climate change adaptation will be explored as a means for responding to environmental change, at the local, national and international scale and from the perspective of individuals, organisations and government. Adaptation will be contextualised within the international climate policy arena and greenhouse gas mitigation responses. The communication of climate science and the frameworks for integrating this information into risk management will be another central theme. Throughout the course there will be a focus on how science links to development and policy, demonstrated through case study examples, at the same time as placing global environmental change in its wider current, social/political/economic context. Students will gain experience in difference methods for assessing vulnerability and social impacts and developing risk communication and adaptation strategies. At the NQF 9 level students will be expected to use their class presentations as the platform on which to submit an additional assignment. Their assignment will be an overview of a teaching module that will require them to submit a three page outline of a seminar on their presentation topic. This will include an overview of the topic, a section outlining key debates on this topic, links to one relevant multi-media product and a reading list (of readings considered essential to this topic but not already provided in the class reading list).
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: Assignments 60%; examination 40%.

EGS5044F/S URBAN ECOLOGY
23 NQF credits at HEQSF level 9
Convener: Dr 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 HEQSF 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 HEQSF 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%.

EGS5047F/S POLICY AND GOVERNANCE
23 NQF credits at HEQSF level 9
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 ie. 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%.

EGS5051F/S ENVIRONMENTAL SCIENCE METHODS
23 NQF credits at HEQSF level 9
Convener: Dr S Raemaekers
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
Course outline:
The course introduces students to the most common quantitative, qualitative and mixed research methods used by the scientists to study human-environmental interactions, as well as development issues and problems. This course focuses on the design of and methods for research in the empirical environmental social sciences. Knowledge that students gain will be directly applied in developing a proper design for a research project. The course considers questions of epistemology, and the implications of theory for the design of research. The course critically engages with the main features and methods for conducting quantitative and qualitative research. Understandings of the ethics conducting and publishing scholarly research will be integrated throughout the course lectures and discussions. Active student participation in learning will be promoted through teaching methods that include lectures, class discussions, computer lab sessions, and weekly reaction papers. There are no statistical pre-requisites to attend the course. However, some knowledge of the basic concepts of statistics will be useful. At the NQF 9 level students will be expected to engage in depth with a wider range of methods, some non-directly linked with their envisaged master thesis methods as well as reflect on the linkages between methods and methodology, as per different environmental science disciplines. At this level students will also be expected to engage with different disciplinary methodologies and their implications for transdisciplinary research.
DP requirements: At least 80% attendance record and submission of all assignments.
Assessment: 100% Coursework.

EGS5052W APPLIED OCEAN SCIENCES MINOR DISSERTATION
90 NQF credits at HEQSF level 9
Convener: Associate 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 HEQSF level 9
Convener: Dr S Daya
Course entry requirements: Acceptance for Honours or Master's specialising in EGS.
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 will 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%.

EGS5057F/S URBAN POLITICAL ECOLOGY
23 NQF credits at HEQSF 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%.

EGS5060W URBAN STUDIES COURSEWORK
0 NQF credits at HEQSF level 9
Convener: Dr A Tomas
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 developing world perspective. The curriculum comprises three compulsory core courses, The City Research Studio and two of the following courses: Urban Theory, The Urban Everyday and The Arts of Space. 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 HEQSF level 9
Convener: Dr A Tomas
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-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 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.

EGS5062F THE URBAN EVERYDAY
23 NQF credits at HEQSF level 9
Convener: Professor S Oldfield
Co-requisites: The City Research Studio (APG5090W); and, either Urban Theory (EGS5063F) or The Arts of Space (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%)

EGS5063F URBAN THEORY
23 NQF credits at HEQSF level 9
Convener: Professor E Pieterse
Co-requisites: The City Research Studio (APG5090W); and, either Everyday Perspectives on the Urban (EGS5062F) or The Arts of Space (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 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%)

APG5089S ARTS OF SPACE
23 NQF credits at HEQSF level 9
Convener: Dr A Tomas
Course outline:
This course aims to bridge humanities and spatial and design sciences, by having as a starting point the notion that spatial transformation, and technical innovation, do not appear out of nowhere. They emerge from the crystallization of philosophical principles, or knowledge-making processes. This course therefore is about understanding the philosophical principles behind the spaces we have inherited, and how to tackle new methods to understand the coming into being of spatial and physical formations. The course is divided into three parts: 1) on the concept of design, in architecture, infrastructure and politics; 2) design of cities through planning, informal planning, counter-planning, and so on; 3) on design 'equipment', focused on methods and methodology. This course also aims to provide theoretical foundations for the practical component.
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%).

APG5090W CITY RESEARCH STUDIO
23 NQF credits at HEQSF level 9
Convener: Dr A Tomas
Course entry requirements: None
Co-requisites: None
Course outline:
This course aims to ground students in city research practice. It will also frame thinking on the development and rigour of urban studies, which is immersed in good questions, exploration which tests and ground truths these ideas, as well as discovery that the research process must open up. The City Research Studio also provides students a chance to engage with the representation of analysis in scholarly as well as public forms. The Studio will help students engage in this propositional work in the research and writing and dissemination processes. These are essential elements for rigorous trans-disciplinary urban studies work in African and broader global southern contexts.
Lecture times: Refer to departmental timetable.
DP requirements: Papers, journal and proposal.
Assessment: Three papers (30%), narrative and visual journal on research practice in studio (25%), group contributions to exhibition (20%), thesis research proposal (10%), participation (10%)

EGS6003W ENVIRONMENTAL & GEOGRAPHICAL SCIENCE THESIS
360 NQF credits at HEQSF 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.

Philipson Stow Professor of Mineralogy & Geology and Head of Department:
C Harris, MA DPhil *Oxon*
Chamber of Mines Professor of Geochemistry:
A P le Roex, BSc *Stell* BSc Hons PhD *Cape Town*
Professor:
S H Richardson, BSc Hons *Cape Town* PhD *MIT*
Emeritus Professor:
J J Gurney, BSc Hons PhD *Cape Town* FRSSAf
Associate Professor:
J S Compton, BA *UC San Diego* PhD *Harvard*
P E Janney, BSc *New Hampshire* PhD *UC San Diego*
Emeritus Associate Professor:
D L Reid, MSc *Wellington* PhD *Cape Town*
Senior Lecturers:
M E Bordy, MSc *Budapest* PhD *Rhodes*
J F A Diener, MSc *Stell* PhD *Melbourne*
Lecturers:
L Greyling, MSc *RAU* PhD *Witwatersrand*
R Pickering, MSc *Witwatersrand* PhD *Berne*
A Sloan, MSc PhD *Cantab*
Senior Research Officer:
P J le Roux, BSc Hons PhD *Cape Town*
Honorary Research Associates:
A Fagereng, BSc Hons *Cape Town* PhD *Otago*
H E Frimmel, PhD *Vienna*
R J Gibbon, MSc PhD *Witwatersrand*
W L Taylor, MSc PhD *Rochester*
Principal Technical Officer:
J Harrison
Chief Scientific Officers:
K Gray, MSc *Cape Town*
F Rawoot, BSc *UWC*
C E Tinguely, MSc *Clermont-Ferrand*
Chief Technical Officer:
D Basson
Senior Scientific Officers:
N Laidler, BSc Hons *Cape Town*
K Moses, BSc Hons *Pret*
Administrative Officer:
N Barends
Senior Secretary:
D Lesch
Thin Section Technician:
R van der Merwe
Departmental 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, electron microprobe and X-ray diffraction 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.

First-Year Courses

GEO1006S INTRODUCTION TO MINERALS, ROCKS & STRUCTURE
18 NQF credits at HEQSF level 5
Convener: Professor C Harris
Course entry requirements: A minimum of 45% in GEO1009F or a pass in AGE1004S
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. Students who fail this course will be advised to register for AGE1004S (see entry in Department of Archaeology).
18 NQF credits at HEQSF level 5
Convener: Associate Professor J S Compton
Course entry requirements: At least 60% for NSC Physical Science, Life Sciences or Geography (or AGE1004S). 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 HEQSF level 6
Convener: Professor S H Richardson
Course entry requirements: GEO1009F (or AGE1004S from 2015) 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 HEQSF level 6
Convener: Dr 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.

GEO2005X FIELD GEOLOGY & GEOLOGICAL MAPPING
24 NQF credits at HEQSF level 6
Convener: Dr 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%.

Third-Year Courses

GEO3001S STRATIGRAPHY & ECONOMIC GEOLOGY
36 NQF credits at HEQSF level 7
Convener: Dr E Bordy
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.

GEO3005F PETROLOGY & STRUCTURAL GEOLOGY
36 NQF credits at HEQSF 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 HEQSF level 8

Convener: Associate Professor P E Janney

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 6 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 HEQSF level 8

GEO5000W GEOLOGY DISSERTATION

180 NQF credits at HEQSF 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 HEQSF 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 HEQSF 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 HEQSF 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 HEQSF 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 HUMAN BIOLOGY (FACULTY OF HEALTH SCIENCES)

Room 5.1.4, Level 5, Anatomy Building, Health Sciences Campus and Sports Science Institute of South Africa Building, Newlands. Telephone (021) 406-6235
(This department incorporates the disciplines of anatomy, biokinetics, biological anthropology, biomedical engineering, cell biology, exercise science, healthcare technology management, human nutrition, physiology, and sport and exercise medicine).

This department offers the Human Biology (HUB) courses detailed in this section towards the Integrated Human Anatomical & Physiological Sciences major for the BSc degree.

Professor and Head of Department:
M R Collins, BSc (Hons) *Stell* PhD *Cape Town* FECSS
Professors:
S H Kidson, BSc (Hons) MSc PhD *Witwatersrand* HDE *JCE*
E V Lambert, BA (PhysEd) MSc *South Carolina* PhD *Cape Town*
M I Lambert, BSc (Agric) *UKZN* BA (PhysEd) (Hons) *Rhodes* MSc *South Carolina* PhD *Cape Town*
G J Louw, BVSc DVSc *Pret* MPhil HES *Cape Town*
S Prince, BSc (Hons) HDE PhD *Cape Town*
M Senekal, BSc (Hons) (Diet) MSc PhD *Stell*
Professor and NRF/DST South African Research Chair in Brain Imaging:
E Meintjes, BSc (Hons) MSc *UKZN* MS PhD *Oregon State*
Professor and NRF/DST South African Research Chair in Biomedical Engineering & Innovation:
T S Douglas, BSc (Eng) MBA *Cape Town* MS *Vanderbilt* PhD *Strathclyde*
Honorary Professors:
M Glucksberg, BSc MSc PhD *Columbia*
J L Jacobson, MA PhD *Harvard*
S W Jacobson, BA *Brandeis* MA PhD *Harvard*
D Kelso, BSc *Purdue* MSc PhD *North West*
A Mairal, BSc *Raipur* MSc *Bombay* PhD *Boulders* MBA *Berkeley*
W van Mechellen, MD PhD *VU Amsterdam* FACSM
Emeritus Professors:
L A Kellaway, BSc (Hons) MSc PhD *Cape Town*
A G Morris, BSc (WLU) PhD *Witwatersrand*
T D Noakes OMS, MBChB MD DSc (Med) *Cape Town* FACSM (Hon) FFSEM *UK*
V A Russell, BSc (Hons) MSc *Cape Town* PhD *Stell*
C L Vaughan, BSc (Hons) *Rhodes* PhD *Iowa* DSc *Cape Town*
Associate Professor and Chief Research Officer:
A V September, BSc (Med) (Hons) (Human Genetics) MSc (Medicine) (Human Genetics) PhD *Cape Town*
Associate Professors:
A N Bosch, BSc *UKZN* BA (PhysEd) (Hons) MA *Rhodes* PhD *Cape Town*
T Franz, PhD *Bremen*
D M Lang, Dr rer nat *Konstanz Germany*
N P Steyn, BSc (Diet) *UKZN* Hons MSc MPH *Cape Town* PhD *Stell*
Adjunct Associate Professor:
W Van der Merwe, MBChB *UFS* BSc Med (Hons) Sport Science *Cape Town* FCS (Ortho)
Honorary Associate Professors:
J H Goedecke, BSc (Med) (Hons) Nutrit&Dietetics PhD *Cape Town* RD(SA)

R P Lamberts, BSc(Physiotherapy) MSc(Pedagogics/Human Movement Science) *Netherlands* PhD *Cape Town* FECSS
G Limbert, BSc MSc *Toulouse* MPhil *Bordeaux* PhD *Southampton* CEng FIMechE
L K Micklesfield, BA (Human Movement Studies) *Rhodes* BSc (Med) (Hons) Biokinetics MSc (Med) PhD *Cape Town*
A van der Kouwe, BEng MEng *Pret* PhD *Ohio State*

Senior Lecturers:
Y Albertus-Kajee, BSc (Med) (Hons) Exercise Science PhD *Cape Town*
R Ballo, MSc PhD *Cape Town*
K Bugarith, BSc (Hons) *UKZN* PhD *Washington State*
J Friedling, MSc PhD *Cape Town*
V E Gibbon, BA (Adv) *University of Manitoba* PhD *Witwatersrand*
G Gunston, MBChB *Cape Town*
A Gwanyanya, MBChB DA *SA* MMed (Anaesthetics) *Zimbabwe* PhD *Leuven*
J Harbron, BSc (Diet) *Stell* MSc PhD *Stell*
T Mutsvangwa, BScEng MSc (Med) PhD (Biomedical Engineering) *Cape Town*
V Naidoo, BSc *UKZN* BSc (Hons) *Pret* MMedSc *UKZN* PhD *Michigan State*
J V Raimondo, MBChB *Cape Town* DPhil *Oxford*
D Shamley, BSc PhD *Witwatersrand*
S Sivarasu, PhD (Biomed Eng) *VIT University India*
C P Slater, MBChB MPhil *Cape Town* FFRad(T) *SA*
J Swart, MBChB MPhil (Sports Medicine) PhD *Cape Town*
E L van der Merwe, BSc (Med) (Hons) MSc PhD *Cape Town*

Honorary Senior Lecturer:
B S Spottiswoode, BSc *Witwatersrand* PhD *Cape Town*

Lecturers:
A Abrahams, BSc (Hons) PhD *Cape Town*
E Badenhorst, BA (Hons) *Stell*
S Booley, MSc (Nutrit Manag) *UWC*
J Fortuin, B. OH *UWC* M eHealth & Telemedicine (UQ) PhD *UWC*
J Kroff, BSc (Human Movement Science) BHons (Biokinetics) MSc (Medical Physiology) PhD *Stell*
M Theron, BSc (Hons) (Diet) *Pret*

Assistant Lecturer:
K S Mpolokeng, BSc BMedSc (Hons) Anatomy and Cell Morphology *UFS*

Honorary Lecturers:
V Gouttebarge, MSc (Sport Science) PhD (Medicine) *Amsterdam*
M G Kiessig, MPhil (Sport Medicine) *Cape Town*
M K Patrick, MA *Cape Town*
J Scholefield, PhD (Human Genetics) *Cape Town*

Clinical Educators:
M Blacker, BSc (Hons) (Diet) *Cape Town*
N Jaffer, BSc (Hons) (Diet) *Cape Town*
B Najaar, M Nutrition *Stell*
K Sexton, BSc (Hons) (Diet) *Cape Town*

Senior Research Officers:
C Draper, BSocSc (Hons) (Psych) MA (Psych) PhD *Cape Town*
T Kohn, BSc (Hons) (Biochemistry) PhD *Stell*
D Rae, BA (Human Movement Studies) *AUS* BSc (Med) (Hons) Exercise Science PhD *Cape Town*

Research Officers:
M Jankiewicz, MS *Nicolas Copernicus* PhD *Vanderbilt*
M Nglazi, BSc (Microbiology) *Zambia* MPH *Cape Town*
L Rauch, BSc (Physiology) BSc(Med) (Hons) Exercise Science PhD *Cape Town*
F Robertson, BSc (Eng) MSc (Eng) PhD *Cape Town*

J Smith, PhD *Cape Town*
Honorary Research Associate:
M Posthumus, BSc (Med) (Hons) Exercise Science PhD *Cape Town*
Principal Technical Officers:
S Cooper, BSc BMedSc (Hons) BEd MMedSc MBA *UFS*
C Harris, NTC *Athlone Tech Coll*
Chief Technical and Scientific Officers:
D A Bouwers, BSc (Hons) *Cape Town* MSc *Stell*
G de Bie, BSc *Rhodes* BSc (Hons) *UFS* MPhil *Stell*
I Fakier, NDElectricEng *CPUT*
V Fourie, NTC (Mechanotechnology, Electrical Fitting) Artisan Red Seal *Wingfield Tech College*
M Petersen, Dip (MedTech) BTech *CPUT*
H Victor, Dip (Datametrics) *Unisa*
Senior Technical and Scientific Officers:
M Cassar
J Peres, BSc BSc (Hons) *Witwatersrand* PhD (Cell Biology) *Cape Town*
P Steyn, BSc (Hons) MSc PhD *Stell*
Technical Officer:
D Abrahams

Second-Year Courses

HUB2019F INTEGRATED ANATOMICAL AND PHYSIOLOGICAL SCIENCES PART A

Entrance is limited to 80 students.
24 NQF credits at HEQSF level 6; 60 lectures, 10 practicals.
Convener: Dr E L van der Merwe
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 coved 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 physiologic parameters such as blood type, fluid compartment volumes, enzyme activities etc.
Lecture times: Lectures: 8h00- 8h45 Monday to Friday; Practicals: 14h00-17h00 Mondays or Tuesdays
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 HEQSF level 6; 60 lectures; 10 practicals.
Convener: Dr E L van der Merwe; Co-convener: Dr A Gwanyanya
Course entry requirements: HUB2019F or approved equivalent, CEM1000W (or 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: 8h00- 8h45 Monday to Friday; 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.

Third-Year Courses

HUB3006F APPLIED HUMAN BIOLOGY
36 NQF credits at HEQSF 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 and PTY2000S.
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.

HUB3007S HUMAN NEUROSCIENCES
36 NQF credits at HEQSF 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.

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.

Professor and Head of Department:
P K S Dunsby, BSc PhD *London*
South African Research Chair in Computational Mechanics:
B D Reddy, BSc (Eng) *Cape Town* PhD *Cantab* FRSSAf, MASSAf, OMB
Professors:
I V Barashenkov, MSc *Moscow* PhD *Dubna*
B A Bassett, MSc *Cape Town* PhD *Trieste*
G Janelidze, MSc PhD *Tbilisi Georgia* DSc *St Petersburg*
H-P A Künzi, MSc PhD *Berne*
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 Brümmer, MSc *Stell* Docts Math *Amsterdam* PhD *Cape Town*
D S Butterworth, MSc *Cape Town* PhD *London*
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J H Webb, BSc Hons *Cape Town* PhD *Cantab*
South African Research Chair in Physical Cosmology:
A Weltman, BSc Hons *Cape Town* PhD *Columbia*
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C W Hellaby, BSc Hons *St Andrews* MSc PhD *Queen's (Ontario)*
A B Ianovsky, MSc *Sofia* PhD *Dubna*
J Murugan, MSc PhD *Cape Town*
H Skokos, BSc PhD *Athens*
Adjunct Associate Professor:
C A Clarkson, BSc Hons *Edinburgh* PhD *Glasgow*
Emeritus Associate Professors:
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C R A Gilmour, MSc PhD *Cape Town*
Honorary Research Associates:
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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:
NV Alexeeva, MSc *Sofia* PhD *Cape Town*
F Ebobisse Bille, PhD *Pisa*
D J Erwin, MSc *Natal* PhD *Western Michigan*
J L Frith, MSc PhD *Cape Town*
M Kirova MSc *Konstantin Preslavski*
J Larena MSc PhD *Paris*
H de G Laurie, BA *Stell* BSc *Unisa* BSc Hons PhD *Cape Town*
N R C Robertson, MSc PhD *Cape Town*
F Russo, MSc PhD *Naples Federico II*
A Schauerte, BSc Hons *Natal* MSc *Cape Town* PhD *McMaster*
J P Shock, MPhys *Bristol* PhD *Southampton*

T C van Heerden, MSc *Cape Town* MASt *Cantab*
Lecturers:
P W M Adams, BSc MSc *Cape Town*
C Blackman, MSc *Wisconsin* PhD *Cape Town*
T Chinyoka, MSc *Zimbabwe* PhD *Virginia Tech*
Á de la Cruz-Dombriz, MSc *London* PhD *Madrid*
E Fredericks, MSc PhD *Witwatersrand*
T Janelidze-Gray, MSc *Tbilisi* PhD *Cape Town*
R Martin, BSc *Guelph* MSc PhD *Waterloo*
B Mongwane, BSc *Limpopo* BSc Hons *PU* MSc PhD *Cape Town*
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J Sánchez Ortega, MSc PhD *Málaga*
H Spakowski, PhD *Heinrich-Heine Germany*
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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 Administrator:
A Willis-Thomas
Postgraduate Administrator:
T Hannival
Undergraduate Administrator:
G Mc Bride
Senior Secretary:
S Esterhuizen
K Peters
Departmental Assistant:
S Allie
T Mobo
Campus Cleaning Services Supervisor:
M Louw
Campus Cleaning Services:
N Bam
T Mbonja
M Valentyn

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 Ianovsky)

General Relativity and Cosmology (P W M Adams, B A Bassett, C A Clarkson, Á de la Cruz-Dombriz, P K S Dunsby, G F R Ellis, C W Hellaby, J Larena, B Mongwane, J Murugan, J P Shock, A Weltman)
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 Brandao, 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, 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)
Sampling theory, operator algebras (R Martin)
Computational Fluid Dynamics (T Chinyoka)
Stochastic Ordinary Differential Equations (E Fredericks)
Rangeland Systems Modelling (F D Richardson)
National Astrophysics & Space Science Programme (B A Bassett, C A Clarkson, Á de la Cruz-Dombriz, P K S Dunsby, G F R Ellis, C W Hellaby, J Larena, J Murugan, P A Whitelock, J P Shock, A Weltman)
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:
MAM1043H, MAM1044H, MAM2046W, MAM3040W with courses in Mathematics, Oceanography, Statistics and Computer Science.

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:

		Semester	Prerequisites
3MP	Methods of Mathematical Physics	1	2AC, 2OD, and 2ND
3CV	Methods of Functions of Complex Variables	1	2RA
3AN	Advanced Numerical Methods	2	2LA and 2NA
3GR	Introduction to General Relativity	2	2AC
3FD	Fluid Dynamics	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 HEQSF level 5
Convener: Dr C Blackman
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: Monday and Wednesday, 1st or 3rd period.

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.

18 NQF credits at HEQSF level 5
Convener: P 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 HEQSF level 5
Convener: Professor P K S 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 HEQSF level 6
Convener: Dr B Osano
Course entry requirements: MAM1043H, MAM1044H and MAM1000W
Co-requisites: Modules 2LA and 2AC of MAM2000W/2004H

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)
Non-linear equations and rates of convergence. Direct and iterative methods for solving linear systems, pivoting strategies, matrix factorization, norms, conditioning. Solutions to initial value problems including higher order ordinary differential equations. Interpolation and approximation theory, splines, discrete and continuous least squares. Numerical differentiation and integration. Error analysis and control.
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)
Boundary-value problems, Sturm-Liouville problems, Green's function. Variational calculus, applications to Lagrangean and Hamiltonian mechanics. Diffusion, Laplace's and wave equation. Solution by separation of variables.
2ND: NONLINEAR DYNAMICS
Fixed points, bifurcations, phase portraits. Conservative and reversible systems. Index theory, Poincáre-Bendixson theorem, Liénard systems, relaxation oscillators. Hopf bifurcations, quasiperiodicity and Poincaré maps. Applications. Chaos on a strange attractor, Lorentz map, logistic map, Hénon map, Lyapunov exponents. Fractals.
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 HEQSF level 6
Convener: Dr B Osano
Course entry requirements: MAM1043H, MAM1044H and MAM1000W
Co-requisites: Modules 2LA and 2AC of MAM2000W/2004H
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 HEQSF level 6
Convener: Dr B Osano
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, and a project. 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 HEQSF level 7
Convener: Associate Professor J Murugan
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)
Fourier-transform solution of linear PDEs on the line. Long-term asymptotic behaviour: methods of Laplace, stationary phase, steepest descents. Nonlinear waves: Riemann invariants. Effect of dissipation; Cole-Hopf transform for the Burgers equation; travelling fronts for the KPP equation. Effect of dispersion: KdV, sine-Gordon equation. Elliptic integrals, elliptic functions; cnoidal waves, solitons. Multisoliton solutions: Hirota method, Baecklund transformations.
3CV: METHODS OF FUNCTIONS OF COMPLEX VARIABLES
Complex calculus, calculus of residues, special functions, applications to physics.
3AN: ADVANCED NUMERICAL METHODS (MAM3050S in EBE)
Advanced methods for ODEs, boundary value problems, differential eigenvalue problems. Numerical solution of PDEs by methods of finite differences, finite elements and spectral methods.
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 HEQSF level 7
Convener: Associate Professor J Murugan
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 HEQSF level 7
Convener: Associate Professor J Murugan
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, provided a written project is completed.
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.

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. However, students who obtain a mark of 65% or higher for MAM1004F and who pass the mid-year MAM1000W test (or equivalent)

will be allowed to transfer to MAM1000W in the second semester instead of taking MAM1008S. Students who are considering this should speak to the MAM1000W convenor.
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:

		Semester	Prerequisites
2LA	Linear Algebra	1	-
2AC	Advanced Calculus	1	-
2IA	Introductory Algebra	2	2LA
2RA	Real Analysis	2	-
2DE	Differential Equations	2	2LA and 2AC
3AL	Modern Abstract Algebra	1	2LA and 2IA
3DM	Discrete Mathematics	1	-
3MS	Metric Spaces	1	2RA
3CA	Complex Analysis	2	2RA
3TA	Topics in Algebra	2	3AL
3TN	Topics in Analysis	2	3MS

Undergraduate Courses

First-Year Courses

MAM1000W MATHEMATICS 1000
36 NQF credits at HEQSF level 5
Convener: Dr J P Shock
Course entry requirements: A pass in NSC Mathematics with at least 70%. *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 HEQSF level 5
Convener: T C van Heerden
Course entry requirements: At least 70% in NSC Mathematics. *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 Computer Science, 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 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.

MAM1004S MATHEMATICS 1004
18 NQF credits at HEQSF level 5
Convener: To be advised.
Course entry requirements: At least 70% in NSC Mathematics. *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 Computer Science, 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 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 HEQSF level 5
Convener: P Adams
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 HEQSF level 5

Convener: 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: First period, three days per week.

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 HEQSF level 5

Convener: 1st semester: Dr C Swart. 2nd semester: Prof H-P A Kunzi

Course entry requirements: At least 70% NSC Mathematics or a D symbol at A-level.

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, including the compulsory module 2LA and at least one of 2IA and 2RA (students intending to do MAM3000W should take both). 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 HEQSF level 6

Convener: Dr J Sánchez Ortega

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

Multivariable calculus. Curves and surfaces in three dimensions, change of coordinates. Line integrals, surface integrals. Stokes'. Green's and divergence theorems.

2DE: DIFFERENTIAL EQUATIONS (for Actuarial and Business Science students)

Topics from: First and second-order difference equations. Linear differential equations, constant coefficients. Laplace transforms. Nonlinear equations, phase plane analysis. Parabolic partial differential equations, separation of variables, boundary value problems. Black-Scholes equation. Stochastic differential equations

2IA: INTRODUCTORY ALGEBRA

Introduction to abstract algebra and number theory. Topics include: induction, strong induction and Well-Ordering axiom. Divisibility and prime factorization. Modular arithmetic. Permutations. Groups. Subgroups. Cyclic groups. Isomorphisms. Simple groups. Factor groups. Lagrange's Theorem. The First Isomorphism Theorem.

2LA: LINEAR ALGEBRA

Vector spaces, linear independence, spans, bases, row space, column space, null space. Linear maps. Eigenvectors and eigenvalues. Inner product spaces, orthogonality.

2RA: REAL ANALYSIS

Axioms of the real numbers, supremum and infimum. Countable sets. Sequences and series. Open and closed sets, compactness. Limits, continuity, differentiability. Sequences and series of functions, uniform convergence, power series. Integration.

Lecture times: The second semester module 2DE is offered in 4th period. All other MAM2000W modules are Monday - Friday, 5th period.

DP requirements: Minimum of 30% in class record.

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 HEQSF level 6

Convener: Dr J Sánchez Ortega

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 HEQSF level 6
Convener: Dr J Sánchez Ortega
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. With permission from the convenor and agreement from a suitable supervisor in the department, students may do a project. MAM3000W students who are considering continuing to MAM4000W (Honours in Mathematics) are urged to consult the Honours Program website (www.mamhonours.uct.ac.za) and/or the Honours Program Convenor before choosing their MAM3000W modules. 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 HEQSF level 7
Convener: Dr N R C Robertson
Course entry requirements: MAM1019H and MAM2000W.
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 theorem, Fundamental Theorem of Algebra. Maximum Modulus Theorem. Index of a closed curve. 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
Ring Theory (Isomorphism Theorems, Fields of Fractions of Domains, maximal, prime and principal ideals, Euclidean and Principal Ideal Domains, unique factorization, rings of algebraic integers). Field Theory (characteristic and prime subfields, extensions, finite fields, adjoining roots of polynomials). Further Group Theory (nilpotent and solvable groups, some finite simple groups).
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; a project and test on additional reading, where applicable, may also contribute to the overall 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 HEQSF 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. No project is required for this course. 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 HEQSF 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 and if the necessary project is completed. Otherwise the combination may be equivalent to MAM3001W. A second-year module may be taken as part of a third-year half course with the course co-ordinator's approval.
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 HEQSF 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 and if the necessary project is completed. Otherwise the combination may be equivalent to MAM3001W. A second-year module may be taken as part of a third-year half course with the course co-ordinator's approval.

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.

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, Dr 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 HEQSF level 8

Convener: Dr 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 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 convenor 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 HEQSF level 8

Convener: Dr 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 convenor 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 convenor 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.

MAM4007W MATHEMATICS OF COMPUTER SCIENCE HONOURS

This course will not be offered in 2018. Students interested in Mathematics of Computer Science are encouraged to register for an Honours Degree in Applied Mathematics, which offers considerable flexibility in curriculum choice, including the possibility of taking modules offered by MAM's Laboratory for Discrete Mathematics and Theoretical Computer Science and electives in the Department of Computer Science.

160 NQF credits at HEQSF level 8

Course entry requirements: Normally a BSc degree with a major in either Computer Science or Mathematics and at least second-year level in the other, but in all cases subject to individual approval by the Heads of both departments.

Course outline:

This Honours degree is offered jointly by the Departments of Computer Science and Mathematics & Applied Mathematics. Its subject matter involves logical and mathematical theories and structures relevant to computer science, together with their applications. Students will be required to do approximately half their work in each department, including course work in both departments for the

course. Courses that are offered typically include some of the following: Computational Complexity, Cryptography, Enumerative Combinatorics, and Graph Theory. Every syllabus must be approved by the Heads of both departments. Each student will be required to do a research project. Completion of this degree could yield admission to Master's studies in either Mathematics or Computer Science.
Assessment: The project counts 18.75% of the final mark for the course and must be passed (with 50%). On average, the examination counts at least 50% of the balance of the final course mark.

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 HEQSF level 8
Convener: Dr S L Blyth
Course entry requirements: AST3002F and AST3003S or PHY3004W (or PHY3021F and PHY3022S) 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 HEQSF level 9
Convener: Dr S L Blyth
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 HEQSF 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 HEQSF 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 HEQSF 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 HEQSF 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 HEQSF 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.

DEPARTMENT OF MOLECULAR AND CELL BIOLOGY

The Department is housed in the Molecular Biology Building, 22 University Avenue
Telephone (021) 650-3270 Fax (021) 650-1861
The Departmental abbreviation for Molecular and Cell Biology is MCB.

Professor and Head of Department:
J P Hapgood, BSc Hons PhD *Cape Town*
South African Research Chair in Molecular Physiology of Plant Desiccation Tolerance:
J M Farrant, BSc Hons PhD *Natal*
Professors:
N Illing, MSc *Cape Town* DPhil *Oxon*
E P Rybicki, MSc PhD *Cape Town*
Emeritus Professors:
H Klump, Dr rer nat habil Dipl Chem *Freiberg*
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*
R A Ingle, BA Hons DPhil *Oxon*
L Roden, BSc Hons *Witwatersrand* PhD *Cantab*
Senior Lecturers:
P Meyers, BSc Hons PhD *Cape Town*
C O'Ryan, BSc Hons PhD *Cape Town*
S Rafudeen, BSc Hons PhD *Cape Town*
Lecturers:
F Dube, BSc Hons PhD *Cape Town*
R Hurdayal, MSc *UKZN* PhD *Cape Town*
T Oelgeschläger, Dr rer nat *Hanover*
Senior Research Officer:
I Hitzeroth, BSc Hons PhD *Cape Town*
Research Officers:
C Avenant, BSc Hons *Stell* PhD *Cape Town*
A Meyers, BSc Hons PhD *Cape Town*
NRF Research Career Advancement Fellow:
L Donaldson, BSc Hons PhD *Cape Town*
Honorary Research Affiliate:
R Lamprecht, Bsc Hons MSc *Pret* PhD *Stell*
Principal Scientific Officers:
M Chauhan, NHD Med Tech PGDipMan *Cape Town*
F Davids, BTech Biomed Tech *CPUT*
Chief Scientific Officers:
A M Filmer, BSc Hons *Cape Town*
P Ma, MSc *Cape Town*
T Millard, BSc *Pret*
S Sattar, MSc *Cape Town*
Senior Scientific Officers:
B L Arendze-Bailey, BSc Hons *Cape Town*
K Cooper, MSc *Cape Town*
M D Krige, MSc *Stell*
Research Assistant:
K van der Merwe, HDipEd *CPUT*

Principal Technical Officer:
N Bredekamp
Chief Technical Officers:
U R Mutzeck
D September
Department Manager:
Y L Burrows
Finance Administrator:
C Saunders
Procurement Administrator:
G Spannenberg
SAP Purchaser:

Departmental Assistants:
M Andreas
M Jacobs
C Liebenberg
K Makalima
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, Associate Professors Ingle and Roden and Dr Rafudeen): research is focussed on developing virus-resistant and drought-tolerant crops, and optimising transient and transgenic expression of pharmaceutically-relevant proteins. Signal transduction in *Arabidopsis thaliana* is being studied during plant-pathogen and plant-insect interactions, as well as in the control of flowering time. Eukaryotic gene expression (Professors Hapgood and Illing, Associate Professor Roden and Dr Oelgeschläger): projects include regulation of transcription by steroid receptors, the role of chromatin modifications in regulating the onset of flowering, the regulation of gene transcription in the malaria parasite *Plasmodium*, and the regulation of gene expression during neuronal differentiation. Evolutionary genetics (Dr O'Ryan): projects focus on the evolution of neutral DNA markers to address population-genetics questions. 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 (Professor 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*, the causative agent of severe malaria. 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 (Dr Meyers): South African soil and marine actinomycete bacteria are being screened for novel antibiotics. Analytical services: the Department runs a DNA synthesis facility and a Proteomics/Metabolomics platform.

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.
24 NQF credits at HEQSF level 6
Convener: Dr P Meyers
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: 40% test average; 50% average for assignments; attendance at practicals.
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.
24 NQF credits at HEQSF level 6
Convener: Dr T Oelgeschläger
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: 40% test average; 50% average for assignments; attendance at practicals.
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 HEQSF level 6
Convener: Associate Professor L Roden
Course entry requirements: MCB2020F and MCB2021F (or at least 40% subminimum for the examinations and a 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: 40% test average; 50% average for assignments; attendance at practicals.
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.

MCB2023S FUNCTIONAL GENETICS
Entrance is limited to 140 students
24 NQF credits at HEQSF level 6
Convener: Professor N Illing
Course entry requirements: MCB2020F and MCB2021F (or at least a 40% subminimum for the examinations and a 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: 40% test average; 50% average for assignments; attendance at practicals.
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.

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 all third year second semester MCB courses.

MCB3012Z RESEARCH PROJECT IN MOLECULAR & CELL BIOLOGY
0 NQF credits at HEQSF level 7
Convener: Dr L Donaldson
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 HEQSF level 7
Convener: Dr C O'Ryan
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: 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: 40% test average
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 HEQSF level 7
Convener: Associate Professor R Ingle
Course entry requirements: MCB2020F, MCB2021F and MCB2022S or MCB2023S
Course outline:
This course will examine the innate immune systems of invertebrates and plants. The focus will switch to the adaptive immune system, with emphasis on three major disease challenges in South Africa, such as HIV, TB and malaria, and host-pathogen interactions. Finally, the course will examine strategies to produce vaccines that enable immunity to viral infection.
Lecture times: Monday - Friday, 5th period
DP requirements: 40% test average
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 HEQSF 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: 40% test average; 50% average for assignments; attendance at practicals.
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 HEQSF level 7
Convener: Dr 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: 40% test average; 50% average for assignments; attendance at practicals.
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.

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 HEQSF level 8
Convener: Associate Professor V Coyne
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 HEQSF 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 HEQSF 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 in the RW James Building, Residence Road
Telephone (021) 650-3277 Fax (021) 650-3979
The Departmental abbreviation for Oceanography is SEA.

Associate 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:
C J C Reason, BSc Hons *Cape Town* MPhil *City* MSc PhD *British Columbia*
Senior Scholar:
J G Field, BSc Hons PhD *Cape Town* FRSSAf
Emeritus Professors:
G B Brundrit, BSc Hons PhD *Manchester*
F A Shillington, BSc Hons *Witwatersrand* MSc PhD *Cape Town*
Associate Professor:
M Vichi, MSc *Bologna* PhD *Oldenburg*
Lecturers:
K E Altieri, MA *Princeton* PhD *Rutgers*
S Fawcett, BA Hons *Harvard* MA PhD *Princeton*
Honorary Research Associates:
B Backeburg, PhD *Cape Town*
S Bernard, BSc *Soton* PhD *Cape Town* (CSIR)
N Burls, MSc PhD *Cape Town*
J Deshayes, PhD *Paris*
N Fauchereau, PhD *Bourgogne*
S Herbette, PhD *Uni de Bretagne Occidentale*
J Hermes, BSc *Bangor* PhD *Cape Town* (SAEON)
W Joubert, PhD *Cape Town*
M Krug, MSc PhD *Cape Town*
T Lamont, PhD *Cape Town*
P M S Monteiro, MSc PhD *Cape Town* (CSIR)
S Pous, PhD *Uni de Bretagne Occidentale*
P Penven, PhD *Uni de Bretagne Occidentale*
C Rautenbach, PhD *TUC Norway*
S Swart, PhD *Cape Town*
S Thomalla, PhD *Cape Town*
Departmental Librarian:
N Jabaar, ND (Cost accounting) *CPUT*
Principal Technical Officer:
P Truter, BSc *Stell*
Chief 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*
B Backeberg, BSc Hons PhD *Cape Town*
M Rouault, MSc PhD *Aix-Marseille*

MARINE RESEARCH INSTITUTE (MA-RE)
The Department of Oceanography is affiliated to the Marine Research Institute. For more information refer to the "Inter-Faculty Units" section, further on in this handbook.

RESEARCH IN OCEANOGRAPHY AND ATMOSPHERIC SCIENCE
Oceanography: Ocean and atmospheric modelling, coastal oceanography, air-sea interaction, shelf dynamics, marine climatology, climate change and variability, marine and coastal meteorology, extreme events, regional oceanography, marine and atmospheric biogeochemistry (Professors C J C Reason and M Rouault, Associate Professors M Vichi, and I J Ansorge, Lecturers Drs S E Fawcett and K Altieri).

Undergraduate Courses

Second-Year Courses

SEA2004F PRINCIPLES OF OCEANOGRAPHY
24 NQF credits at HEQSF level 6
Convener: Dr K Altieri
Course entry requirements: BIO1004F/S or GEO1009F, CEM1000W.
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 six 2-week 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 tutorials and practicals and a class mark of at least 40%.
Assessment: Tutorials/practicals and tests count 40%; one 3-hour examination written in June counts 60%. A subminimum of 40% in the examination is required.

SEA2005S MARINE SYSTEMS
24 NQF credits at HEQSF level 6
Convener: Dr S E Fawcett
Course entry requirements: BIO1004F/S or GEO1009F, CEM1000W, SEA2004F
Course outline:
Building on the principles of oceanography, this more advanced course will cover the main ocean and atmosphere systems. This includes an introduction to Earth system dynamics and the study of interactions between physical processes and major biogeochemical cycles. The physical forcing and ecosystem responses will be quantitatively illustrated for upwelling systems, oligotrophic systems, coastal systems around South Africa and the Southern Ocean. Emphasis will be on treating the systems in an integrative manner. The course comprises six 2-week modules, which cover the above topics. Methods of data sampling and analysis 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.

Third-Year Courses

SEA3004F OCEAN & ATMOSPHERE DYNAMICS
36 NQF credits at HEQSF level 7
Convener: Associate 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 HEQSF level 8
Convener: Associate Professor I J Ansorge and Dr K Altieri
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 HEQSF 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 HEQSF 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 HEQSF level 9
Convener: Associate 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 cover 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 Research Institute 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 Research Institute).

SEA5012W APPLIED OCEAN SCIENCES MINOR DISSERTATION
90 NQF credits at HEQSF level 9
Convener: Associate 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 HEQSF 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.

Professor and Head of Department:
A Buffler, MSc PhD HDE *Cape Town*
Professor:
A Peshier, MA PhD *Dresden*
Senior Scholars:
J W A Cleymans, MSc D en Sc *Louvain* FRSSAf
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*
R D Viollier, Dipl Phys Dr phil nat *Basel* FRSSAf
Associate Professors:
M S Allie, MSc PhD *Cape Town* (CHED)
M D Blumenthal, BSc *Witwatersrand* Dipl Phys *Bonn* PhD *Cantab*
H W G Weigert, Dipl Phys Dr rer nat habil *Regensburg*
Emeritus Associate Professors:
R W Fearick, BSc Hons PhD *Witwatersrand*
M Härting, Dipl Phys *Regensberg* Dr. Ing BW *München*
P E Spargo, BSc (Eng) MSc *Witwatersrand* Cert Ed *Cantab* FRSSAf
G N v d H Robertson, BSc Hons *Cape Town* DPhil *Oxon*
Senior Lecturers:
W A Horowitz, MA MSc PhD *Columbia*
S W Peterson, MA PhD *Wisconsin*
D L Taylor, BSc Hons HDE *UKZN* MSc PhD *Witwatersrand* (CHED)
S M Wheaton, MSc PhD *Cape Town*
S Yacoob, MSc *Cape Town* PhD *Northwestern*
Lecturers:
K E Cole, MSc *Liverpool* PhD *ICL*
T Dietel, Dipl Phys *Heidelberg* Dr phil nat *Frankfurt am Main*
T Leadbeater, MSc PhD *Birmingham*
T Salagaram, MSc PhD *UKZN*
Honorary Research Associates:
J A Ayala, PhD *Minnesota*
M Loewe, PhD *Hamburg*
F E Lubben, MSc *Delft* MA *York* PGCE *Delft*
K Schilcher, PhD *Vienna*
M Spiesberger, PhD *Mainz*
Chief Scientific Officer:
N Razak, MSc PhD *Cape Town*
Scientific Officer:

Adjunct Research Officers:
C J Lee
S Singh
Principal Technical Officers:
J Dickson
G K Fowle

K J Ontong
C J J Sadler
Chief Technical Officer:

Senior Technical Officer:
M Christians
Department Administrator:
N Lovric
Senior Secretaries:
J Patel
M Mayiya
Laboratory Assistant:
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 (D G Aschman, A Buffler, R W Fearick, T Leadbeater) 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 (J W A Cleymans, 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 (J W A Cleymans, T Dietel, S Yacoob), 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, KE Cole, T Leadbeater, S W Peterson, T Salagaram, 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 HEQSF level 5

Convener: Professor A Buffler

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, kinetic theory of gases, efficiency of engines. 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 HEQSF level 5

Convener: Dr 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, Doppler Effect.
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 written examination in November counts 50%.

PHY1031F GENERAL PHYSICS A
18 NQF credits at HEQSF 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, Doppler Effect.
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 written examination in June counts 50%.

PHY1032F GENERAL PHYSICS B
18 NQF credits at HEQSF 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% in 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 HEQSF level 5
Convener: Dr T Dietel
Course entry requirements: PHY1031F or PHY1023H
Course outline:
PHY1032S 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: 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% in 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%.

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 HEQSF level 6
Convener: Dr S Yacoob
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% in 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 2-hour examination in June counts 20%; one 3-hour examination in November counts 30%. A subminimum of 40% is required for the weighted average 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 HEQSF level 7

Convener: Dr S W Wheaton

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% in 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 counts 25%; two 2-hour examinations in November counts 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 HEQSF level 8

Convener: Professor A Peshier

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 co-ordinator. 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 comprising at least 12, but not more than 14 units. The compulsory modules are: Research Project (3 units), Electromagnetism 1, Electromagnetism 2, Quantum Mechanics 1, Quantum Mechanics 2, and Statistical Physics. At least three further modules must be chosen from: Classical Mechanics, Computational Physics, Particle Physics, Nuclear Physics, Relativistic Quantum Mechanics, Quantum Field Theory, and Solid State Physics. 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. The choice of modules and research project must be approved by the Head of Physics in consultation with the Honours co-ordinator. Details appear on the Physics website: www.phy.uct.ac.za.
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 two 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 HEQSF 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 HEQSF 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 HEQSF 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 HEQSF 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 HEQSF level 9
Convener: Dr T Dietel
Course entry requirements: Core modules of the Master's 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 component will be required.

PHY5008W DATA SCIENCE MINOR DISSERTATION
90 NQF credits at HEQSF 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 HEQSF 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 HEQSF 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 Little, MSc PhD *Cape Town*
Professor:
G D I Barr, MSc PhD *Cape Town*
Emeritus Professor:
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*
Honorary Research Associates:
A Antoniadis, PhD DSc *Grenoble I*
D Borchers, PhD *St Andrews*
J Colville, PhD *Cape Town*
D Maphisa, PhD *Cape Town*
S Mecenero, PhD *Cape Town*
A Stein, PhD *Wageningen*
H Winkler, PhD *Rhodes*
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*
B Erni, BSc Hons MSc *Cape Town* PhD *Basel*
F N Gumedze, MSc PhD *Cape Town*
J C Nyirenda, BSc *Newcastle Upon Tyne* PhD *Cantab*
S Silal, PhD *Cape Town*
K Stielau, BSc Hons *Natal*
Adjunct Associate Professor:
I Durbach, MSc PhD *Cape Town*
Adjunct Senior Lecturers:
M J P Lacerda, MSc *Cape Town* PhD *Galway*
M Varughese, BSc Hons MSc *Witwatersrand* DipAc&Tech *Edinburgh* PhD *Cape Town*
Lecturers:
S Britz, MSc *UFS*
S Er, PhD *Istanbul*
D Katshunga, BSc Hons *DRC* MSc *Cape Town*
M Mavuso, MPhil *Cape Town*, MSc *Cape Town*
W Msemburi, MPhil *Cape Town*
M Ngwenya, MSc *Cape Town*
E Pienaar, PhD *Cape Town*
N Watson, MSc *Cape Town*
Principal Scientific Officers (Consultants):
A Hardy, MSc *San Jose State Univ California*

R Kassanjee, PhD *Witwatersrand*
Administrative Manager:
B King, HDE *UWC*
Administrative Assistants:
K Franz
C Jansen-Fielies
N Maqubela
Financial Officer:
S Meyer, BCom *Unisa*
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*
B Erni, BSc Hons MSc *Cape Town* PhD *Basel*
A C Jarre, PhD *Bremen*
I L Macdonald, PhD *Cape Town*
D Maphisa, PhD *Cape Town*
S Mecenero, PhD *Cape Town*
P G Ryan, PhD *Cape Town*
L G Underhill, PhD *Cape Town*
M M Varughese, PhD *Cape Town*
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).
BIOINFORMATICS: The application of statistical and computational techniques to problems in genetics and molecular biology (M J P Lacerda).
BIOSTATISTICS: Medical applications of statistics (F Little, L M Haines, F Gumedze, S Silal, R Kassanjee). 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 (M J P Lacerda, 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 (G D I Barr, 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 Gumedze, 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).
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, M Varughese, 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.

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. Workshops: One short workshop per week and one long workshop per week. Not compulsory but recommended.
18 NQF credits at HEQSF 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 or STA1001F. In addition students will be admitted to STA1000F if they have failed but obtained a DP for any of the above courses and are concurrently registered for an equivalent Mathematics course during the first semester.
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 various tests on means); 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.
This course is offered in a blended learning format. Students make use of online learning and have the option to attend face to face workshops.
DP requirements: A class record of at least 35% and quiz completion with a minimum of 90% for each quiz.
Assessment: The class record counts 30%. One 2-hour examination counts 70%.

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. Workshops: One short workshop per week and a long workshop per week. Not compulsory but recommended.

18 NQF credits at HEQSF 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 or STA1001F. 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 failed but obtained a DP for MAM1010F, MAM1004F, MAM1020F or STA1001F and are concurrently registered for an equivalent Mathematics course during the second semester, or (4) have a supplementary examination for MAM1010F, MAM1004F, MAM1020F or STA1001F 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 various tests on means); 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.

The course is offered in a blended learning format. Students make use of online learning and have the option to attend face to face workshops.

DP requirements: A class record of at least 35% and quiz completion with a minimum of 90% for each quiz.

Assessment: The class record counts 30%. One 2-hour examination counts 70%.

STA1000P/L INTRODUCTORY STATISTICS

(offered during summer and winter terms)

18 NQF credits at HEQSF 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 various tests on means); 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. The course is presented in online format.

DP requirements: A class record of at least 35% and quiz completion with a minimum of 90% for each quiz.

Assessment: The class record counts 30%. One 2-hour examination counts 70%.

STA1006S MATHEMATICAL STATISTICS I

18 NQF credits at HEQSF level 5

Convener: Dr F Gumedze

Course entry requirements: At least 70% in NSC Mathematics; concurrent registration on MAM1000W, or MAM1006H or MAM1012S or MAM1021S

Course outline:

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.

Lecture times: Five lectures per week, Monday - Friday, 4th period

DP requirements: Attendance and completion of all tests/assignments; minimum 90% average for quizzes; class record of 35%

Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA1007S INTRODUCTORY STATISTICS FOR SCIENTISTS

18 NQF credits at HEQSF level 5

Convener: Dr G Distiller

Course entry requirements: A pass in any of MAM1004F/S or MAM1005H. In addition students will be admitted to STA1007S if they (1) are concurrently registered for MAM1000W, or (2) are concurrently registered for MAM1005H or (3) have failed but obtained a DP for MAM1004F and are concurrently registered for an equivalent Mathematics course during the second semester, or (4) have a supplementary examination for MAM1004F that will be written in November of the year of registration.

Course outline:

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.

Lecture times: Five lectures per week, Monday - Friday, 1st period.

DP requirements: Attendance and completion of all tests; class record of 35%.

Assessment: Coursework 40%. One 3-hour examination counts 60%.

Second-Year Courses

STA2004F STATISTICAL THEORY & INFERENCE

24 NQF credits at HEQSF 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.
Distribution Theory: Univariate and bivariate distributions. Conditional distributions. Moments. Generating functions (moment, probability and cumulative). Convergence in distribution and central limit theorem. Transformations of random variables. Sampling distributions from the normal distribution (chi-squared, t, F). Order statistics.
Statistical Inference: Parameter estimation. Methods of moments. Maximum likelihood. Asymptotic theory. Efficiency and sufficiency. The exponential family. Hypothesis testing. Confidence intervals.
Lecture times: Five lectures per week, Monday to Friday, 1st period.
DP requirements: Attendance at all tests, attendance at 85% of tutorials, 50% average for tutorial tests, class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA2005S LINEAR MODELS

24 NQF credits at HEQSF level 6
Convener: Dr B Erni
Course entry requirements: DP certificate for STA2004F.
Course outline:
This course gives an introduction to statistical modelling and the theory of linear statistical models. The student is introduced to the principles of experimental design, statistical software and practical data analysis through weekly computer practicals and the exposure to many data sets. The course has three 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.
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.
Nonparametric statistics: Introduction to nonparametric tests and methods, including Mann-Whitney U, Kruskal Wallis, Friedman and randomisation tests.
Lecture times: Five lectures per week, Monday - Friday, 1st period.
DP requirements: Attendance and completion of all tests/assignments, minimum 80% average for quizzes, class record of 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA2007F/S STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS

This course is offered in blended learning format. Students make use of online learning workshops. One introductory workshop at the beginning of each semester. One tutorial per week.

24 NQF credits at HEQSF level 6

Convener: Associate Professor R Altwegg

Course entry requirements: (STA1000F/S or STA1006S or STA1007S) and (MAM1000W or MAM1004F/S or MAM1005H or MAM1010F/S or MAM1020F/S or STA1001F)

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. Students must attend one of these workshops before being given access to the online material. They can elect to do the online material in their own time and at their own pace subject to assignment and quiz deadlines being met. Communication with lecturers will be through an online forum.

Lecture times: Monday & Tuesday & Thursday & Friday, 2nd period; Wednesday, 2nd & 7th period

DP requirements: At least 35% for class record and satisfactory completion of all projects (subminimum of 40% for each project).

Assessment: Class record counts 40% .One 2-hour examination counts 60%.

STA2007H STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS

This course is offered in blended learning format. Students make use of online learning workshops. One introductory workshop at the beginning of each semester. One tutorial per week. Students can elect to write exam either in June or November of year of registration.

24 NQF credits at HEQSF level 6

Convener: Associate Professor R Altwegg

Course entry requirements: (STA1000F/S or STA1006S or STA1007S) and (MAM1000W or MAM1004F/S or MAM1005H or MAM1010F/S or MAM1020F/S or STA1001F)

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. Students must attend one of these workshops before being given access to the online material. They can elect to do the online material in their own time and at their own pace subject to assignment and quiz deadlines being met. Communication with lecturers will be through an online forum. Students can choose to write the examination (at UCT) either at the end of the first or second semester.

DP requirements: At least 35% for class record and satisfactory completion of all projects (subminimum of 40% for each project).

Assessment: Class record counts 40% (equally divided between tests and projects). One 2-hour examination counts 60%.

STA2007P/L STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS

This course is offered in blended learning format during summer and winter term dependent on there being sufficient demand. Students make use of online learning workshops.

24 NQF credits at HEQSF level 6

Convener: Associate Professor R Altwegg

Course entry requirements: (STA1007S (preferably), or STA1000F/S or STA1006S) and (MAM100W or MAM1004F/S or MAM1005H or MAM1010F/S or MAM1020F/S or STA1001F)

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. Students must attend one of these workshops before being given access to the online material. They can elect to do the online material in their own time and at their own pace subject to assignment and quiz deadlines being met. Communication with lecturers will be through an online forum. Students can choose to write the examination (at UCT) either at the end of the first or second semester.

DP requirements: At least 35% for class record and satisfactory completion of all projects (subminimum of 40% for each project).

Assessment: Class record counts 40% (equally divided between tests and projects). One 2-hour examination counts 60%.

STA2020F APPLIED STATISTICS

24 NQF credits at HEQSF level 6

Convener: N Watson

Course entry requirements: STA1000S or STA1006S or STA1007S and DP for MAM1000W or MAM1004F or MAM1010F/S or MAM1020F/S or STA1001F. Concurrent registration for MAM1000W or MAM1005H or MAM1004F or MAM1010F/S or MAM1020F/S if not already passed.

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 rigor 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: At least 35% for class record and at least 50% for Excel test.

Assessment: Class record counts 40%. One 3-hour examination counts 60%.

STA2020S APPLIED STATISTICS
24 NQF credits at HEQSF level 6
Convener: N Watson
Course entry requirements: STA1000S or STA1006S or STA1007S and DP for MAM1000W or MAM1005H or MAM1004F or MAM1010F/S or MAM1020F/S or STA1001F. Concurrent registration for MAM1000W or MAM1005H or MAM1010F/S or MAM1020F/S or STA1001F if not already passed.
Course outline:
This is designed to extend the student's basic knowledge, acquired in STA1000F/S. The emphasis of the course is on applying statistical methods and modelling techniques to data rather than focusing on the mathematical rigor 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: At least 35% for class record and at least 50% for Excel test.
Assessment: Class record counts 40%. One 3-hour examination counts 60%.

STA2030S THEORY OF STATISTICS
24 NQF credits at HEQSF level 6
Convener: S Britz
Course entry requirements: STA2020F/S or STA2007F/S/H and MAM1000W or MAM1005H or MAM1004F or MAM1010F/S or MAM1020F/S or STA1001F. Concurrent registration for MAM1006H or MAM1008S or MAM1012S or MAM1021F/S if not already passed.
Course outline:
This course explores aspects of probability theory that are particularly relevant to statistics. Such aspects include 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 and introduction to GLMs.
Lecture times: Monday - Thursday, 1st period
DP requirements: Class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

Third-Year Courses

STA3022F RESEARCH AND SURVEY STATISTICS
36 NQF credits at HEQSF level 7
Convener: Dr S Er
Course entry requirements: STA2020F/S or STA2005S or STA2007F/S/H
Course outline:
The aim of this course is to create a practical working familiarity with analysis of the data, focusing on multivariate methods as applied in areas such as marketing and social science research. Topics covered include classification trees, correspondence analysis, principal components and factor analysis, cluster analysis, discriminant analysis and structural equations modelling.
Lecture times: Monday - Thursday, 4th period
DP requirements: Attendance and completion of all tests/assignments, class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA3030F INFERENTIAL STATISTICS
36 NQF credits at HEQSF level 7
Convener: Dr J Nyirenda
Course entry requirements: STA2030F/S 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. The course consists of modules: estimation and simulation. The estimation module introduces students to the methods used in the estimation of distribution parameters. Topics covered include: bias and efficiency of estimators; method of maximum likelihood; method of moments; asymptotic theory; Bayesian methods; decision theory; hypothesis testing and likelihood ratio tests. 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.
Lecture times: Monday - Thursday, 1st period
DP requirements: Attendance and completion of all tests/assignments, class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA3036S OPERATIONAL RESEARCH TECHNIQUES
36 NQF credits at HEQSF level 7
Convener: Dr S Silal
Course entry requirements: STA2030S; 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: Attendance and completion of all tests/assignments, class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA3041F MARKOV PROCESSES & TIME SERIES
36 NQF credits at HEQSF level 7
Convener: To be advised
Course entry requirements: STA2004F and STA2005S; MAM2000W 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. The aim of the Stochastic Processes module is to provide grounding for theory and basic applications in financial modelling while the aim of the Time Series module is to introduce students to the foundations of the Box-Jenkins methodology with the intention of applying the techniques using statistical software. The content of the modules are as follows:
Stochastic processes: The modules cover the general theory underlying stochastic processes and their classifications, definitions and applications of discrete Markov chains. Branching processes are examined for extinction or survival. Probabilities associated with multiple events are derived and

applications presented. Counting processes in discrete and continuous time are modelled with a view to establishing methods of forecast and backcast. Ruin theory and reinsurance themes are insurance of continuous time processes. Ruin and loss are considered in a framework covering single claims for losses or insured events. Students are also introduced to run-off triangles.
Time series analysis: Topics that are covered include: 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 cointergration.
Lecture times: Five lectures per week, Monday - Friday, 1st period
DP requirements: Attendance and completion of all tests; class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA3043S DECISION THEORY & GLM
36 NQF credits at HEQSF level 7
Convener: To be advised
Course entry requirements: STA2004F and STA2005S; MAM2000W 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: The Generalised Linear Models module introduces students to the theory and application of fitting linear models to different types of response variables with different underlying distributions. The Decision and Risk Theory module is an introduction to the structure of decision making under uncertainty. The content of the modules are 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, Poisson regression and loglinear models.
Decision theory: Topics covered include: game theory and non-probabilistic decision criteria; probabilistic decision criteria; expected value and utility; use of Bayes' theorem; value of information; Bayesian statistical analysis for Bernoulli and normal sampling; empirical Bayes and credibility theory; loss and extreme value distributions; Monte Carlo method.
Lecture times: Five lectures per week, Monday - Friday, 1st period.
DP requirements: Attendance and completion of all tests and assignments; class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

STA3045F ADVANCED STOCHASTIC PROCESSES
36 NQF credits at HEQSF level 7
Convener: To be advised
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 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 include: Poisson processes, continuous-time Markov chains, random walks, probability theory, discrete-time martingale processes, Brownian motion and diffusion processes.
Lecture times: Five lectures per week, Monday - Friday, 2nd period.
DP requirements: Attendance of all tests and tutorials; class record of at least 35%.
Assessment: Class record counts 30%. One 3-hour examination counts 70%.

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). Entrance is limited to 24 students for the combined Honours courses made up of STA4007W, STA4019H, STA4006W and STA4010W

160 NQF credits at HEQSF level 8

Convener: Dr G Distiller

Course entry requirements: The minimum requirements are MAM1000W (MAM1010 and MAM1012), 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 HEQSF level 8

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.

STA5000W STATISTICS DISSERTATION
180 NQF credits at HEQSF 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 HEQSF 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.

STA5003W ADVANCED ANALYTICS COURSEWORK

The code STA5003W represents the overall coursework component of the Master's course in Analytics; the overall coursework result will be reflected against this code.

0 NQF credits at HEQSF level 9

Convener: Dr S Er

Course entry requirements: For the coursework component (STA5003W), an honours degree in Statistics or a four-year Bachelor's degree of equal standard to the UCT honours degree in Statistical Sciences with a mark of at least 65% in the 4th year of study at first attempt or a mark of at least 65% (on first attempt during 4th year of study) for an honours degree in another 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.

Course outline:

The course work component of the Master's course in Statistical Sciences (STA5003W) aims to train students in more advanced statistical methodology needed for the analysis of data from Commerce, Science and Health Sciences. Students need to complete a selection of modules chosen from, Advanced Topics in Regression, Multivariate Statistics, Simulation and Optimisation, Machine Learning, Longitudinal Data Analysis, Survival Analysis, Bayesian Decision Analysis, Biological Statistics (Biostatistics, Bioinformatics or Ecological Statistics), Advanced Portfolio Management, Financial Statistics, Problem Structuring and Project Management, Operation Research Case Studies, Infectious Diseases Modelling and Causal Modelling or modules making up the Data Science master's. The course is structured to allow for a focus on Data Analytics through the choice of the first four modules mentioned above together with modules from Computer Science or other programming modules and the choice of a topic in the area of Big Data Analytics for the dissertation component (STA5004W) of the masters. Through the combination of modules in Operations Research, Statistics and Decisions Modelling, the master's degree offers a qualification in Decision Sciences. In addition it allows for streaming in the popular areas of Biological or Financial Statistics. Each module accounts for either 15 or 12 HEQF credits on level 9 and students need to complete 90 credits with the option of completing a maximum of 30 credits in a different department or faculty or from level 8 Statistics courses. Not all modules will be offered every year; the course will be tailored to the interests and needs of the particular students and the resources available in the department.

Assessment: The coursework component of the degree will be assessed through class assignments and examinations for each module taken. The overall mark for the coursework component will be a weighted average (based on contribution towards total credit count) of the marks obtained for the individual modules. Students who fail the coursework component will not be allowed to reregister in a subsequent year.

STA5004W ADVANCED ANALYTICS MINOR DISSERTATION

90 NQF credits at HEQSF 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.

IBS5004Z BIOINFORMATICS FOR HIGH-THROUGHPUT BIOLOGY
15 NQF credits at HEQSF 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.

IBS5005W DATA SCIENCE MINOR DISSERTATION
90 NQF credits at HEQSF 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.

STA5010W OPERATIONAL RESEARCH IN DEVELOPMENT COURSEWORK
This course may not be offered in 2018
90 NQF credits at HEQSF 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.

STA5011W OPERATIONAL RESEARCH IN DEVELOPMENT MINOR DISSERTATION
This course may not be offered in 2018
90 NQF credits at HEQSF 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.

STA5013W STATISTICAL ECOLOGY DISSERTATION

180 NQF credits at HEQSF 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 HEQSF level 9

Convener: Dr S Er

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.

STA5057W BIOSTATISTICS COURSEWORK

The code STA5057W represents the overall coursework component of the Master's course in Biostatistics; the overall coursework result will be reflected against this code.

0 NQF credits at HEQSF level 9

Convener: Associate Professor F Little

Course entry requirements: A mark of at least 65% for an honours degree in Statistics of equal standard 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.

Course outline:

The course work component of the MSc course in Biostatistics aims to train students in more advanced statistical methodology needed for the analysis of data from the Health and Biological Sciences. Students complete 6 modules, of which 4 are compulsory and include Multivariate Statistics (STA5069Z), Longitudinal Data Analysis (STA5067Z), Survival Analysis (STA5072Z) and Design of Clinical Trials (STA5063Z). The remaining two electives are chosen from among others, Advanced Topics in Regression (STA5090Z), Simulation and Optimisation (STA5071Z), Machine Learning (STA5068Z), Bayesian Decision Analysis (STA5061Z), Infectious Disease Modelling (STA5066Z), Ecological Statistics (STA5064Z) and Causal Modelling (STA5062Z).

Each module accounts for 15 HEQF credits on level 9 and students need to complete 90 credits with the option of completing a maximum of 30 credits in a different department or faculty or from level 8 Statistics courses. Not all modules will be offered every year; the course will be tailored to the interests and needs of the particular students and the resources available in the department.
Assessment: The coursework component of the degree will be assessed through class assignments and examinations for each module taken. The overall mark for the coursework component will be a weighted average (based on contribution towards total credit count) of the marks obtained for the individual modules. Students who fail the coursework component will not be allowed to reregister in a subsequent year.

STA5058W BIOSTATISTICS MINOR DISSERTATION
90 NQF credits at HEQSF level 9
Convener: Associate Professor F Little
Course entry requirements: Successful completion of the coursework component (STA5057W) 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 HEQSF level 9
Convener: Associate 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 HEQSF level 9
Convener: Associate 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 HEQSF level 9
Convener: Professor T Stewart
Course entry requirements: Acceptance into STA5003W or STA5057W or STA5080W 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 leaning 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 HEQSF level 9
Convener: Dr S Er
Course entry requirements: Acceptance into either STA5003W, STA5056W or STA5080W, 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 Probablity 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 HEQSF level 9
Convener: Associate Professor F Little
Course entry requirements: Acceptance into STA5057W, 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 HEQSF 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 HEQSF level 9
Convener: Professor G Barr
Course entry requirements: Acceptance into STA5003W or STA5080W 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 HEQSF level 9
Convener: Dr S Silal
Course entry requirements: Acceptance into STA5003W or STA5057W or STA5080W 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.

STA5067Z LONGITUDINAL DATA ANALYSIS
15 NQF credits at HEQSF level 9
Convener: Associate Professor F Little
Course entry requirements: Acceptance into either STA5003W, STA5056W or STA5080W, 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.

STA5068Z MACHINE LEARNING
15 NQF credits at HEQSF level 9
Convener: Dr E Pienaar
Course entry requirements: Acceptance into STA5003W or STA5057W or STA5080W 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 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, Bagging, Random Forests and Gradient Boosting Machines. The course may not be offered every year.
DP requirements: 40% for assignment and project component
Assessment: Assignment 1: 10% Assignment 2: 10%. Project: 30%. Exam: 50%. A subminimum of 40% in each component is required.

STA5069Z MULTIVARIATE STATISTICS
15 NQF credits at HEQSF level 9
Convener: Associate Professor F Little
Course entry requirements: Acceptance into STA5003W, STA5057W or STA5080W 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 HEQSF level 9
Convener: Associate Professor L Scott
Course entry requirements: Acceptance into either STA5003W, STA5057W or STA5080W 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 HEQSF level 9
Convener: Dr S Silal
Course entry requirements: Acceptance into STA5003W or STA5057W or STA5080W 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 HEQSF level 9
Convener: Dr F Gumedze
Course entry requirements: Acceptance into either STA5003W, STA5056W or STA5080W, 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.

STA5073Z DATA SCIENCE FOR INDUSTRY
12 NQF credits at HEQSF level 9
Convener: Associate Professor I Durbach
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 seeks to equip the student with the skills required for a career in Data Science within industry. Topics covered include A/B Testing, Design of Experiments (which includes

Randomisation, Block Design and Replication), Natural Language Processing and Recommendation Systems. It teaches students how to deal with non-standard datasets such as images, audio recordings and network graphs.
DP requirements: At least 40% for the assignments section
Assessment: Assignments: 40%. Examination: 60%. A sub-minimum of 40% for each of the assignment and examination component will be required.

STA5074Z DECISION MODELLING FOR PRESCRIPTIVE ANALYTICS
12 NQF credits at HEQSF 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.

STA5075Z STATISTICAL AND HIGH PERFORMANCE COMPUTING
12 NQF credits at HEQSF 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:
This courses 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.

STA5076Z SUPERVISED LEARNING
18 NQF credits at HEQSF 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.

STA5077Z UNSUPERVISED LEARNING
12 NQF credits at HEQSF 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:
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, principal component analysis.

STA5079W DATA SCIENCE MINOR DISSERTATION
90 NQF credits at HEQSF 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.

STA5080W DATA SCIENCE COURSEWORK
The code STA5080W represents the overall coursework component of the Master's course in Data Science; the overall coursework result will be reflected against this code. The course will be convened by the Department of Statistical Sciences and is offered jointly with the departments of Astronomy, Physics, Computer Science and Intergrative Biomedical Sciences. There are a range of possible minor dissertation codes, depending on the discipline in which the student chooses to register for the for the research component.
0 NQF credits at HEQSF level 9
Convener: Dr S Er
Course entry requirements: A mark of at least 65% for an honours degree (equivalent in standard to that of a UCT degree) in any discipline that included a substantial component of quantitative and computing skills. 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. If the applicant is considered to be lacking in particular skills deemed necessary to succeed in this degree they may be required to register for and pass pre-courses before final acceptance.
Course outline:
This is an interdisciplinary degree in Data Science. Topics covered include database construction and management, statistical and high performance computing, data visualisation, unsupervised learning (including market basket analysis, self-organising maps, multidimensional scaling, cluster analysis, principal component analysis) and supervised learning (generalized linear models, tree-based methods, multivariate methods, neural networks, support vector machines), decision modelling for prescriptive analytics, bayesian modelling as well as the application of these techniques to Astronomy, Particle Physics, Bioinformatics, Finance and other areas.
DP requirements: Attendance of lectures and successful completion of class assignments.
Assessment: The coursework component of the degree will be assessed through class assignments and examinations for each module taken. Students will be required to pass 5 core and 2 elective modules. Students will be required to pass each individual module in order to pass the coursework component of the degree. Students may fail a maximum of two core modules and may repeat these

modules once. The overall mark for the coursework component will be a weighted average (based on contribution towards final credit count) of the marks obtained for the individual modules.

STA5086Z ADVANCED PORTFOLIO THEORY

Fifth year status, second semester, two double lectures per week (24 lectures).
15 NQF credits at HEQSF level 9
Convener: Associate Professor T Gebbie
Course entry requirements: Acceptance into either STA5003W or STA5080W 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 adnaved 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 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 HEQSF level 9
Convener: Dr S Er
Course entry requirements: Acceptance into either STA5003W, STA5057W or STA5080W 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

12 NQF credits at HEQSF level 9
Convener: Associate Professor T Gebbie
Course entry requirements: Acceptance into either STA5003W, STA5057W or STA5080W 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 aquire skills in Understanding and Preparing Financial Market Data; Data Science of Market Microstructure; Market Structure and Market Microstructure; Statistical Learning for Financial Market Data.

STA6001W STATISTICAL SCIENCES THESIS
360 NQF credits at HEQSF 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 HEQSF 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.

INTER-FACULTY UNITS

AFRICAN CLIMATE AND DEVELOPMENT INITIATIVE (ACDI)

Professor, Director, Pro-VC for Climate Change, 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*
Research Fellows:
L Pasquini, PhD *Sheffield*
D Spear, PhD *Stellenbosch*
Postdoctoral Fellows:
C Ofoegbu, PhD *Pretoria*
T Perez, PhD *Cape Town*
Research Manager:
L Scodanibbio, MSc *British Columbia*
Research Officer:
N Methner, PhD *Cape Town*
Scientific Officers:
T Hoffman, PhD *Cape Town*
B Ottermann, MA *Cape Town*
N Reay, BA *Cape Town*
Portfolio Managers:
L Cobban, MSc *Rhodes*
R Fortune, Nat.Dipl Journalism *CPUT*
K Fosseus, BNur *Cape Town*
Z Visser, MSocSci *Cape Town*
Portfolio Officer:
A Okeyo, MPhil *Cape Town*
Portfolio Assistant:
P Chauke, MSc *Oxon*
R Karriem
Senior Secretary and PA to Director:
N Somatube

The African Climate & Development Initiative (ACDI) is the University of Cape Town's (UCT) active response to the climate change and development challenge. ACDI was inaugurated in 2011 by the University of Cape Town's (UCT) Vice-Chancellor, Max Price, as one of four strategic initiatives, each contributing to UCT's mission to tackle key issues in the social and natural worlds. Uniquely, ACDI merges climate change issues with development issues bringing together UCT's breadth and depth of research and teaching in these areas. Its interdisciplinary focus provides a multi-layered perspective on climate change and development that merges interdisciplinary expertise from specialists working in collaboration 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 access to a network of associated and affiliated climate change researchers and academics. ACDI supports doctoral and master's students through its Graduate 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 can also be referred to for detailed course outlines.

ELECTRON MICROSCOPE UNIT

Electron Microscope Unit
Director:
Professor B T Sewell, MSc *Witwatersrand* PhD *Lond*
Principal Scientific Officer:
B W Weber, BSc Hons PhD *Cape Town*
Principal Technical Officers:
M A Jaffer, BSc Hons *Cape Town*
M A Woodward, BSc *Cape Town*
Principal Scientific Officer:
M E Waldron, BSc Hons *Swansea* MSc *Cape Town*
Chief Scientific Officer:
I Shuro, BSc *Zimbabwe* MSc PhD *Toyohashi Japan*
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 FEI Nova Nano field emission gun (FEG)SEM with accessories including X-ray analyser and electron backscattered diffraction pattern analysis, and a Zeiss 1450, equipped with an X-ray analyser, backscatter detector and cryo facilities. The Unit also has two high resolution Transmission Electron Microscopes namely the 200 kV Tecnai TF20 (FEG)TEM and the Tecnai G²20 energy-filter (EF)TEM equipped with a LaB6 filament. The Unit also houses a FEI QEMSCAN and an X-Ray diffractometer. Preparative, darkroom, light microscopy, image analysis and library facilities are also provided.

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 RESEARCH INSTITUTE (MA-RE)

Marine Research Institute (Ma-Re)
Director:
M Vichi, MSc *Bologna* PhD *Oldenburg*
Deputy Directors:
J G Field, BSc Hons PhD *Cape Town*
J Glazewski, BCom LLB MA *Cape Town* LLM *London*
Masters Course Conveners:
C C Reed, MSc PhD *UFS*
M Vichi, MSc *Bologna* PhD *Oldenburg*

Communications Officer:
S Ragaller, BSocSc Hons MSocSc *Cape Town*
Administrator:
S Bosma, BA BSc Hons MSc *Cape Town*

Ma-Re is a virtual marine institute with an administrative unit based in the R W James Building, Residence Road. The Institute is an inter-departmental and cross-faculty network that links staff and students involved in all aspects of marine research. It aims to foster interdisciplinary research, conduct global change research under its own research project(s), link with other national and international marine institutions and groups, and raise funds for student bursaries and mentoring. It is associated with over forty tenured researchers from a range of units, departments and faculties and has over 160 postgraduates in its postgraduate network (please visit www.ma-re.uct.ac.za for more details). One of Ma-Re's primary functions is to provide administrative and other support to collaborative research projects within its remit of being an inter-faculty unit.
Ma-Re convenes a one year coursework Master's in Applied Ocean Sciences, which is a joint collaboration between the Department of Oceanography and the Department of Biological Sciences. This course provides interdisciplinary vocational 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 several 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.

UCT Departments/units that have research staff affiliated with Ma-Re:
Department of Biological Sciences
Department of Civil Engineering
Department of Economics
Department of Electrical & Computer Engineering
Department of Environmental & Geographical Sciences
Department of Geological Sciences
Department of Historical Studies
Department of Mathematics & Applied Mathematics
Institute of Marine & Environmental Law
Department of Mechanical Engineering
Department of Molecular & Cell Biology
Department of Oceanography
Department of Socio-Anthropology
Department of Sociology
(For details of affiliated staff members, visit http://ma-re.uct.ac.za/staff/academic-staff/)

Honorary Research Associates (Marine) in affiliated departments:
R Anderson, Hon Prof *Cape Town* (Biological Sciences; DAFF)
L Atkinson, MSc PhD *Cape Town* (Biological Sciences; SAEON)
B Backeberg, PhD *Cape Town* (Oceanography; CSIR)
R Barlow, MSc *Natal* PhD *Cape Town* (Biological Sciences)
L M Beal, PhD *Southampton* (Oceanography; Univ. Miami, USA)
S Bernard, MSc PhD *Cape Town* (Oceanography; CSIR)
N Burls, PhD *Cape Town* (Oceanography; George Mason Univ., USA)
R J M Crawford, PhD *Cape Town* (Biological Sciences; DEA)
J Deshayes, PhD *Paris* (Oceanography; CNRS France)
J C Hermes, PhD *Cape Town* (Oceanography; SAEON)
J Huggett, MSc PhD *Cape Town* (Biological Sciences; DEA)
P B Hulley, PhD *Cape Town* (Biological Sciences)

K Hutchings, BSc Hons PhD *Cape Town* (Biological Sciences)
L Hutchings, Hon Prof *Cape Town* (Biological Sciences)
S Kerwath, MSc *Erlangen* PhD *Rhodes* (Biological Sciences; DAFF)
M J Krug, PhD *Cape Town* (Oceanography; CSIR)
T Lamont, PhD *Cape Town* (Oceanography; DEA)
K MacHutchon, PhD *Stell* (Civil Engineering; Coastal Marine Technologies)
M W Matthews, PhD *Cape Town* (Oceanography)
O Maury, PhD *ENSAR France* (Oceanography; CNRS France)
A Mavume, PhD *Cape Town* (Oceanography; University Eduardo Mondlane, Mozambique)
P M S Monteiro, MSc PhD *Cape Town* (Oceanography; CSIR)
B Paterson, BSc Hons *Natal* PhD *Cape Town* (Biological Sciences; St Mary's Univ., Canada)
G Pitcher, BSc Hons *Natal* PhD *Cape Town* (Biological Sciences; DAFF)
S Pous, PhD *Paris* (Oceanography; CNRS France)
C Rautenbach, PhD *Norway* (Oceanography; UWC)
C Roy, PhD *UBOFrance* (Oceanography; IRD France)
T Samaai, BSc Hons *IC London* PHD *UWC* (Biological Sciences; DEA)
C Savage, MSc *Cape Town* PhD *Stockholm* (Biological Sciences; Univ. Otago, NZ)
Y-J Shin, MSc PhD *Paris* (Biological Sciences: IRD France)
K Sink, PhD *Cape Town* (Biological Sciences; SANBI)
S Swart, PhD *Cape Town* (Oceanography; CSIR)
S Thomalla, PhD *Cape Town* (Oceanography; CSIR)
C van der Lingen, MSc *Rhodes* PhD *Cape Town* (Biological Sciences; DEA)
H Verheye, MSc *Ghent* PhD *Cape Town* (Biological Sciences; DEA)
H Winker, MSc *Plymouth* PhD *Rhodes* (Statistical Sciences; SANBI)
D Yemane Ghebrehewit, PhD *Cape Town* (Oceanography; DEA)

SCHEDULE OF COURSES

LECTURE PERIODS

The academic day is divided into lecture periods as follows:

Period 1	08h00 to 08h45	Meridian	13h00 to 13h45
Period 2	09h00 to 09h45	Period 6	14h00 to 14h45
Period 3	10h00 to 10h45	Period 7	15h00 to 15h45
Period 4	11h00 to 11h45	Period 8	16h00 to 16h45
Period 5	12h00 to 12h45	Period 9	17h00 to 17h45

COURSE CODE	COURSE TITLE	LECTURE TIMES	PRACTICAL/ TUTORIAL TIMES	COURSE ENTRY REQUIREMENTS
AGE1002S	ARCHAEOLOGY & OUR COMMMON HERITAGE	5 M to Th	By arrangement; F 5th	None
AGE1004S	INTRODUCTION TO EARTH & ENVIRONMENT SCIENCES	To be advised M to F	One prac per week, F 14h00-17h00	See departmental entry
AGE2011S	HUMAN EVOLUTION	2 M to Th	One per week, by arrangement	See departmental entry
AGE2012F	THE FIRST PEOPLE	2 M to Th	One per week, by arrangement	See departmental entry
AGE3006H	DIRECTED READING & RESEARCH	By arrangement	None	See departmental entry
AGE3011F	THE ROOTS OF RECENT AFRICAN IDENTITY	4 M to Th	One per week, by arrangement	See departmental entry
AGE3012S	GLOBAL DIASPORAS & THE ARCHAEOLOGY OF THE HISTORICAL PAST	4 M to Th	One 2-hour prac per week, by arrangement	See departmental entry
AGE3013H	ARCHAEOLOGY IN PRACTICE	See departmental entry	None	See departmental entry
AST1000F	INTRODUCTION TO ASTRONOMY	5 M to F	W 14h00-17h00	None
AST2002H	ASTROPHYSICS	2 M, W, F	W 14h00-17h00	See departmental entry
AST2003H	ASTRONOMICAL TECHNIQUES	2 T, Th	W 14h00-16h30	See departmental entry
AST3002F	STELLAR ASTROPHYSICS	2 M to F	W 14h00-16h30	See departmental entry
AST3003S	GALACTIC & EXTRAGALACTIC ASTROPHYSICS	2 M to F	W 14h00-16h30	See departmental entry

BIO1000F	CELL BIOLOGY	5 M to F	One prac a week, M,Tu,W or Th 14h00-17h00	See departmental entry
BIO1000H	CELL BIOLOGY	5 M to F	One prac a week, Th 14h00-17h00	See departmental entry
BIO1004F	BIOLOGICAL DIVERSITY	5 M to F	One prac a week, Th 14h00-17h00	See departmental entry
BIO1004S	BIOLOGICAL DIVERSITY	5 M to F	One prac a week, M,Tu,W, Th or F 14h00-17h00	See departmental entry
BIO2010F	PRINCIPLES OF ECOLOGY & EVOLUTION	1 M to F	M 14h00-17h00	BIO1000F/H, BIO1004F/S, DP for STA1007S
BIO2011S	LIFE ON LAND: ANIMALS	3 M to F	M 14h00-17h00	BIO1000F/H, BIO1004F/S
BIO2012S	LIFE ON LAND : PLANTS	2 M to F	Th 14h00-17h00	BIO1000F/H, BIO1004F/S
BIO2013F	LIFE IN THE SEA	3 M to F	W 14h00-17h00	BIO1000F/H, BIO1004F/S
BIO3002F	MARINE ECOSYSTEMS	1 M to F	W 14h00-17h00	See departmental entry
BIO3013F	GLOBAL CHANGE ECOLOGY	2 M to F	M 14h00-17h00	BIO1000F or BIO1000H, BIO1004F/S, approved 2000-level semester Science course.
BIO3014S	CONSERVATION: GENES, POPULATIONS & BIODIVERSITY	2 M to F	M 14h00-17h00	See departmental entry
BIO3015F	ECOSYSTEM ECOLOGY	5 M to F	By arrangement	BIO2010F
BIO3016S	SYSTEMATICS AND MACROEVOLUTION	5 M to F	Tu 14h00-7h00	BIO2010F
BIO3017S	MARINE RESOURCES	3 M to F	F 14h00-17h00	See departmental entry
CEM1000W	CHEMISTRY 1000	2 or 4 M to W, F	Prac: Tu or Th or F, 14h00-17h00/Tut: 2 or 4 Thu	See departmental entry
CEM1009H	CHEMISTRY 1009	4 W to F	Prac: W 14h00-17h00/ Tut: 4 M & Tu	See departmental entry
CEM1010H	CHEMISTRY 1010	4 M to W, F	Prac: Tu 14h00-17h00/Tut: 4 Th	CEM1009H

CEM2005W	INTERMEDIATE CHEMISTRY	3 M to F	Prac: Th 14h00-17h00 EBE Tu 14h00-17h00/ Tut: 6 by arrangement	See departmental entry
CEM3005W	CHEMISTRY 3005	3 M to F	Two pracs per week W and F, 14h00-17h00	See departmental entry
CSC1010H	COMPUTER SCIENCE 1010	5 M to F	Th 14h00-7h30	See departmental entry
CSC1011H	COMPUTER SCIENCE 1011	4 M to Th	M 14h00-16h00	CSC1010H, MAM1005H
CSC1015F	COMPUTER SCIENCE 1015	4 or 5 M to F	M, Tu, W or Th 14h00-16h00 or 16h00-18h00	See departmental entry
CSC1016S	COMPUTER SCIENCE 1016	4 or 5 M to F	M, Tu or W, 14h00-16h00 or 16h00-18h00	CSC1015F
CSC2001F	COMPUTER SCIENCE 2001	2 M to F	One prac per week, M,Tu,W,Th or F 14h00-18h00	CSC1015F, CSC1016S or CSC1010H, CSC1011H
CSC2002S	COMPUTER SCIENCE 2002	2 M to F	One prac per week, M,Tu,W,Th or F 14h00-18h00	CSC2001F
CSC2003S	COMPUTER GAMES	3 M to F	One prac per week, M,Tu,W,Th or F 14h00-18h00	CSC2001F
CSC3002F	COMPUTER SCIENCE 3002	2 M to F	Two pracs per week, M,Tu,W,Th or F 14h00-18h00	CSC2001F, CSC2002S and ((MAM1004F+MAM1008S) or MAM1000W). CSC2004Z is required if CSC2002S was passed after 2017.
CSC3003S	COMPUTER SCIENCE 3003	2 M to F	Two pracs per week, M,Tu,W,Th or F 14h00-18h00	See Departmental entry
CSC3020H	THREE DIMENSIONAL & DISTRIBUTED GAMES DESIGN	3 M to F alternating with CSC3022H	By arrangement	CSC2001F, CSC2002S, CSC2003S and ((MAM1004F+MAM1008S) or MAM1000W). CSC2004Z is required if CSC2002S was passed after 2017.

CSC3022H	C++ WITH APPLICATIONS	3 M to F alternating with CSC3020H	By arrangement	As for CSC3002F
EEE3095S	EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS	See Departmental entry	See Departmental entry	See Departmental entry
EGS1003S	GEOGRAPHY, DEVELOPMENT & ENVIRONMENT	2 M to F	M or Tu or Th, 14h00-17h00	See departmental entry
EGS2013F	THE PHYSICAL ENVIRONMENT	5 M to F	F 14h00-17h00	GEO1009F or EGS1004S
EGS2014S	CONTEMPORARY URBAN CHALLENGES	5 M to F	F 14h00-17h00	See departmental entry
EGS3012S	ATMOSPHERIC SCIENCE	1 M to F	Tu or W, 14h00-17h00	See departmental entry
EGS3021F	SUSTAINABILITY & ENVIRONMENT	3 M to F	W 14h00-17h00	See departmental entry
EGS3022S	GEOGRAPHIC THOUGHT	4 M to F	W 14h00-17h00	EGS2014S
EGS3023F	ANTHROPOCENE ENVIRONMENTS IN PERSPECTIVE	5 M to F	Th 14h00-7h00	EGS2013F
GEO1006S	INTRO TO MINERALS, ROCKS & STRUCTURE	5 M to F	F 14h00-17h00	See departmental entry
GEO1009F	INTRO TO EARTH & ENVIRONMENTAL SCIENCES	2 M to F	One prac a week, M or Tu or Th or F, 14h00-17h00	See departmental entry
GEO2001F	MINERALOGY & CRYSTALLOGRAPHY	2 M to F	W 14h00-17h00	See departmental entry
GEO2004S	PHYSICAL GEOLOGY	2 M to F	W 14h00-17h00	GEO2001F, PHY1031F or equivalent
GEO2005X	FIELD GEOLOGY & GEOLOGICAL MAPPING	None	See departmental entry	GEO1006S, GEO2004S (co-requisite)
GEO3001S	STRATIGRAPHY & ECONOMIC GEOLOGY	2 M to F	Two pracs per week Tu and Th 14h00-17h00	GEO2004S, DP in GEO3005F
GEO3005F	PETROLOGY & STRUCTURAL GEOLOGY	2 M to F	Two pracs per week Tu and Th 14h00-17h00	GEO2001F, GEO2004S,

HUB2019F	INTEGRATED ANAT & PHYSIO SCIENCES A	1 M to F	M or Tu, 14h00-17h00	CEM1000W (or equivalent), BIO1000W
HUB2021S	INTEGRATED ANAT & PHYSIO SCIENCES B	1 M to F	M or Tu, 14h00-17h00	HUB2019F or equivalent
HUB3006F	APPLIED HUMAN BIOLOGY	1 M to F	W or Th, 14h00-17h00	HUB2021S
HUB3007S	HUMAN NEUROSCIENCES	1 M to F	W or Th, 14h00-17h00	HUB3006F or equivalent
MAM1000W	MATHEMATICS 1000	1 or 3, M to F	One 2-hour tutorial per week	See departmental entry
MAM1004F	MATHEMATICS 1004	1 M to F	M or W 14h00-16h00	See departmental entry
MAM1004S	MATHEMATICS 1004	Meridian M to F	By arrangement M or W	See departmental entry
MAM1005H	MATHEMATICS 1005	1 or 3 M to F	F 8h00-9h00, M 14h00-16h00	See departmental entry
MAM1006H	MATHEMATICS 1006	1, three days per week	1, two days per week	See departmental entry
MAM1008S	INTRODUCTION TO DISCRETE MATHEMATICS	1 or 3 M and W	By arrangement	See departmental entry
MAM1019H	FUNDAMENTALS OF MATHEMATICS	Meridian	M, W 13h00-14h00	See departmental entry
MAM1043H	MODELLING & APPLIED COMPUTING	2 M to F	One hour per week	See departmental entry
MAM1044H	DYNAMICS	2 M to F	Every second F 14h00-16h00	See departmental entry
MAM2000W	MATHEMATICS 2000	5 M to F with options in 4th	Th or F 14h00-16h00	MAM1000W or equivalent
MAM2004H MAM2002S	MATHEMATICS 2004 & 2002	5 M to F with options in 4th	Th or F 14h00-16h00	MAM1000W or equivalent
MAM2046W	APPLIED MATHEMATICS 2046	3 M to F	Th 14h00-16h00	See departmental entry
MAM2047H	APPLIED MATHEMATICS 2047	See departmental entry	Th 14h00-16h00	MAM1043H, MAM1044H and MAM1000W
MAM2048H	APPLIED MATHEMATICS 2048	See departmental entry	Th 14h00-16h00	MAM2047H
MAM3000W	MATHEMATICS 3000	5 M to F with options in 4th	M 13h00-15h00	MAM2000W
MAM3001W	MATHEMATICS 3001	5 M to F with options in 4th	Tu 13h00-16h00	MAM2000W
MAM3002H and MAM3003S	MATHEMATICS 3002 & MATHEMATICS 3003	5 M to Th with options in 4th	Th 13h00-15h00	MAM2000W

MAM3040W	APPLIED MATHEMATICS 3040	4 M to F	W 14h00-16h00	See departmental entry
MAM3041H	APPLIED MATHEMATICS 3041	See departmental entry	Th 14h00-16h00	See departmental entry
MAM3048H	APPLIED MATHEMATICS 3048	See departmental entry	Th 14h00-16h00	MAM3040W
MCB2020F	BIOLOGICAL INFORMATION TRANSFER	4 M to F	Th or F 14h00-17h00	CEM1000W or equivalent, BIO1000F and BIO1004F/S
MCB2021F	MOLECULAR BIOSCIENCE	5 M to F	M or Tu 14h00-17h00	CEM1000W or equivalent, BIO1000F and BIO1004F/S
MCB2022S	METABOLISM AND BIO ENGINEERING	5 M to F	M or Tu 14h00-17h00	MCB2020F, MCB2021F
MCB2023S	FUNCTIONAL GENETICS	4 M to F	Th or F 14h00-17h00	MCB2020F, MCB2021F
MCB3012Z	RESEARCH PROJECT IN MOLECULAR & CELL BIOLOGY	None	Two afternoons per week	See departmental entry
MCB3023S	MOLECULAR EVOLUTIONARY GENETICS & DEVELOPMENT	4 M to F	One per week by arrangement	See departmental entry
MCB3024S	DEFENCE & DISEASE	5 M to F	One per week by arrangement	See departmental entry
MCB3025F	STRUCTURAL & CHEMICAL BIOLOGY	5 M to F	M or Tu 14h00-17h00	See departmental entry
MCB3026F	MOLECULAR GENETICS & GENOMICS	4 M to F	Th or F 14h00-17h00	See departmental entry
PHY1004W	MATTER & INTERACTIONS	3 M to F	Tu 14h00-17h00	See departmental entry
PHY1023H	PRINCIPLES OF PHYSICS A	3 M to F	Tu 14h00-17h00	See departmental entry
PHY1031F	GENERAL PHYSICS A	3 M to F	M or W or Th, 14h00-17h00	See departmental entry
PHY1032F	GENERAL PHYSICS B	3 M to F	W 14h00-17h00	PHY1023H or PHY1031F
PHY1032S	GENERAL PHYSICS B	3 M to F	M or W or Th, 14h00-17h00	PHY1031F or PHY1023H
PHY2004W	INTERMEDIATE PHYSICS	4 M to F	Prac M 14h00-17h00 Tut Tu 14h00-16h00	See departmental entry

PHY3004W	ADVANCED PHYSICS	4 M to F	Prac M 14h00-17h00 Tut Tu 14h00-16h00	See departmental entry
SEA2004F	PRINCIPLES OF OCEANOGRAPHY	4 M to F	Tu 14h00-17h00	See departmental entry
SEA2005S	MARINE SYSTEMS	4 M to F	Tu 14h00-17h00	See departmental entry
SEA3004F	OCEAN & ATMOSPHERE DYNAMICS	4 M to F	M 14h00-17h00	See departmental entry
STA1000F AND STA1000S	INTRODUCTORY STATISTICS	See departmental entry	By arrangement	See departmental entry
STA1006S	MATHEMATICAL STATISTICS I	4 M to F	One per week by arrangement	See departmental entry
STA1007S	INTRODUCTORY STATISTICS FOR SCIENTISTS	1 M to F	One per week by arrangement	See departmental entry
STA2004F	STATISTICAL THEORY & INFERENCE	1 M to F	One per week by arrangement	MAM1000W and STA1006S
STA2005S	LINEAR MODELS	1 M to F	One per week by arrangement	DP for STA2004F
STA2007F/S/H	STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS	See departmental entry	One per week by arrangement	See departmental entry
STA2020F	APPLIED STATISTICS	1 or 5 M to Th	One per week by arrangement	See departmental entry
STA2020S	APPLIED STATISTICS	7 M to Th	F 08h00-09h00	See departmental entry
STA2030S	THEORY OF STATISTICS	1 M to Th	By arrangement	See departmental entry
STA3022F	RESEARCH & SURVEY STATISTICS	4 M to Th	By arrangement	See departmental entry
STA3030F	INFERENTIAL STATISTICS	1 M to Th	By arrangement	See departmental entry
STA3036S	OPERATIONAL RESEARCH TECHNIQUES	3 M to Th	By arrangement	See departmental entry
STA3041F	MARKOV PROCESSES & TIME SERIES	1 M to F	Tutorials and practicals by arrangement	See departmental entry
STA3043S	DECISION THEORY & GLM	1 M to F	Two per week by arrangement	See departmental entry
STA3045F	ADVANCED STOCHASTIC PROCESSES	2 M to F	Two per week, by arrangement	See departmental entry

SCIENCE FACULTY COURSES ARRANGED BY LECTURE PERIOD

COURSE CODE	COURSE TITLE	LECTURE PERIOD	PRACTICAL/ TUTORIAL TIMES
First period, first semester			
BIO2010F	PRINCIPLES OF ECOLOGY & EVOLUTION	1	M 14h00-17h00
BIO3002F	MARINE ECOSYSTEMS	1	W 14h00-17h00
HUB2019F	INTERGRATED ANATOMY & PHYSIO SCIENCES A	1	M or Tu, 14h00-17h00
HUB3006F	APPLIED HUMAN BIOLOGY	1	W or Th, 14h00-17h00
MAM1000W	MATHEMATICS 1000, two days per week	1/3	One 2-hour tutorial per week
MAM1004F	MATHEMATICS 1004	1	M or W, 14h00-16h00
MAM1005H	MATHEMATICS 1005	1/3	M 14h00-17h00 F 08h00-09h00
MAM1006H	MATHEMATICS 1006	1	One hour per week
STA1000F	INTRODUCTORY STATISTICS	1	One per week by arrangement
STA2004F	STATISTICAL THEORY & INFERENCE	1	One per week by arrangement
STA2020F	BUSINESS STATISTICS	1	By arrangement
STA3030F	INFERENTIAL STATISTICS	1	By arrangement
STA3041F	MARKOV PROCESSES & TIME SERIES	1	By arrangement
First period, second semester			
EGS3012S	ATMOSPHERIC SCIENCE	1	Tu or W, 14h00-17h00
HUB2021S	INTERGRATED ANATOMY & PHYSIO SCIENCES B	1	M or Tu, 14h00-17h00
HUB3007S	HUMAN NEUROSCIENCES	1	W or Th, 14h00-17h00
MAM1008S	INTRODUCTION TO DISCRETE MATHEMATICS	1/3	By arrangement
STA1000S	INRODUCTORY STATISTICS	1	One per week by arrangement
STA1007S	BIONUMERACY	1	One per week by arrangement
STA2005S	LINEAR MODELS	1	One per week by arrangement
STA2030S	THEORY OF STATISTICS	1	By arrangement
STA3043S	DECISION THEORY & GLM	1	Two tutorials per week by arrangement
Second period, first semester			
AGE2012F	THE FIRST PEOPLE	2	One per week by arrangement
AST2002H	ASTROPHYSICS	2	W 14h00-17h00
AST2003H	ASTRONOMICAL TECHNIQUES	2	W 14h00-16h30
AST3002F	STELLAR ASTROPHYSICS	2	W 14h00-16h30
BIO3013F	GLOBAL CHANGE ECOLOGY	2	M 14h00-17h00
CEM1000W	CHEMISTRY 1000	2/4	Tu, Th or F 14h00-17h00

CSC2001F	COMPUTER SCIENCE 2001	2	M to F 14h00-18h00
CSC3002F	COMPUTER SCIENCE 3002	2	M to F 14h00-18h00
GEO1009F	INTRO TO EARTH & ENVIRONMENTAL SCIENCES	2	M, Tu, Th or F 14h00-17h00
GEO2001F	MINERALOGY & CRYSTALLOGRAPHY	2	W 14h00-17h00
GEO3005F	PETROLOGY & STRUCTURAL GEOLOGY	2	Tu and Th, 14h00-17h00
MAM1043H	MODELLING & APPLIED COMPUTING	2	By arrangement
MAM1044H	DYNAMICS	2	By arrangement
STA2007H	STUDY DESIGN & DATA ANALYSIS FOR SCIENTISTS	2	By arrangement
STA3045F	MARKOV PROCESSES & ADVANCED TIME SERIES	2	By arrangement
Second period, second semester			
AGE2011S	HUMAN EVOLUTION	2	By arrangement
AST3003S	GALACTIC & EXTRAGALACTIC ASTROPHYSICS	2	W 14h00-16h30
BIO2012S	LIFE ON LAND : PLANTS	2	Th 14h00-17h00
BIO3014S	CONSERVATION: GENES, POPULATIONS & BIODIVERSITY	2	M 14h00-17h00
CSC2002S	COMPUTER SCIENCE 2002	2	M to F 14h00-18h00
CSC3003S	COMPUTER SCIENCE 3003	2	M to F 14h00-18h00
EGS1003S	GEOGRAPHY, DEVELOPMENT & ENVIRONMENT	2	M, Tu or Th 14h00-17h00
GEO2004S	PHYSICAL GEOLOGY	2	W 14h00-17h00
GEO3001S	STRATIGRAPHY & ECONOMIC GEOLOGY	2	Tu and Th, 14h00-17h00
Third period, first semester			
BIO2013F	LIFE IN THE SEA	3	W 14h00-17h00
CEM2005W	INTERMEDIATE CHEMISTRY	3	Th 14h00-17h00
CEM3005W	CHEMISTRY 3005	3	W and F, 14h00-17h00
CSC3020H	THREE DIMENSIONAL & DISTRIBUTED GAMES DESIGN	3	By arrangement
CSC3022H	C++ WITH APPLICATIONS	3	By arrangement
EGS3021F	SUSTAINABILITY & ENVIRONMENT	3	W 14h00-17h00
MAM1000W	MATHEMATICS 1000	3	By arrangement
MAM1005H	MATHEMATICS 1005	1/3	By arrangement
MAM2046W	APPLIED MATHEMATICS 2046	3	Th 14h00-16h00
MAM2047H	APPLIED MATHEMATICS 2047	3	Th 14h00-16h00
MAM2048H	APPLIED MATHEMATICS 2048	3	Th 14h00-16h00
MAM3040W	APPLIED MATHEMATICS 3040	3	Th 14h00-16h00
MAM3041H	APPLIED MATHEMATICS 3041	3	Th 14h00-16h00
MAM3048H	APPLIED MATHEMATICS 3048	3	Th 14h00-16h00
PHY1004W	MATTER & INTERACTIONS	3	Tu 14h00 to 17h00
PHY1023H	PRINCIPLES OF PHYSICS A	3	Tu 14h00-17h00
PHY1031F	GENERAL PHYSICS A	3	M, W or Th 14h00-17h00
PHY1032F	GENERAL PHYSICS B	3	W 14h00-17h00

Third period, second semester			
BIO2011S	LIFE ON LAND: ANIMALS	3	M 14h00-17h00
BIO3017S	MARINE RESOURCES	3	F 14h00-17h00
CSC2003S	COMPUTER GAMES	3	M to F 14h00-18h00
MAM1008S	INTRODUCTION TO DISCRETE MATHEMATICS	3	By arrangement
PHY1032S	GENERAL PHYSICS B	3	M, W or Th 14h00-17h00
STA3036S	OPERATIONAL RESEARCH TECHNIQUES	3	M to F
Fourth period, first semester			
AGE3011F	THE ROOTS OF RECENT AFRICAN IDENTITIES	4	By arrangement
CEM1000W	CHEMISTRY 1000	2/4	Tu, Th or F, 14h00-17h00
CEM1009H	CHEMISTRY 1009	4	W 14h00-17h00
CEM1010H	CHEMISTRY 1010	4	Tu 14h00-17h00
CSC1011H	COMPUTER SCIENCE 1011	4	M 14h00-16h00
CSC1015F	COMPUTER SCIENCE 1015	4/5	M, Tu or W 14h00-17h30
MCB2020F	BIOLOGICAL INFORMATION TRANSFER	4	Th or F 14h00-17h00
MCB3026F	MOLECULAR GENETICS & GENOMICS	4	Th or F 14h00-17h00
PHY2004W	INTERMEDIATE PHYSICS	4	M 14h00-17h00 and Tu 14h00-16h00
PHY3004W	ADVANCED PHYSICS	4	M 14h00-17h00 and Tu 14h00-16h00
SEA2004F	PRINCIPLES OF OCEANOGRAPHY	4	Tu 14h00-17h00
SEA3004F	OCEAN & ATMOSPHERE DYNAMICS	4	M 14h00-17h00
STA3022F	RESEARCH & SURVEY STATISTICS	4	By arrangement
Fourth period, second semester			
AGE3012S	GLOBAL DIASPORAS & THE ARCHAEOLOGY OF THE HISTORICAL PAST	4	By arrangement
CSC1016S	COMPUTER SCIENCE 1016	4/5	M, Tu or W 14h00-17h30
EGS3022S	GEOGRAPHIC THOUGHT	4	W 14h00-17h00
MCB2023S	FUNCTIONAL GENETICS	4	Th or F 14h00-17h00
MCB3023S	MOLECULAR EVOLUTIONARY GENETICS & DEVELOPMENT	4	By arrangement
PHY2004W	INTERMEDIATE PHYSICS	4	M 14h00-17h00 and Tu 14h00-16h00
PHY3004W	ADVANCED PHYSICS	4	M 14h00-17h00 and Tu 14h00-16h00
SEA2005S	MARINE SYSTEMS	4	Tu 14h00-17h00
STA1006S	MATHEMATICAL STATISTICS I	4	By arrangement
Fifth period, first semester			
AST1000F	INTRODUCTION TO ASTRONOMY	5	W 14h00-17h00
BIO1000F	CELL BIOLOGY	5	M, Tu, W or Th 14h00-17h00
BIO1000H	CELL BIOLOGY	5	Th 14h00-17h00
BIO1004F	BIOLOGICAL DIVERSITY	5	Th 14h00-17h00
BIO3015F	ECOLOGY	5	By arrangement
CSC1010H	COMPUTER SCIENCE 1010	5	Th 14h00-17h30

CSC1015F	COMPUTER SCIENCE 1015	4/5	M, Tu or W 14h00-17h30
EGS2013F	THE PHYSICAL ENVIRONMENT	5	F 14h00-17h00
EGS3023F	ANTHROPOCENE ENVIRONMENTS IN PERSPECTIVE	5	Th 14h00-17h00
MAM2000W	MATHEMATICS 2000	5	Th or F, 14h00-16h00
MAM2004H	MATHEMATICS 2004	5	Th or F, 14h00-16h00
MAM3000W	MATHEMATICS 3000	5	F 14h00-17h00
MAM3001W	MATHEMATICS 3001	5	F 14h00-17h00
MAM3002H	MATHEMATICS 3002	5	F 14h00-17h00
MCB2021F	MOLECULAR BIOSCIENCE	5	M or Tu 14h00-17h00
MCB3025F	STRUCTURAL & CHEMICAL BIOLOGY	5	M or Tu 14h00-17h00
STA2020F	BUSINESS STATISTICS	5	By arrangement
Fifth period, second semester			
AGE1002S	ARCHAEOLOGY & OUR COMMON HERITAGE	5	F 12h00-13h00
BIO1004S	BIOLOGICAL DIVERSITY	5	M, Tu, W, Th or F 14h00-17h00
BIO3016S	SYSTEMATICS AND MACROEVOLUTION	5	Tu 14h00-17h00
CSC1016S	COMPUTER SCIENCE 1016	4/5	M, Tu or W 14h00-17h30
EEE3095S	EMBEDDED SYSTEMS II FOR SCIENCE STUDENTS	5	By arrangement
EGS2014S	CONTEMPORARY URBAN CHALLENGES	5	F 14h00-17h00
GEO1006S	INTRODUCTION TO MINERALS, ROCKS & STRUCTURE	5	F 14h00-17h00
MAM2002S	MATHEMATICS 2002	5	Th or F, 14h00-16h00
MAM3003S	MATHEMATICS 3003	5	F 14h00-17h00
MCB2022S	METABOLISM AND BIOENGINEERING	5	M or Tu 14h00-17h00
MCB3024S	DEFENCE & DISEASE	5	By arrangement

Various			
AGE1004S	INTRODUCTION TO EARTH & ENVIRONMENTAL SCIENCES	To be advised	F 14h00-17h00
AGE3006H	DIRECTED READING & RESEARCH	By arrangement	None
MAM1019H	FUNDAMENTALS OF MATHEMATICS	Meridian	W 13h00-14h00
MAM1004S	MATHEMATICS 1004	Meridian	By arrangement
STA1000F/S	INTRODUCTORY STATISTICS	See departmental entry	By arrangement

ADDITIONAL INFORMATION

Fellows in the Faculty

The Council of the University has established Fellowships for members of the permanent academic staff in recognition of original distinguished academic work of such quality as to merit special recognition. The following are Fellows in the Faculty of Science.

Professor I V Barashenkov
Professor S Bourne
Professor K Chibale
Professor A Chinsamy-Turan
Professor P K S Dunsby
Professor T J Egan
Professor J Farrant
Professor B Hewitson
Professor G Janelidze
Professor R Kraan-Korteweg
Professor H-P Künzi
Professor A P le Roex
Professor C Reason
Professor B D Reddy
Professor S H Richardson
Professor P Ryan
Professor E Rybicki
Professor J C Sealy

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)

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	*The Living Shores of South Africa 1985*
Professor G M Branch, Associate Professor C L Griffiths, Mrs M L Branch and Dr L E Beckley	*Two Oceans - A guide to the Marine life of Southern Africa 1995*
Professor B Warner	*Cataclysmic Variable Stars 1997*
Dr P Bruyns	*Stapeliads of Southern Africa & Madagascar 2008*

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 Borcherds 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 outstanding, original postgraduate research.

Merck Prize plus medal
Awarded to the best student in third-year Chemistry who will be proceeding to Honours in the Department.

Merck Prize
Best student in Molecular & Cell Biology Honours

Purcell Memorial Prize
Awarded for the best MSc or PhD dissertation dealing with a Zoological subject

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 every second year to a candidate who has obtained the BSc Hons degree in the first class and who proposes 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
[GEPS – Refer to 2012 Handbook]
(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 http://hesa-enrol.ac.za/mb
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 BSocSc 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 counts as a half course credit (CX MAM1005H)
MAM1021F/S counts as a half course credit (CR MAM1006H)
MAM1020F/S plus MAM1021F/S with an average of 60% or more is required for entry into MAM2000W (CX MAM1000W)
MAM1023F/S counts as a half course credit (CX MAM1005H)
MAM1024F/S counts as a half course credit (CX MAM1006H)
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 PHY1032S)
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%

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