POSTGRADUATE 2022

Auckland Park Kingsway Campus
& Doornfontein Campus

Faculty of Science

UNIVERSITY
OF
JOHANNESBURG

FACULTY OF SCIENCE

RULES AND REGULATIONS
FOR POSTGRADUATE PROGRAMMES

KINGSWAY AND DOORNFONTEIN CAMPUS

2022

IMPORTANT NOTICE

Always compare the information contained in this copy of the Rules and Regulations book with the copy on the Internet. The electronic copy is updated regularly.
www.uj.ac.za/science

Updated December 2021

** This book continues on from the Kingsway and Doornfontein Undergraduate books*

GENERAL INFORMATION AND CONTACT DETAILS

EXECUTIVE DEAN
Prof D Meyer
C Ring 211, APK
011 559 4554

VICE-DEAN: TEACHING & LEARNING
Prof WS Leung
011 559 2906

HEAD: FACULTY ADMINISTRATION
C Burger
C Ring 216, APK
011 559 2961

SENIOR FACULTY OFFICERS
Mr GT Miza
C Ring 206, APK
011 559 2961

Mrs M Haripersad
Postgraduate studies
C Ring 216, APK
011 559 2459

FACULTY OFFICERS
Ms A Greyling
C Ring 202, APK
011 559 2374

Mr C Mashele
C Ring 204, APK
011 559 4168

Ms H Mtyoboza
C Ring 205, APK
011 559 3718

Mrs T Nyoka
C Ring 203, APK
011 559 3826

Mr TA Sithole
Doornfontein Campus
3205 John Orr Building, DFC
011 559 6349
Kingsway Campus
C Ring 209B, APK

RESEARCH
Mr T Thanyani
C Ring 217, APK
011 559 4644

VICE-DEAN: RESEARCH & POSTGRADUATE
Prof R Meijboom
011 559 2367

DEAN'S SECRETARY
Ms B Fasser
C Ring 212, APK
011 559 4554

FACULTY COORDINATOR
Vacant
C Ring 218, APK
011 559 3357

FINANCIAL BUSINESS PARTNER
Mrs L van Greune
C Ring 220, APK
011 559 3751

FINANCIAL ASSISTANT
Ms S Reyneke
C Ring 209A, APK
011 559 4916

FACULTY MARKETER
Vacant
C Ring 224, APK
011 559 2393

RECEPTIONIST/ ADMIN ASSISTANT
Mrs L Bessick
C Ring 201, APK
011 559 4562

ADMIN ASSISTANT
Ms MS Rakgoho
C Ring 201, APK
011 559 2547

GENERAL ASSISTANT
Vacant
C Ring 201, APK
011 559 2547

GENERAL ENQUIRIES
011 559 4562/ 2547
Fax No: 011 559 3207
E-mail: web-science@uj.ac.za
Faculty of Science on the Internet www.uj.ac.za/science

POSTAL ADDRESS
University of Johannesburg
Faculty of Science: C Ring 201
PO Box 524
Auckland Park 2006

ACADEMY OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING
Kingsway Campus
Contact person: Ms S Msibi / Gugu Ndevu
Tel : 011 559 2839 / 2967
E-mail : simangelem@uj.ac.za

DEPARTMENT OF BIOCHEMISTRY
Kingsway Campus
Contact Person: Mrs L de Kooker
Tel : 011 559 2370
E-mail : ldekooker@uj.ac.za

DEPARTMENT OF BIOTECHNOLOGY AND FOOD TECHNOLOGY
Doornfontein Campus
Contact Person: C Robbetze
Tel : 011 559 6456
E-mail : christabo@uj.ac.za

DEPARTMENT OF BOTANY AND PLANT BIOTECHNOLOGY
Kingsway Campus
Contact Person: Ms M Muller
Tel : 011 559 2436
E-mail : mmuller@uj.ac.za

DEPARTMENT OF CHEMICAL SCIENCES
Kingsway Campus
Contact Person: Mrs E O'Rourke
Tel : 011 559 2363 (mornings only)
E-mail : eurekao@uj.ac.za

Doornfontein Campus
Contact Person: Ms L Moshe
Tel : 011 559 6148
E-mail : lmoshe@uj.ac.za

DEPARTMENT OF GEOGRAPHY, ENVIRONMENTAL MANAGEMENT AND ENERGY STUDIES
Kingsway Campus
Contact Person: Ms D Mekwe
Tel : 011 559 2433/ 3736
E-mail : dmekwe@uj.ac.za

DEPARTMENT OF GEOLOGY
Kingsway Campus
Contact Person: Mrs E Minnaar
Tel : 011 559 4701
E-mail : elainem@uj.ac.za

DEPARTMENT OF PHYSICS
Kingsway Campus
Contact Person: Ms C Gouws
Tel : 011 559 2327
E-mail : physics@uj.ac.za or chanelleg@uj.ac.za

Doornfontein Campus
Contact Person: Ms R Motloung
Tel : 011 559 6007
E-mail : refiloem@uj.ac.za

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS
***Kingsway Campus* (Applied Mathematics)**
Contact Person: Mrs S Geldenhuys
Tel : 011 559 2067 (mornings only)
E-mail : sgeldenhuys@uj.ac.za

***Kingsway Campus* (Mathematics)**
Contact Person: Ms P Mapimele
Tel : 011 559 2831
E-mail : pmapimele@uj.ac.za

***Doornfontein Campus* (Mathematics)**
Contact Person: Ms R Motloung
Tel : 011 559 6007
E-mail : refiloem@uj.ac.za

DEPARTMENT OF STATISTICS
Kingsway Campus
Contact Person: Mrs AM Bothma
Tel : 011 559 2852
E-mail : lettieb@uj.ac.za

Doornfontein Campus
Contact Person: Ms S Xashimba
Tel : 011 559 6648
E-mail : sibongilex@uj.ac.za

DEPARTMENT OF ZOOLOGY
Kingsway Campus
Contact Person: Ms N Ngobeni
Tel : 011 559 2441
E-mail : zoologysecretary@uj.ac.za

SPECTRUM
Kingsway Campus
Contact Person: Dr W Oldewage
Tel : 011 559 2274
E-mail : willieho@uj.ac.za

GENERAL INFORMATION

UJ Website: www.uj.ac.za
Faculty website: www.uj.ac.za/science

STUDENT FINANCE

In respect of fees payable please refer to the Brochure: **Student Fees**

If you are not in possession of this brochure and you need information urgently, please contact STUDENT FINANCE: (011) 559-3935/4339/3910/3277/4303.

DIVISION FOR INTERNATIONALISATION

Auckland Park Kingsway Campus
Student Enrolment Centre
Room 01, Admin Building
011 559 4517

Doornfontein Campus
Student Enrolment Centre
Ground floor, Admin Building
011 559 6510

PART 11

SC.11.1 THE FACULTY OF SCIENCE OFFERS THE FOLLOWING POSTGRADUATE PROGRAMMES

- Bachelor of Science Honours (BSc Hons)
- Master (Master)
- Master of Science (MSc)
- Master of Philosophy (MPhil)
- Doctor Philosophiae (DPhil)
- Philosophiae Doctor (PhD)

SC.11.2 ACADEMIC AND FACULTY SPECIFIC REGULATIONS

A selection of the Academic Regulations (AR) for the specific attention of students in the Faculty of Science is given below.

*In the Academic Regulations of the University reference is made to Faculty-specific rules. The list below provides the **number and text from the Academic Regulation** together with the interpretation or application of the specific regulation in the Faculty of Science in italics. In cases where no faculty-specific interpretation is given, the general Academic Regulation applies.*

2.3.22 **"Faculty-specific assessment"** means opportunities such as continuous assessments that are determined by academic departments and approved by the Faculty Board.

Module-specific assessment criteria as approved by the Faculty are set out in the relevant learning guides in accordance with regulation 10.2.

2.3.33 **"Marks"** means the following in the defined context:

(a) **"Final mark"** means a mark calculated according to a prescribed ratio/ proportion and/or weighting per programme of the final period or semester or year mark and the mark of the last summative assessment opportunity, determined by the Faculty Board.

The relative weighting applied to the various assessments in each module is set out in the relevant learning guides.

(b) "**Final period/semester/year mark"** means the mark obtained from summative assessment opportunities during the period of registration for the module. The final period or semester or year mark obtained from the summative assessment is calculated as determined by the Faculty Board.

Calculation of the final mark of a module, as approved by the Faculty, is set out in the relevant learning guides

2.3.40 **"Module"** is a learning component (building block) within a programme of study towards a qualification and means the following in the defined context:

a) **"Compulsory module"** is a module that students must register for as part of a particular programme and whose outcomes must be achieved successfully before a qualification can be awarded.

b) **"Couplet module"** is a first-semester module followed by the second-semester module where the content of the second-semester module is dependent on the content of the first-semester module, subject to a minimum of 40% obtained for the first-semester module to progress to the second-semester module.

c) **"Elective module"** is any module that can be exchanged for another module as provided for in the programme.

d) **"Semester module"** is a module that extends over one semester (approximately 14 academic weeks) as reflected in the academic calendar approved by Senate.

g) **"Term module"** is a module that extends over one term (approximately 7 academic weeks) within a particular semester as reflected in the academic calendar as approved by Senate.

2.3.48 **"Plagiarism"** means passing off ideas, however expressed, including in the form of phrases, words, images, artefacts, sounds, or other intellectual or artistic outputs, as one's own when they are not one's own; or such passing off, as an original contribution, of ideas that are one's own but have been expressed on a previous occasion for assessment by any academic institution or in any published form, without acknowledgement of the previous expression. Plagiarism is understood as one of several related forms of academic dishonesty, all of which are addressed in the Student Disciplinary Code and the UJ Policy on Academic Misconduct (once approved).

"**Actionable plagiarism**" means *Plagiarism* that:

(a) Vitiates the attempt fairly and meaningfully to assess and, where relevant, assign a mark, grade, or other outcome to the work in question; *and/or*

(b) Is such that an educational response (which may include capping or prescribing a mark) is inappropriate and that a formal academic response or a disciplinary response is appropriate, given the plagiarism history of the student, the nature and extent of the plagiarism, the level of the student, and all the other relevant circumstances of the case; *or*

(c) In the case of work that is not submitted for assessment (for example, work submitted by a graduate student to a supervisor or lecturer for comment), is deemed by the individual academic staff member in question to be actionable, having regard to the nature of the offence, the plagiarism history of the student, the possibility or probability of repeat offence, and all the other circumstances of the case..

2.3.52 **"Promotion"** means the advancement of students who meet the minimum requirements of a particular study level from that particular study level to the next (e.g. from the first-year level to the second-year level) as determined per programme by the academic department and the relevant Faculty Board, approved by Senate and contained in the Faculty Rules and Regulations.

The conditions for promotion as set out in Regulation 6 apply. Any deviations from these will be programme-specific and set out in the Faculty Rules and Regulations under the particular programme.

2.3.60 **"Special assessment opportunity"** means a further assessment opportunity equivalent to the original assessment opportunity aimed at accommodating students who were unable to be assessed in the original assessment opportunity.

2.3.64 **"Supplementary assessment opportunity"** means an assessment that supplements the original assessment granted to students. Admission to this assessment opportunity is based on the results of the original assessment opportunity.

4. ADMISSION

4.8 Minimum admission requirements applicable to BTech and Advanced Diplomas

For Advanced Diplomas in the Faculty of Education, refer to the minimum requirements for Teacher Education Qualification as contained in the Faculty Rules and Regulations.

4.8.1 BTech and Advanced Diploma applicants must have successfully completed a relevant diploma or bachelor's degree in the same or relevant field of study as determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations.

4.8.2 Programme-specific admission requirements such as a minimum achievement in the relevant majors or other approved appropriate modules in the prerequisite qualification are

determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations

4.10 Alternative admission requirements

4.10.3 Recognition of prior learning (RPL)

The University may, on the grounds of RPL, and subject to Senate-approved special admission rules, admit students who do not comply with the minimum admission requirements.

The Faculty of Science Policy on RPL will be followed. A student who has obtained entry to any level on the basis of RPL is not entitled to the award of the qualification which normally determines entry to the study, even if the study is not completed.

4.11 Application for admission to study at the University

4.11.1 Prospective students must apply for admission to programmes not later than the determined programme specific closing dates as stipulated on the official UJ website. An annually determined application fee is payable for paper applications. Online applications are free.

4.11.2 Admission is subject to selection in accordance with programme-specific admission requirements determined by the Faculty Board, as well as minimum requirements set for transfer students, approved by Senate and contained in the relevant Faculty Rules and Regulations.

The Faculty of Science does not have specific regulations applicable to transferring students.

4.12 Admission of International applicants

Refer to the Academic Regulations

5. REGISTRATION

5.1.17 Students may not register simultaneously for two programmes at the University, or for a programme or module at another university, concurrently with their registration at the University without prior written consent of the Executive Dean or his/her delegated authority of the relevant faculty and the relevant authority of the other university.

5.1.21 A student may not register for more than the prescribed number of modules per academic year/semester as:

a) approved by Faculty Board and Senate
b) reflected in Faculty rules and regulations and curriculum
c) specified per year level

The Executive Dean of the Faculty may approve a maximum of two additional semester modules or one year-module per academic year.

5.1.22 Faculty Boards may determine the maximum number of students who may register for a programme or module in accordance with the University's Enrolment Management Plan or in order to ensure quality teaching.

Unless approved by the Executive Dean:

- *No student will be permitted to register for two or more modules in the same semester of any year if any lecture, tutorial or practical session of the relevant modules are allocated the same timetable period.*
- *The module on the lower academic level will have to be completed before registration for the other module/s will be permitted.*

5.2.2 Transfer students from other higher education institutions

a) SA identity document, international identity document, passport or permanent residence permit where applicable
b) Senior Certificate or National Senior Certificate or equivalent qualification only when specifically requested by faculties
c) Certified copies of academic record from the previous higher education institution(s)
d) Certified copies of certificate of conduct, if not included on the academic record.
e) Additional faculty or programme requirements as determined by the relevant Faculty Board.

The decision to accept or reject modules passed at the previous higher education institution is vested in the Head of the relevant department.

Confirmation by the Head of Department that the student has been accepted is required.

5.2.3 International students

a) Passport
b) Study permit
c) Postgraduates: SAQA evaluation of previous qualification
d) Undergraduates: USAf evaluation of school-leaving certificate
e) English proficiency test certificate or proof of English passed at school-leaving level or at a level determined by the relevant faculty.
f) Proof of South African medical insurance cover

5.7 Programme and module changes

5.7.1 After the official registration period and within the appointed time, students may change their registration only with the permission of the HFA of the faculty.

5.7.2 Application for module or programme changes must be made according to the University and Faculty rules. These changes are subject to approval according to the Academic Regulations.

5.8 Cancellation of studies

5.8.1 Students cancel their studies in a particular programme or module by official notification on a prescribed form and in accordance with the prescribed procedure thereof before the date determined by the University. This form is submitted to the relevant faculty officer for processing.

5.8.3 Cancellation of studies in a semester module(s) or a year module(s) within the 21-calendar day period before the beginning of the assessment opportunity will be regarded as absent from the assessment opportunity. Cancellation of studies in a continuous evaluation year module within the 42-calendar day period before the beginning of the assessment opportunities will be regarded as absent from the assessment opportunity.

6. CREDIT AND PROMOTION REQUIREMENTS

6.2 A module passed at a particular NQF level may not serve as an equivalent for a module at a higher NQF level.

6.3 Students retain credit for exemption and/or renewal of registration purposes for a module passed for a period not exceeding seven years, provided that there are no material changes to the curriculum content in this period and provided further that there has been no change in the statutory body regulating the relevant qualification. This retention is also subject to the programme-specific requirements contained in the Faculty Rules and Regulations. Exceptions may be allowed by the Executive Dean in consultation with the Head of Department.

Any deviations from this regulation will be department-specific, apply ad hominem and will be subject to approval by the Executive Dean.

6.5 Students who have temporarily discontinued their studies and who have passed a module whose content has in the meantime undergone substantial changes may be refused admission to a module for which this module is a prerequisite.

6.6 Students who have failed a module twice will not be allowed to continue their studies in the same module at the University, except with the permission of the Executive Dean on recommendation of the relevant Head of Department after consultation with the Lecturer, or on recommendation of the faculty's examination or assessment committee.

This regulation includes any modules failed previously at another higher education institution.

6.9 If students have been granted special permission to continue with studies as determined in AR 6.6 and AR 6.8, the Executive Dean may refuse continuation of studies if their work in the first semester is unsatisfactory. Students may also be refused further admission if they continue to perform unsatisfactorily at the end of the relevant academic year and will academically be excluded.

The Executive Dean will determine what constitutes unsatisfactory performance.

6.10 The formal time during which students were registered for a particular programme at another higher education institution as well as their results at such institution, may be considered in applying AR 6.6, 6.8 and 6.9.

6.12 Unsatisfactory attendance of lectures or (where applicable) participation in an electronic learning environment, tutorials and practicals is taken into consideration when decisions are made regarding the academic exclusion of students.

The description of unsatisfactory attendance is determined by each department.

7. APPEALS AGAINST ACADEMIC EXCLUSION

Students may lodge an appeal against their academic exclusion (such as receiving an F7 (undergraduate) or 7F (postgraduate) global result code) at the specific faculty on the campus where the student is registered. Faculty-specific arrangements will be made and dates publicised by the Faculty concerned.

(a) Applicants who want to appeal must follow the prescribed administrative procedure by submitting their motivation and supporting documents as well as other substantiating documents to the relevant dean's office according to faculty guidelines and procedures and in accordance with UJ policies.
(b) The Faculty Appeals Committee will consider the appeals and may refuse or allow readmission.
(c) The students will be notified in writing of the outcome of the appeal.
(d) The decision of the Faculty Appeals Committee is final, subject to AR 7(f).
(e) Students who transfer to another faculty retain their academic record related to their previous registration for any other programme/s.
(f) When a Faculty Appeals Committee allows re-admission under circumstances where a student had submitted incorrect information and documentation material to an appeal, or had omitted to provide information or documentation material to an appeal, the Faculty Appeals Committee may reverse its decision and the registration of the student may be cancelled.

The description of unsatisfactory attendance is determined by the relevant lecturer and the Executive Dean.

8. EXEMPTION AND RECOGNITION REQUIREMENTS

8.1 A Head of Department may, in consultation with the Executive Dean or in accordance with a list of exemptions approved by the Executive Dean, grant exemption for a module and award a credit on the grounds that students have passed a relevant module at the University or at another accredited higher education institution.

8.2 Exemption from and awarding of credit for modules, as stipulated in AR 8.1, may not be granted for more than half the number of modules required in an undergraduate programme in which exemption and recognition are requested. A faculty may determine rules and regulations in this regard in agreement with the existing Faculty Rules and Regulations, and subject to approval by Senate. At least half the number of semester modules, including the exit level modules where appropriate, should be passed at the University for the University to award the diploma or confer the degree. The Executive Dean concerned, in consultation with the Registrar, may give permission to the student (for legitimate reasons) to complete such exit level module(s) at another HEI in South Africa, or abroad in accordance with the academic record concerned. For the purposes of this sub-regulation, a year module counts as two semester modules, and one term module counts as half a semester module.

8.3 Only in exceptional circumstances may the Executive Dean grant exemption from an exit level or semester core module that has been passed at another institution or in another programme.

The Executive Dean will determine whether exceptional circumstances apply.

8.4 Exemption from or credit for a module may only be granted for one further programme in addition to the programme in which the module was originally completed.

10. DURATION OF PROGRAMME

10.1 The minimum duration of a programme is in accordance with the HEQSF and HEMIS requirements.

10.2 The maximum duration of a programme is per the table below. For any qualification offered part time, one additional year may be added to the maximum duration

The minimum duration of each programme is according to the curricula of the programmes offered by the Faculty. The maximum duration of each undergraduate programme is listed in the table below, and is subject to regulations 6.6, 6.7, 6.8, 6.9 and 6.10.

Duration of programmes

Qualification	Maximum Duration
1 year Degree or Diploma or Certificate	2 years
2 year Degree or Diploma	3 years
3 year Degree or Diploma	5 years
4 year Degree or Diploma	6 years
Masters Degree (Minimum duration is 1 year)	2 years
Doctoral Degree (Minimum duration is 2 years)	4 years

11. TEACHING, LEARNING AND ASSESSMENT

11.1.4 Any form of dishonesty, including plagiarism, in relation to any assessment event in any programme, will be dealt with in accordance with the University's disciplinary code and/or criminal law. *Refer to Regulation 2.3.48.*

11.2.5 Every summative assessment opportunity carries a predetermined weight that takes the integration of the outcomes into account. A number of smaller summative assessments may count as *one* assessment opportunity in a module.

A student who does not participate in all assessment opportunities in a module, and has not been excused from participation by the relevant lecturer, will only be permitted to pass in exceptional circumstances, and after submission of a written motivation from the relevant Head of Department to, and approved by, the Executive Dean, irrespective of the weighted average of the marks obtained by the student.

11.2.6 When a summative assessment opportunity is used as a last (comprehensive) assessment opportunity, a minimum final period/semester or year mark of 40% is required for admission to the summative assessment opportunity concerned.

Attendance of practicals, where applicable, are required for admission.

11.4 Appeals

11.4.1 After the final mark for a module is made known, students:

a) who failed the module with a final mark of at least 45%, or
b) whose last summative assessment (examination) mark is at least 15% lower than their module mark, or
c) who passed a module without distinction, but whose module mark or last summative assessment (examination) mark was a distinction mark, may apply to the Lecturer who awarded marks in the final or last summative assessment opportunity for an explanation of the final mark obtained.

11.4.2 Requests for the explanation of the award of final marks in the final summative assessment opportunity as indicated in AR 11.4.1 must be made within **10 days** after classes commenced for the second semester for first semester assessments. In the case of a second semester assessment opportunity, requests must be made 3 days prior to commencement of classes the following year. No assessment material (for example, answer scripts or portfolios) or copies of it may be provided to students after such explanatory discussion, if such material would not otherwise have been returned to the student.

11.4.3 If, after the explanation has been provided as described in A-Regulation 11.4.2, students are still dissatisfied with the award of marks, they may appeal to the Executive Dean. The Executive Dean may, at own discretion decide to appoint an external arbitrator to re-assess the final and/or last summative assessment. A fee, as determined by the University is payable for the assessment by arbitration.

11.4.4 The fee is refunded if the arbitrator alters results from a fail to a pass or from a pass without distinction to a pass with distinction. In all other cases the fee is forfeited to the University.

11.5 Special summative assessment and supplementary summative assessment opportunities

11.5.1 Special summative assessment opportunities are considered by the faculty in which the programme/qualification resides, for students who, in the event of illness, for compassionate reasons, on religious grounds or for similar legitimate reasons, were prevented from attending a summative assessment opportunity. Students may be granted a special summative assessment opportunity if they apply for it within **seven calendar days** after the original date of the relevant summative assessment opportunity. The Executive Dean or the Vice-Dean, in consultation with the relevant Head of Department, considers all applications and decides whether or not to grant the special summative assessment opportunity.

The Faculty Board determines the procedure for and manner of such application in accordance with University procedure. The application procedure must be contained in a relevant programme-specific information or learning guide.

11.5.2 The Assessment Committee or a senior administrative officer of a faculty in which the module resides may grant a student a supplementary last summative assessment opportunity if

(a) the student failed a module but obtained a final mark of at least 40%;
or
(b) student failed a module but obtained a final period/semester/year mark of at least 60%.

11.5.3 The Assessment Committee or a senior administrative officer of a faculty in which the qualification resides may grant a student a supplementary last summative assessment opportunity if the student requires not more than the equivalent of two semester modules or one year module for the completion of the relevant qualification, provided that the student

(a) was registered for the relevant module in the current academic year; and
(b) was admitted to, and participated in the last assessment opportunity in the relevant module; and
(c) has complied with all the experiential or practical requirements prescribed for the qualification (where applicable) excluding work integrated modules; and
(d) was not granted a supplementary last assessment opportunity in the relevant module during the current academic year;
The Executive Dean of the faculty in which the qualification resides may, in exceptional circumstances and in consultation with the Executive Dean of the faculty in which the particular module resides, waive one or more of the conditions specified in (c) or (d).

11.5.4 Supplementary assessments for continuous assessment modules are scheduled as part of the assessment plan for a particular module. The following applies:

(a) A minimum of 40% final mark in the predetermined assessment is required to gain access to a supplementary assessment.
(b) Supplementary assessments are limited to a minimum of one scheduled assessment per semester module, or two scheduled assessments per year module, or according to each faculty's internal assessment policy.
(c) A maximum of no more than a pass mark is awarded for the supplementary assessment.

11.5.6 Students are personally responsible for ascertaining whether they qualify for a special assessment or a supplementary assessment opportunity and for acquainting themselves with the details of the timetable and the venue.

11.5.7 Students' entitlement to a special or supplementary summative assessment opportunity lapses if they fail to use the opportunity.

11.5.8 Students may not be granted another supplementary summative assessment opportunity if they have used and failed a previous one, except if the Executive Dean of the faculty in which the qualification resides has waived requirement.

11.5.9 The final mark after a supplementary assessment opportunity is capped at 50%. This rule does not apply to continuous assessment modules (refer to AR 11.5.4)

11.5.10 No capping of a final mark is applicable in the case of a special summative assessment opportunity.

11.6 Obtaining a qualification

11.6.1 Students obtain a qualification if they have passed every module prescribed for a programme and have successfully completed, service or work integrated learning where applicable. It is the student's responsibility to ensure all prescribed modules, service or work integrated learning are completed.

11.6.2 A qualification is awarded or conferred with distinction if the requirements below are met:

(a) Duration:
  (i) Students must complete an undergraduate programme in the minimum period of study specified for the programme, unless the Executive Dean has approved a longer period of study for legitimate reasons.
  (ii) Students must complete an advanced diploma, postgraduate diploma or an honours qualification within one year if registered full-time and within two years if registered part-time.
  (iii) Students must complete a master qualification within the maximum period allowed for the master programme.

(b) Average final mark for the qualification:
  (i) Students must achieve a weighted and/or proportional calculated average final mark for an undergraduate qualification of at least 75% as determined by the Faculty Board, approved by Senate and contained in the Faculty Rules and Regulations.
  (ii) Students must achieve an average final mark for an advanced diploma, postgraduate diploma or an honours qualification of at least 75% calculated by weighting the final marks for all the modules comprising the qualification in accordance with the NQF credit values allocated to the modules.
  (iii) Students for a master qualification by dissertation must achieve a final mark of at least 75% for the dissertation.
  (iv) Students for a masters qualification by coursework must achieve an average final mark for the qualification of at least 75% calculated by weighting the average final marks for all the coursework modules and the final mark for the minor dissertation in accordance with the credit values allocated to all the coursework modules and the minor dissertation respectively (for example, if the credit value of the minor dissertation represents 40% of the total credit value of the qualification, the average final mark for the qualification will be weighted in the proportion of 40 for the minor dissertation and 60 for all the coursework modules).
  (v) Decimal marks may be rounded upwards or downwards in accordance with the decision taken by the Faculty Assessment Committee concerned.

(c) A student must never have failed a module as a first attempt in the relevant programme.

(d) A student must have obtained a minimum mark of 65% in every prescribed module at NQF level 6 for Diplomas, NQF 7 for Advanced Diplomas/BTech and Degrees, NQF level 8 for Professional Bachelor Degrees, Postgraduate Diplomas and Honours Degrees and NQF level 9 for Masters Degrees and, in the case of a masters qualification by coursework, in the minor dissertation as well.

(e) Students must have been registered for the full curriculum as prescribed for each academic year on a full-time or part-time basis, as the case may be.

(f) If students are transferred from another Higher Education Institution in the same qualification to UJ, the same requirements as stated shall apply.

(g) If students change programmes within the UJ, only the modules related to the new programme will be taken into consideration in calculating whether the qualification is obtained with distinction.

11.7 Students with disabilities

11.7.1 Students wishing to submit an application for special assessment conditions based on the grounds of a disability must do so in accordance with the procedure prescribed in the University's Policy on People with Disabilities.

11.7.2 Students should submit the application, together with the relevant medical/psychological reports supporting the request, to the Disability Unit at the beginning of every semester/year. The request should clearly specify the needs and concessions requested. After consideration, the Disability Unit will refer the request, together with a recommendation to

the respective Executive Dean, other divisions and lecturers. Extension of assessment time and/or the granting of a concession must be reaffirmed every semester/year.

11.8 Access control during assessments

11.8.1 Students may not enter a summative assessment venue later than 30 minutes after the official starting time of the summative assessment opportunity to take part in the assessment opportunity, and neither may they leave the assessment venue during the first 30 minutes of an assessment opportunity or during the last 15 minutes of the allocated assessment time.

11.8.2 Students must identify themselves as required for admission to an assessment venue.

During an assessment event the access card must be placed on the student's desk where it is to be in plain view for the duration of the assessment event.

A student who is not in possession of an access card (for whatever reason) must place another form of identification on the desk. The alternative form of identification must be a formal document that shows the student's name, photograph and National Identity number or other reference number (a driver's licence or passport, for example).

A student who is not in possession of any of the above forms of identification will be required to provide his/her National Identity number in addition to the student number on the attendance slip and assessment script.

The assessment script and attendance slip of any student without an access card will be prominently marked by the invigilator as an indication to the assessor that the student was unidentified and possibly suspect.

11.10 Transgressions during any assessment opportunity

11.10.1 Students commit a transgression when

(a) they commit plagiarism;
(b) during a formal assessment opportunity, the student is in possession of any book, cell phone, electronic devices that has not been switched off, memorandum, notes in whatsoever form, or any papers, documents or database equipment, except for access to such answer books or other books, papers or documents that the invigilator has supplied or access to such other sources that the invigilator authorised as per instructions of the examiner.
(c) students help or attempt to help other students, or obtain help or attempts to obtain help from other students, or obtain help or attempt to obtain help from any source of information, with the exception of explicitly approved sources as permitted by the assessor;
(d) student help other students to commit an offence (also considering that students are under an obligation to take all reasonable measures to ensure that other students do not have access to their work);
(e) students have unauthorised information stored on a pocket calculator, cellphone or any other device brought into the assessment venue, whether or not they have had the opportunity to access such information;
(f) students cause a disturbance in the proximity of, or inside the assessment venue, or conduct themselves in an improper or unbecoming manner;
(g) students disregard the instructions of invigilators or assessors;
(h) students pose as other students.

11.9.2 Persons who are not registered for a relevant module and are present in an assessment venue with the intention of taking part in the assessment are guilty of fraud and may face disciplinary procedures or legal action.

11.9.3 Executive Deans of Faculties can initiate disciplinary procedures in certain cases. They may implement disciplinary procedures with regard to alleged transgressions in class assessments, assignments, tasks and essays as well as undisciplined behavior towards academic or administrative staff.

11.11 Irregularities during participation in summative assessment and practical opportunities

11.11.1 Students who, in the opinion of the invigilator, commit an irregularity during an assessment or practical opportunity will have their assessment script, product or any other material or equipment that, in the opinion of the invigilator pertains to the irregularity, confiscated immediately with the time recorded on it. Students will be issued immediately with a new

assessment script or any other relevant material or equipment and the time of issue will be written on the front cover of the script.

11.11.5 If the suspected offence involves an electronic device, the invigilator will consult the assessor before responding to the offence as described in AR11.10.1.

Before commencement of the assessment event students are advised that all cell phones and any other unauthorized electronic devices have to be switched off and remain so for the duration of the assessment event. They must remove these devices from their persons and place them on the floor under their seats or in their bags.

Any cell phone or other unauthorized electronic device that is seen to be held in the hand or operated in any way for whatever reason once the assessment has formally begun, will be confiscated by the invigilator. Any scripts will be dealt with in accordance with A-Regulation 11.11.1.

Confiscated phones will be left on the invigilators' table in full view to protect the invigilator from accusations of tampering.

Any student who refuses to hand the cellphone to the invigilator or argues will be deemed to have disqualified him/herself from the assessment event, will have his/her script/s removed and will be required to leave the venue immediately (or once the first half hour of the assessment period has lapsed.

All details pertaining to any such incidents will be reported in writing to the Head of Department and the Executive Dean by the staff member/s involved.

14. ACADEMIC REGULATIONS APPLICABLE TO POSTGRADUATE DIPLOMAS AND HONOURS PROGRAMMES

14.1 Minimum admission requirements

14.1.1 Admission to an honours programme or postgraduate diploma: relevant bachelor's degree, advanced diploma, or an equivalent qualification on NQF Level 7 in the same or relevant field of study as determined by the relevant Faculty Board.

14.1.2 In addition to institutional requirements, programme-specific admission requirements are determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations.

The academic requirements for admission to an Honours programme are department-specific subject to confirmation by the Faculty Board. Generally, an average mark of 60% in the relevant subject in the final year of the preceding qualification will be required. Admission to an Honours programme is not automatic even if the applicant is in possession of an appropriate preceding qualification.

A department may, subject to approval by the Executive Dean, require a student to successfully complete certain specified components of the bachelor's degree prior to, or during the Honours programme before the Honours degree can be awarded.

A department could limit the number of admissions due to constraints of space and facilities.

14.1.4 The Head of Department may, where applicable, initiate the University's Policy on RPL to award academic status equivalent to that of the prerequisite qualification to applicants in order to allow them access to the programme as determined by the relevant Faculty Board and approved by Senate.

14.1.5 The University reserves the right not to admit applicants to a particular programme in accordance with programme-specific selection and other relevant criteria. Applicants who have applied for admission and have been refused may request written reasons for such refusal from the Head of Department.

14.1.6 Meeting the Faculty's minimum requirements for a particular programme does not necessarily guarantee admission to that programme. Specific selection criteria may be applied within the required Enrolment Management Plan as the University has a specific number of places available as approved by the Department of Higher Education and Training

The Faculty of Science Policy on RPL will be followed.

Applicants for admission to an Honours programme must follow the application process and closing dates as determined by the relevant department. Intending applicants are advised to approach the department of their choice before the end of October in the academic year preceding their expected registration.

14.2 Registration

14.2.1 Applicants register for the programme subject to confirmation that they have met the minimum admission requirements and have been selected.

14.2.2 Renewal or suspension of registration of students is based on the promotion requirements as determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations.

A student registers for the Honours programme on a full-time or part-time basis, in accordance with the specific requirements of the programme as contained in the relevant Faculty Rules and Regulations, as approved by Senate, and with due regard to the requirements for registration as a professional scientist.

A Head of Department may, subject to approval by the Executive Dean, permit a student to replace a maximum of two Honours modules in the formal curriculum with modules of equivalent weight from another department within the Faculty of Science or, in exceptional cases, from another Faculty.

If a student's progress is unsatisfactory the Executive Dean, in consultation with the relevant Head of Department, may terminate the student's registration for the honours programme. Each department may set its own description of what constitutes unsatisfactory progress.

14.3 Assessment

The assessment requirements are determined by the relevant Faculty Board and contained in the relevant Faculty Rules and Regulations. This includes the consideration and awarding of supplementary assessment opportunities for modules failed. The weighting of the individual modules must be in line with the credit values of the modules. The weighting of the individual modules must be in line with the NQF credit values of the modules.

Every module in the Honours programme has to be passed separately and individually for the Honours degree to be awarded.

Supplementary summative assessment opportunities can be awarded in modules which have been failed, except in modules based on a research project, practicals or field excursions.

Refer to Regulation 11.6.2 where the requirements for cum laude *are specified.*

Re-assessment by way of a supplementary examination is permitted in Honours modules, subject to Regulations 11.5.2 (a) and (b), 11.5.7, 10.5.8 and 14.3, provided that no more than 25% of the number of modules prescribed for the specific degree require to be re-assessed.

A student who fails more than 25% of the number of modules prescribed for the specific degree will have his/her registration as student cancelled with immediate effect. Failure is taken to mean that a pass mark has not been achieved in a module, including after re-assessment.

Re-registration for a failed module can only be done with the specific approval of the Executive Dean on recommendation of the Head of Department involved.

Duration of study

Refer to A-regulation 10.1 and 10.2
An additional year of study may be granted in exceptional cases by the Executive Dean in consultation with the Head of Department concerned.

Ethical considerations

Research in Honours programmes is conducted in accordance with ethical requirements as contained in the University's Higher Degrees and Postgraduate Studies Policy, the

University's Academic Ethics Policy, faculty-specific procedures, as determined by the Faculty Board concerned, with due regard to statutory and professional regulatory requirements and general best-practice principles to protect human and animal dignity in research.

Research projects in Honours programmes will not require formal registration but must be approved by the Department concerned.

It is incumbent on all staff members of academic departments to ensure that the above requirements are met.

15. ACADEMIC REGULATIONS APPLICABLE TO MASTERS PROGRAMMES

15.2 Admission

15.2.1 The minimum admission requirement for a master programme is a qualification at NQF Level 8, an honours qualification, a four-year 480 NQF credit bachelor's qualification (with a minimum of 96 credits at NQF Level 8), or a postgraduate diploma, in the same or a relevant field of study or discipline. The relevant field of study or discipline is determined by the relevant Faculty Board, approved by the Senate Higher Degrees Committee and ratified by Senate.

Admission requirements are department specific and approved by the Executive Dean. Admission to a master programme is not automatic even if the applicant is in possession of an appropriate preceding qualification. A department may, subject to approval by the Executive Dean, require a student to successfully complete certain specified components before the master's degree can be awarded.

Students applying for master's degree studies in general need to have obtained their previous relevant degree with an average mark of at least 65% or equivalent. In exceptional cases a student with a mark between 60% and 64% may apply to be accepted for study provided a motivation from the Supervisor and the Head of Department where the study is to be conducted is submitted to the Executive Dean of the Faculty of Science for approval.

15.2.2 Applicants apply for admission and, if successful, register either for a research master programme, coursework master programme or professional master programme.

15.2.3 Additional admission and selection requirements may be determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations.

15.2.4 In the case of interdisciplinary master programmes additional admission requirements may be set by the two or more relevant interdisciplinary fields/departments/faculties, approved by Senate and contained in the relevant Faculty Rules and Regulations.

The form that the assessment will take is department specific, subject to approval by the Executive Dean. An external assessor may, however, request an oral examination.

15.2.7 The University reserves the right not to admit applicants to a particular master programme in accordance with programme-specific selection criteria and other relevant criteria such as:

(a) the limitations of enrolments per programme;
(b) capping of admissions in terms of the University's approved enrolment plan or professional regulatory requirements; or
(c) the inability to identify an appropriate supervisor within the University.

A department may limit the number of admissions due to constraints of space and facilities in the interests of quality of instruction.

15.3 Registration

15.3.1 Registration is done in accordance with dates set by the University.

15.3.2 Renewal of registration for a minor dissertation or dissertation takes place during the first semester of the academic year as contained in the University's Year Programme.

15.3.3 Failure to submit the research or minor research proposal within the time frame specified in the Higher Degrees Policy may result in cancellation of registration.

15.3.4 Interruption of study may be granted by the Executive Dean for legitimate reasons, as reflected in the Higher Degrees Administration: Structure and Processes.

15.3.5 Allowance is made for a possible pre-registration period during which a student will have limited access to university resources such as the library. This is done in accordance with the relevant Faculty Rules and Regulations.

(a) The pre-registration period may extend from a minimum of three months to a maximum of twelve months. Where the pre-registration period carries over to a following academic year the student must re-register. Pre-registration will be accommodated on the student administration system in either the first semester or the second semester of the academic year.

(b) Pre-registration is only available according to the published registration dates set for the programme. Students who fail to meet the pre-registration requirements will not be given a second chance.

(c) In order to qualify for formal registration, the student must have complied with all the conditions for progression set and recorded by the faculty, in time to register in accordance with the times set by the University

15.3.6 Students register for a master programme full time or part time in accordance with the specific requirements of the programme as contained in the relevant Faculty Rules and Regulations as approved by Senate, and with due regard to the programme qualification mix as approved by the DHET.

15.3.7 The minimum duration of a master programme is one academic year. Residency less than the prescribed minimum study period may not be granted.

15.3.8 The maximum period of registration for a master programme is two years full time or three years part time. Further registration may be granted by the relevant Executive Dean in accordance with the University's Higher Degrees Policy and the Higher Degrees Administration: Structures and Processes.

15.3.9 The approval of applicants' research proposals, supervisors, study fields and provisional and/or final titles of minor dissertations or dissertations takes place in accordance with the University's Higher Degrees Policy, the Higher Degrees Administration: Structures and Processes and faculty-specific regulations as determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations.

The proposed topic of the dissertation/minor dissertation, the name of the supervisor/s as well as confirmation of the requirements set out below, are submitted to the Faculty Higher Degrees Committee for recommendation to the Dean's Committee. This proposal must be submitted within 3 months of registration of the student.

The requirements that have to be met are:
- *That the supervisor considers the student competent to undertake the study;*
- *That the supervisor/s and assessor/s have at least M-degrees or equivalent;*
- *That the proposed field of study falls within the department's or supervisor's field of research;*
- *That the proposed field of study is of sufficient academic merit to justify a master's degree;*
- *That the proposed study can be undertaken with available equipment and facilities without delays due to overcrowding.*

15.3.10 Any amendment to a project or research title is done in accordance with faculty-specific requirements. The amendment is approved by the relevant Faculty Board or faculty higher degrees committee and noted by the SHDC. A change in project title at any stage does not constitute valid grounds for the extension of registration, residency or formal duration of study.

15.3.11 The renewal of students' registration for a master programme is subject to satisfactory progress in accordance with the University's Higher Degrees Policy and the Higher Degrees: Administration: Structures and Processes, faculty-specific requirements and, where applicable, professional regulatory requirements, with due regard also to the University's Enrolment Management Plan and subsequent throughput interventions.

Satisfactory progress will be determined by bi-annual reports from the supervisors to the Faculty Higher Degrees Committee.

15.3.12 If students' progress is unsatisfactory, the Faculty Board may decide to terminate their registration for the master programme.

A department can formulate its own description of what constitutes unsatisfactory progress, subject to approval by the Executive Dean.

15.4 Ethical considerations

Research in masters programmes is conducted in accordance with ethical requirements as contained in the Code of Academic Ethics and faculty-specific procedures as determined by the relevant Faculty Board, and with due regard to statutory and professional regulatory requirements and general best-practice principles to protect human and animal dignity and welfare in research.

15.5 Health and safety

The supervisors of research projects are responsible for assessing whether or not such projects have health and safety implications in accordance with the University's Occupational Health and Safety Policy.

15.6 Conversion/transfer of a research master's degree to a doctoral degree

15.6.1 In exceptional cases, where the scope and impact of a project originally registered for a research master programme prove to expand considerably beyond the initial expectation and where the project is expected to make a novel contribution to the body of knowledge in the discipline, students – with the concurrence of the supervisor and all co-supervisors – may apply to have their registration converted/transferred to a doctoral level in accordance with the University's Higher Degrees Policy and the Higher Degrees: Administration: Structures and Processes.

15.7 Assessment

15.7.4 The master student is responsible for the technical and linguistic editing of the minor dissertation or dissertation with the assistance of the supervisor prior to submission for final summative assessment.

15.7.5 The final research report (minor dissertation or dissertation) is submitted for assessment (with reference to the presentation format, content and layout) in accordance with the faculty-specific regulations as determined by the relevant Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations.

The Masters dissertation is a single document, prepared for the purpose of meeting the requirements for the attainment of the degree.

15.7.10 The final submission of the minor dissertation or dissertation takes place in accordance with the final submission dates per semester as contained in the University's Year Programme to ensure timely completion of the assessment process. Late submission could imply the renewal of a registration.

15.7.11 The minor dissertation or dissertation is assessed in accordance with the University's Higher Degrees Policy, the Higher Degrees Administration: Structures and Processes and faculty-specific criteria as determined by the Faculty Board and approved by Senate.

For a research master's degree, a dissertation must furnish proof that a student is capable of scientific research and the application thereof and does not have the generation of original or unique knowledge as its primary aim.

The master student has, therefore, to demonstrate the ability to

a. *Identify a problem and formulate a hypothesis*
b. *Find and collate the relevant literature on the problem*
c. *Devise an appropriate strategy to address the hypothesis*
d. *Generate legitimate results with which to address the hypothesis*
e. *Place the results found in correct context against the known literature*
f. *Present a cohesive acceptable summation of the study performed, with due regard to the appropriate conventions of style and terminology*

In the event that an assessor awards a mark for a dissertation and requires the dissertation to be amended and re-submitted for re-assessment, the mark given by that specific assessor after re-assessment shall be capped at 50%. The mark/s awarded by the other assessor/s will not be affected by this capping.
This capping will also apply to any subordinate component of the master study such as modules included in master's study by coursework which could require re-assessment.

15.7.12 The recommendations of assessors are considered by the relevant faculty postgraduate assessment committee and a result is recommended to the Faculty Board for approval and ultimately to Senate for noting in accordance with the University's Higher Degrees Policy and the Higher Degrees Administration: Structures and Processes.

In the case of the research master's degree the dissertation is the only assessment requirement that has to be fulfilled. The final assessment mark (which carries a weight of 100%) is the average of the marks given by the external assessors.

In the case of the master's degree by coursework the minor dissertation as well as the successful completion of additional courses, are the assessment requirements that have to be met. Calculation of the final mark in the case of the minor or course-work dissertation is department specific and set out in the Faculty Rules and Regulations. The minor dissertation mark (determined as for the research dissertation) and the average of the course-work modules will each contribute 50% to the final mark.

15.7.17 A student is not deemed to have completed the requirements for conferment of the degree if the electronic version has not been submitted to the relevant faculty administration officer prior to the graduation ceremony and closure of the graduation list for the forthcoming graduation ceremony.

15.10 Dissemination and publication of the minor dissertation and dissertation

15.10.3 In addition to the submission of the final minor dissertation or dissertation, and except where faculty regulations exempt them, masters students are required to submit to their supervisors at least one piece of work suitable for submission to a peer reviewed publication, by the time the faculty-specific research assessment committee meets to consider the assessors' reports.

If required by a department/supervisor, candidates must submit to their supervisor/s a manuscript based on a topic of the dissertation, in the format of a research article meeting the requirements for publication. Once the supervisor is satisfied that the appropriate scientific conventions have been mastered, the student is certified as having met this requirement. Note that submission of the manuscript to an editor is not a requirement.

Departments that require submission of such manuscripts to a journal must include the certification in the final report on the student to the Faculty Higher Degrees Committee.

15.10.5 Students are not deemed to have completed the requirements for graduation until the corrected piece of work suitable for submission to a peer reviewed publication has been submitted to and accepted by the supervisors.

Subject to Regulation 15.10.3

15.11 Dispute resolution

15.11.1 If an unresolved dispute should arise between two or more of the supervisors or between a supervisor and the student, the relevant Head of Department will in the first instance take steps to resolve the matter.

15.11.2 If the dispute is still unresolved, it is referred to the relevant Executive Dean who may refer the matter to the Senate Higher Degrees Committee for final consideration and processes to resolve the matter.

15.12 Intellectual property

15.12.1 Supervisors are responsible for monitoring all masters projects for potential inventions or other commercially viable intellectual property implications and disclosing such inventions or implications to the Executive Director: Research and Innovation.

15.12.2 Students who develop inventions or other forms of commercially valuable intellectual property must disclose such inventions to the supervisors in accordance with the University's Policy on Intellectual Property.

15.12.4 Where disclosures have been made about intellectual property emerging from a masters research project, the Executive Director: Research and Innovation, or an applicant duly mandated in this regard, must certify that any intellectual property matters attendant to the project have been dealt with in terms of relevant university policy as a condition of graduation.

16. ACADEMIC REGULATIONS APPLICABLE TO DOCTORAL DEGREES

16.2 Admission

16.2.1 For admission to a doctoral programme, applicants must have successfully completed a relevant master programme in the same or relevant field of study or discipline as determined by the relevant Faculty Board, approved by the SHDC, ratified by Senate and contained in the relevant Faculty Rules and Regulations.

16.2.2 The extent to which applicants meet admission requirements is assessed by the relevant Head of Department, in consultation with the prospective supervisors, in accordance with the admission requirements for the particular doctoral programme determined by the Faculty Board, approved by Senate and contained in the relevant Faculty Rules and Regulations. The Head of Department, in consultation with the relevant Executive Dean, may set additional admission requirements, as approved by the relevant faculty higher degrees committee, for a particular student.

Admission requirements are department specific and approved by the Executive Dean. Admission to a Doctoral programme is not automatic even if the applicant is in possession of an appropriate preceding qualification. A department may, subject to approval by the Executive Dean, require a student to successfully complete certain specified components before the Doctoral degree can be awarded.

Students applying for Doctoral degree studies in general need to have obtained their previous relevant degree with an average mark of at least 65% or equivalent. In exceptional cases a student with a mark between 60% and 64% may apply to be accepted for study provided a motivation from the Supervisor and the Head of Department where the study is to be conducted is submitted to the Executive Dean of the Faculty of Science for approval.

16.2.5 The University reserves the right not to admit applicants to a particular doctoral programme in accordance with the programme-specific selection criteria and other relevant criteria or if the department lacks adequate supervision capacity. Compliance with minimum admission requirements does not constitute automatic right of admission to the programme.

16.2.7 Applicants who have applied for admission and have been refused may request written reasons for such refusal from the relevant Head of Department or Executive Dean.

16.3 Registration

16.3.1 Applicants register for the relevant doctoral programme in accordance with the registration dates set by the University, faculty-specific procedure and in terms of the requirements of the Higher Degrees Policy and the Higher Degrees Administration: Structure and Processes.

16.3.2 Renewal of registration takes place during the first semester of the academic year.

16.3.3 Failure to submit the research proposal within the specified time frame may result in cancellation of registration.

16.3.4 The Executive Dean may grant a student permission to put his/her study in abeyance for legitimate reasons, as reflected in the Higher Degrees Policy and the Higher Degrees Administration: Structure and Processes.

16.3.5 Allowance is made for a possible pre-registration period during which a student will have limited access to university resources such as the library. This is done in accordance with the relevant Faculty Rules and Regulations.

(a) The pre-registration period may extend from a minimum of three months to a maximum of twelve months. Where the pre-registration period carries over to a following academic year, the student must re-register. Pre-registration will be accommodated on the student administration system in either the first semester or the second semester of the academic year.

(b) Pre-registration is only available according to the published registration dates set for the programme. Students who fail to meet the pre-registration requirements will not be given a second chance.

(c) In order to qualify for formal registration, the student must have complied with all the conditions for progression set and recorded by the faculty, in time to register in accordance with the times set by the University.

16.3.6 Students register for the doctoral programme full time or part time in accordance with the specific requirements of the programme as contained in the relevant Faculty Rules and

Regulations, as approved by Senate, and with due regard to the approval of the DHET, as accredited by the CHE (HEQC) and registered by SAQA.

16.3.7 The minimum duration of a doctoral programme is two academic years (part time or full time). Residency less than the prescribed minimum period is not granted.

16.3.8 The maximum period of registration for a doctoral programme is four years full time or five years part time. Further registration may be granted by the relevant Executive Dean in accordance with the University's Higher Degrees Policy and the Higher Degrees Administration: Structures and Processes.

16.3.9 The approval of students' research proposals, supervisors, study fields and provisional or final titles of theses is in accordance with the University's Higher Degrees and Postgraduate Studies Policy and faculty-specific regulations determined by the relevant Faculty Board, approved by Senate as recommended by the Senate Higher Degrees Committee.

The proposed topic of the thesis, the name of the supervisors as well as confirmation of the requirements set out below, are submitted to the Faculty Higher Degrees Committee for recommendation to the Dean's Committee. This proposal must be submitted within 6 months of registration of the student.

The requirements that have to be met are:

a. *That the supervisor considers the student competent to undertake the study*
b. *That the supervisor/s and assessors have D-degrees or their equivalent*
c. *That the proposed field of study falls within the department's or supervisor's field of research*
d. *That the proposed field of study is of sufficient academic merit to justify a Doctor's degree*
e. *That the proposed study can be undertaken with available equipment and facilities without undue delays due to overcrowding.*

16.3.10 Any amendment to the title of a thesis is in accordance with faculty-specific requirements, and such amendment is approved by the relevant Faculty Board or faculty committee with delegated authority and noted by the Senate Higher Degrees Committee. A change in project title at any stage does not constitute valid grounds for the extension of registration or residency/formal duration of study.

16.3.11 Scholarship development at doctoral level may consist of at least the following formative and integrated assessment opportunities, as determined by the Faculty Board, approved by Senate and contained in the Faculty Rules and Regulations:

(a) regular discourse engagement with the supervisor(s), as contained in the faculty-specific guidelines for doctoral programmes;
(b) two doctoral seminars during the course of the programme: one to present and defend the research proposal and one to present the results of the research project and simultaneously to justify the originality of the thesis.

16.3.12 The renewal of students' registration for a doctoral programme is subject to their satisfactory progress in accordance with the Higher Degrees Policy, Higher Degrees Administration: Structures and Processes, faculty-specific requirements and, where applicable, professional regulatory requirements.

Satisfactory progress will be determined by regular quarterly report from the supervisor to the Faculty Higher Degrees Committee.

16.3.13 In the event of students' progress being unsatisfactory, the relevant Faculty Board recommends to the Senate Higher Degrees Committee that their registration for the doctoral programme be terminated. The decision of the Senate Higher Degrees Committee is final.

16.6 Assessment

16.6.1 A doctoral study is assessed on the basis of a doctoral thesis in the traditional format or in the form of a collection of articles and essays. The Faculty Rules and Regulations, approved by Senate, however, may determine that an oral defence or Viva Voce may form part of the academic requirements for the qualification. The submission of two pieces of work suitable

for publication in a peer reviewed publication, based on the thesis, is a prerequisite for the conferment of the degree.

16.6.3 Doctoral degree students are responsible for the technical and linguistic editing of the thesis with the assistance of the supervisor, prior to submission for final summative assessment.

16.6.6 A thesis is submitted for final summative assessment, subject to the written permission of the supervisors and a completed UJ declaration form for masters and doctoral studies. The permission of the supervisors or the Executive Dean to submit a thesis for final summative assessment does not guarantee a successful outcome of the assessment procedure.

16.6.9 The following results may be recommended by the individual assessors for a doctoral thesis:

Approval of the thesis.
Provisional approval of the thesis with the understanding that the candidate has to make non-substantive corrections and improvements to the thesis to the satisfaction of the supervisor.
Recommendation that substantial amendments be made to the thesis in the light of deficiencies identified in the assessor's narrative report in which case the revised version must be submitted to the particular assessor for reassessment.
Rejection of the thesis in which case no reassessment is recommended or considered.

A Doctoral thesis must be an original or unique contribution to the knowledge and philosophy of the subject. The extent of the original contribution will be determined by the supervisor/s, assessors and the Faculty Higher Degrees Committee.

16.6.11 Students are not deemed to have completed the requirements for conferment of the degree if two pieces of work in a format suitable for peer reviewed publication are not submitted prior to the closure of the graduation list for the forthcoming graduation ceremony.

16.6.12 Students are not deemed to have completed the requirements for conferment of the degree if an electronic copy has not been submitted to the relevant faculty administration officer prior to the graduation ceremony.

16.8 Dissemination and publication of the thesis

16.8.3 In addition to the final submission of the thesis, and except where faculty regulations exempt them or set a higher number, doctoral students are required to submit to their supervisors at least two pieces of work in a format suitable for a peer reviewed publication. Faculty regulations may stipulate additional evidence (e.g. proof of acceptance of the manuscript for publication). The requirement of such additional evidence is approved by the relevant Faculty Board and Senate.

*Doctoral candidates must provide evidence that at least one article based on the doctoral research topic has been **accepted for publication by** an accredited journal or other appropriate publication. A copy of the published paper(s), alternatively proof of acceptance of the publication from the journal editor or editorial panel of the journal, must be submitted electronically to the Faculty.*

16.8.5 Students will not be deemed to have completed the requirements for graduation until such time as the aforementioned manuscript of the research article has been submitted to the supervisors unless the student has been exempted from this requirement by the Faculty Rules and Regulations.

16.8.8 If students do not publish their work, supervisors may take the initiative to publish it in accordance with the Guidelines Authorship as contained in the University's Code for Academic Ethics.

16.8.9 The SHDC may, on the recommendation of the Deputy Vice-Executive Director: Research and Innovation or an applicant duly mandated in this regard, grant a confidentiality classification of two years to the completed thesis, as stipulated in the University's Policy on Intellectual Property, meaning a delay in the public display of the thesis.

16.9 Dispute resolution

16.9.1 If an unresolved dispute should arise between two or more of the supervisors, or between a supervisor and the student, the Head of Department, in the first instance takes steps to resolve the matter.

16.9.2 If a dispute remains unresolved, it is referred to the relevant Executive Dean who may refer the matter to the Senate Higher Degrees Committee for final consideration and processes to resolve the matter.

16.10 Appeals procedure

16.10.1 Where assessors' reports vary considerably about the merit of a particular thesis, thereby giving rise to an impasse in finalising the assessment result, a faculty may invoke one or more of the following procedures to resolve the impasse (in accordance with the Senate Higher Degrees Policy and the Higher Degrees Administration: Structure and Processes):

(a) request additional information from the assessors and/or supervisors;
(b) invite an external expert to advise the FHDC;
(c) appoint an additional assessor to assess the thesis in the hope that the resulting report will resolve the impasse;
or
(d) identify an independent arbitrator to consider the individual assessor's reports and present a decision to the faculty-specific assessment committee;
(e) The SHDC finalises the assessment results of doctoral studies.

16.11 Intellectual property

16.11.1 The supervisors are responsible for monitoring all doctoral projects for potential inventions or other commercially valuable intellectual property implications and disclosing such inventions or implications to the Executive Director: Research and Innovation.

16.11.2 Students who develop inventions or other forms of commercially valuable intellectual property must disclose such inventions to the supervisors in accordance with the University's Policy on Intellectual Property.

16.11.3 Where disclosures have been made about intellectual property emerging from a research project, the Executive Director: Research and Innovation, or an applicant duly mandated in this regard, must certify that any intellectual property matters attendant to the project have been dealt with in terms of relevant university policy as a condition of graduation.

◆◆◆◆◆

PART 12

SC.12 BACHELOR OF SCIENCE HONOURS – LEVEL 8

Purpose and characteristics of the programme

The primary purpose of the BSc Honours qualification is to consolidate and deepen the students' knowledge and expertise in their respective science disciplines/fields, and to develop research capacity in the methodology and techniques of those science disciplines. BSc Honours is essentially a coursework degree of which at least 30 credits are devoted to a research project and reporting under supervision. The degree demands a high level of theoretical engagement and intellectual independence and serves as the initial science postgraduate specialisation qualification providing students with in-depth scientific knowledge and skills preparing them for research based postgraduate science study.

Exit level outcomes

Students should be able to:

- Identify, interpret, analyse and address complex problems, using both routine and advanced skills, conceptual and/or evidence-based enquiry and theory-driven arguments
- Work effectively with others in a team by being answerable for their own work and the work of others
- Identify, evaluate and address their own professional and on-going learning needs
- Demonstrate efficient and effective information retrieval and processing skills, using appropriate ICT
- Demonstrate a comprehensive, systematic and critical knowledge and understanding of the principles, scope, theories and epistemologies of their respective science discipline/field
- Evaluate their own and others' academic work and initiatives against informed criteria
- Present and communicate ideas and texts, offering professional insights, interpretations and solutions to problems and issues appropriate to the science context
- Use science and technology in complex and challenging contexts and make autonomous ethical decisions on complex professional issues in accordance with recognized professional and/or ethical standards
- Critique current research and advanced scholarship in the science area of specialisation and make sound theoretical judgements based on evidence
- Identify, select and apply a range of research methodologies and methods/techniques to research problem/s in their science area of specialisation
- Identify, analyse, synthesise and undertake independent evaluation of quantitative and/or qualitative data, and to engage with and evaluate current research and scholarly or professional literature in their respective discipline/field

SC.12.1 APPLIED MATHEMATICS	
MODULE CODE	**SC NR**
APM08X1	12.1.1
APM08X2	12.1.2
APM8X06	12.1.3
APM8X10	12.1.4
APM8X11	12.1.5
APM8X12	12.1.6
APM8X13	12.1.7
APM8X16	12.1.8
APM8X17	12.1.9
APM8X18	12.1.10
APM8X19	12.1.11
APM8X20	12.1.12
APM8X21	12.1.13
APM8X00	12.1.14
SC.12.2 BIOCHEMISTRY	
MODULE CODE	**SC NR**
BIC8X01	12.2.1
BIC8X02	12.2.2
BIC8X03	12.2.3
BIC8X04	12.2.4
BIC8X00	12.2.5
SC.12.3 BOTANY	
MODULE CODE	**SC NR**
BTO8X01	12.3.1
BOT8X02	12.3.2
BOT8X03	12.3.3
BOT8X04	12.3.4
BOT8X05	12.3.5
BOT8X00	12.3.6
SC.12.4 CHEMISTRY	
MODULE CODE	**SC NR**
CEM8X01	12.4.1
CEM8X02	12.4.2
CEM8X03	12.4.3
CEM8X04	12.4.4
CEM8X05	12.4.5
CEM8X06	12.4.6
CEM8X07	12.4.7
CEM8X08	12.4.8
CEM8X00	12.4.9
SC.12.5 COMPUTER SCIENCE **Also refer to SC.12.10 (Information Technology)**	
MODULE CODE	**SC NR**
IT28X87	12.5.1
COMPUTER SCIENCE specialising in ARTIFICIAL INTELLIGENCE **Also refer to SC.12.10 (Information Technology)**	
MODULE CODE	**SC NR**
IT28X87	12.5.2
COMPUTER SCIENCE specialising in CYBER SECURITY **Also refer to SC.12.10 (Information Technology)**	
MODULE CODE	**SC NR**
IT28X87	12.5.3

SC.12.6 ENERGY STUDIES	
MODULE CODE	**SC NR**
ENS8X01	12.6.1
ENS8X02	12.6.2
ENS8X03	12.6.3
ENS8X04	12.6.4
ENS8X05	12.6.5
ENS8X00	12.6.6
SC.12.7 GEOGRAPHY	
MODULE CODE	**SC NR**
GGR8X17	12.7.1
GGR8X27	12.7.2
GGR8X37	12.7.3
GGR8X47	12.7.4
GGR8X57	12.7.5
GGR8X67	12.7.6
GGR8X77	12.7.7
GGR8X87	12.7.8
GGR8X97	12.7.9
SC.12.8 GEOLOGY	
MODULE CODE	**SC NR**
GLG8X01	12.8.1
GLG8X02	12.8.2
GLG8X03	12.8.3
GLG8X04	12.8.4
GLG8X05	12.8.5
GLG8X06	12.8.6
GLG8X07	12.8.7
GLG8X08	12.8.8
GLG8X00	12.8.9
SC.12.9 INFORMATICS **Please refer to SC.12.10 (Information Technology)**	
MODULE CODE	**SC NR**
IT28X87	12.9.1
SC.12.10 INFORMATION TECHNOLOGY	
MODULE CODE	**SC NR**
IT08X27	12.10.1
IT08X30	12.10.2
IT08X31	12.10.3
IT08X32	12.10.4
IT08X37	12.10.5
IT08X47	12.10.6
IT08X57	12.10.7
IT08X77	12.10.8
IT08X87	12.10.9
IT08X97	12.10.10
IT18X07	12.10.11
IT18X17	12.10.12
IT18X37	12.10.13
IT18X47	12.10.14
IT18X57	12.10.15
IT18X77	12.10.16
IT18X87	12.10.17
IT18X97	12.10.18
IT28X07	12.10.19
IT28X17	12.10.20
IT28X27	12.10.21
IT28X30	12.10.22
IT28X47	12.10.23
IT28X67	12.10.24
IT28X69	12.10.25
IT28X80	12.10.26

IT28X97	12.10.27
IT8X030	12.10.28
IT8X031	12.10.29
SC.12.11 MATHEMATICS	
MODULE CODE	**SC NR**
MAT8X01	12.11.1
MAT8X03	12.11.2
MAT8X04	12.11.3
MAT8X06	12.11.4
MAT8X08	12.11.5
MAT8X11	12.11.6
MAT8X13	12.11.7
MAT8X14	12.11.8
MAT8X99	12.11.9
MAT8X15	12.11.10
MAT8X16	12.11.11
MAT8X17	12.11.12
MAT8X18	12.11.13
SC.12.12 MATHEMATICAL STATISTICS	
MODULE CODE	**SC NR**
STA8X01	12.12.1
STA8X02	12.12.2
STA8X03	12.12.3
STA8X04	12.12.4
STA8X05	12.12.5
STA8X06	12.12.6
STA8X07	12.12.7
STA8X08	12.12.8
STA8X09	12.12.9
STA8X11	12.12.10
STA8X00	12.12.11
SC.12.13 PHYSICS	
MODULE CODE	**SC NR**
PHY8X01	12.13.1
PHY8X02	12.13.2
PHY8X03	12.13.3
PHY8X04	12.13.4
PHY8X05	12.13.5
PHY8X06	12.13.6
PHY8X07	12.13.7
PHY8X08	12.13.8
PHY8X09	12.13.9
PHY8X10	12.13.10
PHY8X11	12.13.11
PHY8X12	12.13.12
PHY8X13	12.13.13
PHY8X14	12.13.14
PHY8X15	12.13.15
PHY8X16	12.13.16
PHY8X00	12.13.17
SC.12.14 PHYSIOLOGY	
MODULE CODE	**SC NR**
PHS8X03	12.14.1
PHS8X04	12.14.2
PHS8X05	12.14.3
PHS8X06	12.14.4
PHS8X07	12.14.5
PHS8X08	12.14.6
PHS8X09	12.14.7
PHS8X00	12.14.8

SC.12.15	ZOOLOGY
MODULE CODE	**SC NR**
ZOO8X03	12.15.1
ZOO8X04	12.15.2
ZOO8X06	12.15.3
ZOO8X07	12.15.4
ZOO8X08	12.15.5
ZOO8X09	12.15.6
ZOO8X10	12.15.7
ZOO8X13	12.15.8
ZOO8X00	12.15.9

SC.12.1 APPLIED MATHEMATICS HONOURS APM

The Honours programme in Applied Mathematics (**H2023Q**) curriculum consists of **NINE semester modules** (own choice) and a **short, written project (APM8X00)** (compulsory). Semester modules are examined at the end of the semester in which they are presented. The project is supervised by a lecturer and presented by the student as a lecture at a predetermined time. The project has the weight of one semester module, examined internally. The choice of the semester modules is done in consultation with the Head of Department.

Approved modules from related study fields up to a maximum of one year or two semester modules may be included in the Honours curriculum). The modules to choose from are listed below:

SC.12.1.1 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM08X1	Dynamical Systems A
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	Bachelor's degree with Applied Mathematics as major. A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. The purpose of this module is to master the modern description of Dynamical Systems in terms of regular or chaotic motion as well as abstract geometrical objects with special reference to one-dimensional maps. This gives the student access to the models of many phenomena not covered by Classical Mechanics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Identify and describe dynamical systems mathematically.
- Establish the analytic properties of functions.
- Analyse the topology of a subset of the real line.
- Analytically or numerically find the periodic points of a map.
- Understand and use Swarovski's Theorem.
- Identify stable and unstable periodic points using differential techniques.
- Construct bifurcation diagrams for selected maps.

SC.12.1.2 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM08X2	Dynamical Systems B
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	Dynamical Systems A (APM08X1)
Purpose	The central theme in Applied Mathematics is that of mathematical Modelling. The purpose of this module is to master the modern description of Dynamical Systems in terms of regular or chaotic motion as well as abstract geometrical objects with special reference to multi-dimensional maps. This gives the student access to the models of many phenomena not covered by Classical Mechanics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Use the logistic map as an illustration of the concepts of Dynamical Systems.
- Master the techniques of Symbolic Dynamics.
- Understand the concept of chaotic motion.
- Use the concept of Topological Conjugacy to apply Symbolic Dynamics to specific maps.
- Generalize the dynamical concepts for one-dimensional maps to higher-dimensional maps.

SC.12.1.3 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X06	Multi-linear Algebra
NQF Level	8
Credits	16
Presentation	Semester 1 or 2
Prerequisites	Bachelor's degree with Applied Mathematics as major. A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. The purpose of this module is to give a comprehensive introduction to multi-linear algebra. This will enable the student to study mathematical models relevant to problems in physics and engineering.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand the concept of multi-linear algebra and product spaces.
- Use multi-linear algebra and the Kronecker product in physics and quantum groups.
- Apply software packages to problems in science.

SC.12.1.4 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X10	Differential Equations A
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	Bachelor's degree with Applied Mathematics as major. A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. The purpose of this module is to introduce the student to advanced Ordinary Differential Equations (ODEs). The module content border on Linear and nonlinear differential equations, systems of differential equations, bifurcations, periodicity and global stability of steady states. This will enable the student to study advanced mathematical models relevant to problems in biological systems analysis, physics and engineering, especially those involving continuous systems

Module learning outcomes: On completion of this learning event, the student should be able to:

- Model physical/biological systems using differential equations.
- Carry out the stability of linear and nonlinear autonomous systems.
- Determine and analyse limit cycles and bifurcations for planar autonomous systems
- Solve ODEs computationally.
- Master the underlying philosophy and language of the field.

SC.12.1.5 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X11	Differential Equations B
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	Differential Equations A (APM8X10)
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. The purpose of this module is to introduce the student to the theory of Partial Differential Equations. The focus of the course is the concepts and techniques for solving the partial differential equations (PDEs) that permeate various scientific disciplines. The emphasis is on nonlinear PDE. Applications include problems from engineering, biomathematics, quantum mechanics, etc. This will enable the student to study advanced mathematical models relevant to problems in biological systems analysis, physics and engineering, especially those involving continuous systems..

Module learning outcomes: On completion of this learning event, the student should be able to:

- Solve Linear PDEs with special emphasis on the Laplace, wave and diffusion equations.
- Convert nonlinear PDEs into linear PDEs looking at exactly solvable cases; traveling waves; nonlinear diffusion and dispersion; reaction-diffusion equations; Fisher's equation; singular perturbations.
- Solve PDEs computationally.
- Master the underlying philosophy and language of the field.

SC.12.1.6 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X12	Numerical Analysis A
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	Bachelor's degree with Applied Mathematics as major. A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. Often these models can only be solved by numerical (rather than analytical) methods. The purpose of this module is to provide a broad introduction to fundamental concepts in advanced Numerical Analysis, including method derivation and error analysis.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Appreciate the mathematical origin of the methods studied in the module.
- Apply these methods to obtain numerical solutions to various mathematically-posed problems.
- Understand that these methods are approximations and that errors are necessarily associated with solutions obtained via these methods.
- Understand the derivation of the error formulae and use these formulae to obtain solutions of desired precision.
- Appreciate the valuable role that computers can play in applying these methods.
- Appreciate the philosophy and language of Numerical Analysis.

SC.12.1.7 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X13	Numerical Analysis B
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	Numerical Analysis A (APM8X12)

Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. Often these models can only be solved by numerical (rather than analytical) methods. The purpose of this module is to provide a broad introduction to advanced concepts in numerical solution of differential equations.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Appreciate the mathematical origin of the methods studied in the module.
- Apply these methods to obtain numerical solutions to various differential equations.
- Understand that these methods are approximations and that errors are necessarily associated with solutions obtained via these methods.
- Understand the derivation of the error formulae and use these formulae to obtain solutions of desired precision.
- Appreciate the valuable role that computers can play in applying these methods.
- Appreciate the philosophy and language of Numerical Analysis.

SC.12.1.8 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X16	Quantum Computing
NQF Level	8
Credits	16
Presentation	Semester 1 or 2
Prerequisites	Bachelor's degree with Applied Mathematics as major. A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	To introduce all techniques and tools used in Quantum Computing.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand the basics of quantum theory.
- Apply Hilbert space theory.
- Understand teleportation and signal transmission.
- Understand basic quantum algorithms.
- Do basic quantum computation.

SC.12.1.9 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X17	Deep Learning for Data Science
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	Scientific Computing (APM8X21)
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. A resurgence of data science as a driver of business development and an increase in relevant data and computational abilities has put data science at the forefront of scientific advancement. This topic will allow the student to integrate their understanding of certain applied maths areas such as optimisation, computational mathematics, as well as scientific computing. The purpose of this module is to introduce the student to the fundamental concepts and theory of current data analysis tools, as well as supervised learning methods, leading to deep learning techniques.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Analyse data to gain insights into a stated problem.
- Analyse and compare specific supervised learning algorithms to determine their appropriateness for a given problem.
- Describe and understand certain concepts and methods in deep learning, as well as implement these to solve problems in data science.
- Implement deep learning algorithms in a computer programming language to solve advanced data science problems.

SC.12.1.10 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X18	Special Topics in Applied Mathematics
NQF Level	8
Credits	16
Presentation	Semester 1 or 2
Prerequisites	-
Purpose	The purpose of this module is to introduce a range of problems, their associated mathematical models and methods of solutions. The topics cover problems motivated by industry, biology, mechanics, the environment and society. The aim is to highlight various techniques, modelling approaches and discuss the appropriateness of models based on selective analytical or numerical solutions. Where appropriate, students will utilise knowledge and skills developed in other modules to perform simulations or to visualise behaviour of solutions to the developed models.

Module learning outcomes: A student who successfully completes this course will be able to:

- Present basic mathematical concepts in industry, biology, mechanics, the environment and society.
- Construct mathematical models given a problem description.
- Analyse and validate a model's suitability in predicting a given phenomenon. (steady-state analysis, positivity
- preservation, etc)
- Fit model parameters to real world data.
- Interpret the simulated results from a constructed model and report on the model's strengths and weaknesses.

SC.12.1.11 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X19	Introduction to Relativity
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	• Bachelor's degree with Applied Mathematics as major. • A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The purpose of this module is to introduce the mathematical concepts and tools required for the development the theory of relativity. Through a mathematical modelling approach based on tensor algebra and tensor calculus, the student is familiarised with the mathematical skills to formulate and solve classical problems in special and general relativity. The use of symbolic computation is also intended to impart on the student a more seamless approach for deriving and solving equations arising in relativity.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Derive tensor properties of a manifold based on coordinate transformations
- Graphically represent geometric properties of a manifold in various coordinates
- Understand and apply the Fundamental Principles of Relativity
- Use coordinate transforms to investigate problems in Special Relativity
- Derive and apply the Einstein field equations to classical test cases
- Create graphical and computational explanations of classical problems in Special and General Relativity.

SC.12.1.12 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X20	Lie Groups and Lie Algebras
NQF Level	8
Credits	16
Presentation	Semester 1 or 2
Prerequisites	• Bachelor's degree with Applied Mathematics as major. • A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. The purpose of this module is to introduce the student to Lie groups and Lie algebras. This will enable the student to study mathematical models relevant to problems in physics and engineering, especially those involving mathematical symmetries.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand the concepts of finite, continuous and Lie groups.
- Use Lie algebras and understand the connection between Lie groups and Lie algebras.
- Apply Lie groups and Lie algebras to problems in mathematical physics, mechanics and computing.

SC.12.1.13 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X21	Scientific Computing
NQF Level	8
Credits	16
Presentation	Semester 1 or 2
Prerequisites	• Bachelor's degree with Applied Mathematics as major. • A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	The central theme in Applied Mathematics is that of Mathematical Modelling. The purpose of this module is to introduce the student to the concepts and theory of computer-based computation and modelling.

Module learning outcomes old: On completion of this learning event, the student should be able to:

- Describe and understand what an algorithm is and how algorithms are used in scientific computing.
- Implement algorithms in a computer programming language to solve advanced scientific problems.
- Analyse and compare to determine their efficiency.
- Describe and understand certain concepts and techniques from discrete mathematics necessary to solve problems in scientific computing.

SC.12.1.14 APPLIED MATHEMATICS LEVEL 8 (HONOURS)

Module APM8X00	Project
NQF Level	8
Credits	16
Presentation	Year module
Prerequisites	Bachelor's degree with Applied Mathematics as major A minimum average of 60% in the final year of undergraduate Applied Mathematics.
Purpose	To give the student the opportunity to analyse a given problem in any of the sub-fields of Applied Mathematics, to write a short report on the solution and to present an oral report before an examining panel.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Collect and understand existing literature on the given problem.

- Identify the fields of knowledge which are relevant.
- Construct the mathematical models arising from the problem.
- Solve mathematical problems arising from the models by using appropriate techniques.
- Write a concise and convincing report on the project.
- Present the report as a lecture.

SC.12.2 BIOCHEMISTRY HONOURS BIC

Standard entrance requirements for admission to the Honours programme are subject to approval by the Department. A prospective candidate must have a minimum average mark of at least 65% for all exit level (NQF 7) Biochemistry modules and 60% for NQF 6 Biochemistry modules.

The Honours programme in Biochemistry (H2002Q) consists of four theory modules: **Advanced Analytical Techniques** (BIC8X01), **Protein Biochemistry** (BIC8X02), **Advanced Catalysis and Enzyme Technology** (BIC8X03) and **Current Advances in Biotechnology** (BIC8X04). Advanced theories in Biochemistry are dealt with. Practical work consists of selected advanced experiments as well as a **short Research Project (one semester module)** (BIC8X00).

Please note:
- *International students will be required to pass the language proficiency test with* a minimum of 60%.
- *Applicants will be required to write an in-house examination as set annually by the Department.*

SC.12.2.1 BIOCHEMISTRY LEVEL 8 (HONOURS)

Module BIC8X01	Advanced Analytical Techniques
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	A BSc degree in Life and Environmental Sciences/Physical Sciences (or equivalent thereof) with Biochemistry as one of the major subjects. A minimum mark of 65% in third year level Biochemistry is required. *Ad hoc* decisions can be made in meritorious cases as well.
Purpose	The purpose of this module as an integral part of the BSc Hons (Biochemistry) qualification provide students with an advanced understanding of the theory, the scientific principles and methods used in Analytical Biochemistry. The focus is on the applications of these techniques in both preparative and analytical situations as well as on the integration of separation techniques and analytical techniques for the preparation, purification and characterization of biomolecules. In addition, laboratory skills and practical knowledge about procedures to investigate and solve problems in Biochemistry and the broader Life Sciences are learned, as well as the necessary skills in data collection, statistical analysis and presentation of results that would equip the student for entry into professional training, practice or further research-based postgraduate studies.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Compare, differentiate and formulate different analytical techniques.
- Describe and appraise the use of spectroscopy and other analytical techniques.
- Select and apply the appropriate analytical technique for specialized applications.
- Compare, differentiate and formulate different centrifugation techniques.
- Describe and appraise the use of electrophoresis as separation and analytical technique for different classes of biomolecules.
- Select and apply the appropriate chromatography technique for preparative and analytical separation of different classes of biomolecules.
- Discuss, discriminate and apply different radioisotopes as tracer and analytical tools in biochemical applications.

SC.12.2.2 BIOCHEMISTRY LEVEL 8 (HONOURS)

Module BIC8X02	Protein Biochemistry
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	A BSc degree in Life and Environmental Sciences/Physical Sciences (or equivalent thereof) with Biochemistry as one of the major subjects. A minimum mark of 65% in third year level Biochemistry is required. *Ad hoc* decisions can be made in meritorious cases.
Purpose	The primary purpose of this module as an integral part of the BSc Hons (Biochemistry) is to provide students with a broad, advanced theory and application education in Protein Biochemistry. Completion of this module will establish in the student a comprehension of scientific principles and methods related to specialized aspects of protein chemistry and biochemistry, such as protein structure, folding, isolation and characterization. The module also develops laboratory skills and practical knowledge concerning biochemical and chemical techniques in the protein field. This will enable students to understand the applications of protein biochemistry that forms a fundamental part of the students' knowledge in Life and Environmental Sciences. This will equip them with the scientific knowledge base, theory and methodology of the discipline that could serve as a basis for entry into the labour market, professional training and practice or further research-based postgraduate studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Comment on protein structure, purification, characterization and function analysis.
- Select appropriate calculation methods in protein biochemistry to estimate particular characteristics of proteins.
- Combine knowledge of protein chemistry and structure to evaluate protein folding and architecture.

SC.12.2.3 BIOCHEMISTRY LEVEL 8 (HONOURS)

Module BIC8X03	Advanced Catalysis and Enzyme Technology
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	A BSc degree in Life and Environmental Sciences/Physical Sciences (or equivalent thereof) with Biochemistry as one of the major subjects. A minimum mark of 65% in third year level Biochemistry is required. *Ad hoc* decisions can be made in meritorious cases.
Purpose	The primary purpose of this module as an integral part of the degree BSc Honours in Biochemistry is to develop the student's understanding of advanced theory related to the scientific knowledge base, principles and methods of Enzymology, as well as the associated laboratory skills and practical knowledge in the area related to Enzyme Kinetics. Furthermore, the students' understanding of scientific principles and methods related to the biotechnological applications of knowledge about enzymes, i.e. the field of Enzyme Technology will be developed. In addition, laboratory skills and practical knowledge about procedures to investigate and solve biochemical problems by means of enzyme technologies are learned. This will enable students to understand the applications of Enzymology as fundamental part of the knowledge in Biochemistry. This will equip the student with the scientific knowledge base, theory and methodology of the discipline that could serve as a basis for entry into the labour market, professional training and practice or further research-based postgraduate studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Have knowledge of and comprehend the principles and theories governing structure-function relationships of enzymes.

- Demonstrate the principles of enzyme kinetics and inhibition of enzymes.
- Interpret the mechanisms and control of enzyme activity.
- Identify and assess enzymes that function in organized systems.
- Distinguish between the various mechanisms of enzyme turnover.
- Demonstrate knowledge of and comprehend the principles and theories of enzymes involved in clinical diagnostics, used for medical purposes and in the biotechnological, mining and pharmaceutical industries.
- Able to demonstrate the principles of enzymes used in the environment.
- Able to interpret the mechanisms and use of enzymes in biosensors and biocatalysts.

SC.12.2.4 BIOCHEMISTRY LEVEL 8 (HONOURS)

Module BIC8X04	Current Advances in Biotechnology
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	A BSc degree in Life and Environmental Sciences/Physical Sciences (or equivalent thereof) with Biochemistry as one of the major subjects. A minimum mark of 65% in third year level Biochemistry is required. *Ad hoc* decisions can be made in meritorious cases.
Purpose	The primary purpose of this module as an integral part of the BSc Hons (Biochemistry) is to provide students with a broad education concerning advanced theory that equips them with the scientific knowledge base, theory and methodology in Molecular Biology/ Molecular Genetics and Biotechnology. This module emphasises the techniques and experiments leading to molecular and biotechnological processes that will enable students to understand the applications of Molecular Biology and of biochemical and molecular biology knowledge in a technological context which forms a fundamental part of the students' knowledge in Biochemistry and the broader Life Sciences. This module could serve as a basis for entry into the labour market, professional training and practice or further research-based postgraduate studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Explain, discuss and compare the control of gene expression in prokaryotic and eukaryotic systems.
- Demonstrate problem identification and solving using fundamental molecular biology principles and techniques.
- Analyse molecular biology information that enable argumentative justification of using vectors and different cell lines like bacteria, yeast, mammalian and plants.
- Discuss and interpret the use of different fermentation cultures for use to produce biotechnology products.
- Recognize, discuss and distinguish the construction of biotechnological products using different molecular biology techniques.
- Demonstrate problem identification and solving using bioinformatics.
- Analyse molecular biology information that enable argumentative justification of biotechnological products, their used and impact on the environment.

SC.12.2.5 BIOCHEMISTRY LEVEL 8 (HONOURS)

Module BIC8X00	Research Project
NQF Level	8
Credits	30
Presentation	Year module
Prerequisites	A BSc degree in Life and Environmental Sciences/Physical Sciences (or equivalent thereof) with Biochemistry as one of the major subjects. A minimum mark of 65% in third year level Biochemistry is required. *Ad hoc* decisions can be made in meritorious cases.
Purpose	The purpose of this module as an integral part of the BSc Hons (Biochemistry) qualification is to educate the student in advanced practical work and research in Biochemistry/Biotechnology/ Molecular Biology and to train him/her in associated standard practical techniques; develop the student's understanding of the scientific method, experimental planning and experimental execution as well as research project management; develop the student's understanding of the scientific principles as applied to the methods and experimental techniques used in the research project; develop laboratory skills and practical knowledge in the application of Biochemical methods to do research and solve problems in the Life- and Environmental Sciences. The module also equips the student for entry into the labour market, professional training and practice or further research-focused postgraduate studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- The application of the scientific method.
- The ability to generate data, collect, analyse and interpret results using the techniques associated with this module.
- The ability to report on acquired knowledge, technical skills and results through the correct use of technical and scientific language.
- The ability to do a scientific presentation to an audience.

SC.12.3 BOTANY HONOURS BOT

Admission to the Honours programme is subject to approval by the Department. A prospective candidate must have a minimum average mark of at least 60% for Botany on the third year level.

The Honours programme in Botany (H2003Q) consists of **six** modules (including a project) which must be passed individually:

The modules for this programme are: Post-harvest Physiology (BOT8X01), Plant Biotechnology (BOT8X02), Plant Systematics and Molecular Evolution (BOT8X03), Scientific Methods (BOT8X04), Advanced Plant Taxonomy and Economic Botany (BOT8X05) and Project (BOT8X00).

In addition, one or more additional modules may be required by the Departmental Head. Participation in Departmental excursions may also be required.

The examination consists of written papers or reports in each section. All sections carry an equal weight, and must all be passed individually.

SC.12.3.1 BOTANY LEVEL 8 (HONOURS)

Module BOT8X01	Post-harvest Physiology
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	BSc with Botany as a major subject, or equivalent. A minimum average mark of 60% is required in the final year.
Purpose	The purpose of this module as an integral part of the BSc Hons (Botany and Plant Biotechnology) programme is to provide the student with a well-rounded and broad education that equips them with a theoretical and practical knowledge base in post physiology and technology that could serve as a basis for entry into the job market and into higher postgraduate studies in postharvest physiology.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Argue the importance and necessity of postharvest studies and describe and explain the origin and composition of edible commodities.
- Examine and evaluate the effect of pre-harvest factors on postharvest quality and comment on, appraise and explain the cardinal cellular, metabolic and physico-chemical changes associated with senescence and ripening in living plant products and explain the role of plant hormones in these processes.
- Review the quality characteristics of fresh produce and relate the factors affecting quality with sound postharvest practices.
- Analyse the principles and practices involved in harvesting, sorting, packing, packaging, storage and transport of fresh produce.
- Appraise the principles and procedures involved in ripening, irradiation, heat treatment and partial processing of fresh produce.
- Comment on the processes involved in the senescence of cut flowers and describe and motivate the procedures and practices used to extend the longevity of cut flowers by correct preservation, storage and transportation.
- Collect information at different stages in the distribution network to demonstrate the correct and incorrect handling practices that affect the quality of cut flowers and/or fresh produce, as well as to illustrate the correct way of preserving, transporting and/or storing of living plant products.

SC.12.3.2 BOTANY LEVEL 8 (HONOURS)

Module BOT8X02	Plant Biotechnology
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	BSc with Botany as a major subject, or equivalent. A minimum average mark of 60% is required in the final year.
Purpose	The primary purpose of this module as an integral part of the BSc Hons (Botany) qualification is to provide students with a well-rounded and broad education that equips them with the scientific knowledge base, theory and methodology of Plant Biotechnology that could serve as a basis for entry into further postgraduate studies or as a research scientist in the field of biology and the life sciences. It further aims at the continuous professional development of the student's intellectual, practical and reflective abilities as a research scientist in the field of biology and the life sciences.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Explain the concept of biotechnology and concepts related to the field by referring to applicable examples.
- Elaborate on the applications of biotechnology in the fields of agriculture, environment and industry.
- Discuss and debate the positive and negative implications of biotechnology in the fields of agriculture, environment and industry.
- Apply several techniques in the field of plant recombinant DNA technology in practical exercises.
- Work successfully and safely in the laboratory while learning the different techniques.
- Read scientific articles to glean the knowledge contained therein.

- Write an appropriate scientific essay and report.
- Give appropriate presentations on assignments given.

SC.12.3.3 BOTANY LEVEL 8 (HONOURS)

Module BOT8X03	Plant Systematics and Molecular Evolution
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	BSc with Botany as a major subject or equivalent. A minimum average mark of 60% is required in the final year.
Purpose	The primary purpose of this module as an integral part of the BSc Hons (Botany and Plant Biotechnology) program is to provide students with a well-rounded and broad education that equips them with knowledge of the dynamics of evolutionary change at the molecular level, the driving forces behind the evolutionary process, and the effects of various molecular mechanisms on the long-term evolution of genomes, genes and their products as well as phylogenetic analyses. In addition, examples on how molecular phylogenies have transformed systematics are discussed in detail. Students are introduced to the classification systems of Cronquist (1988), Thorne (1992), Angiosperm Phylogeny Group (1998) and Judd *et al.* (1999).

Module learning outcomes: On completion of this learning event, the student should be able to:

- Show proper insight regarding the methods and principals involved in biological systematics.
- Know how genomes are organised and be able to discuss the various evolutionary processes which have given genomes their distinctive architecture.
- Reconstruct phylogenetic relationships from systematic evidence and recover evolutionary information from sequence data.
- Detect the signatures of different evolutionary processes from speciation to mass extinctions.
- Explain the diversification and the evolution of plant species – how plant species form, how they interact, and how to define them.
- Expound on the classification systems of Cronquist (1988), Thorne (1992), Angiosperm Phylogeny Group (1998) and Judd *et al.* (1999).

SC.12.3.4 BOTANY LEVEL 8 (HONOURS)

Module BOT8X04	Scientific Methods
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	BSc with Botany as a major subject, or equivalent. A minimum average mark of 60% is required in the final year.
Purpose	The primary purpose of this module is to equip students with knowledge of basic light and electron microscopic techniques used in plant anatomical investigations, essential for any botanical studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Prepare permanent microscope slides by embedding suitably prepared material in glycol methacrylate, sectioning it with an ultra-microtome, carrying out the periodic acid – Schiff/ toluidine blue staining method and mounting the sections for anatomical study.
- Prepare semi-permanent slides of epidermal peels and/or cuticular preparations, and wood macerations.
- Determine the identity microscopically of the various simple and complex tissues and other plant structures, recognise taxonomically important characters, write anatomical descriptions, and draw accurate line diagrams to show the distribution of tissues using a drawing tube.
- Take microphotographs using a light microscope and compile photographic plates, construct suitable scale bars for photographs and diagrams, compare and contrast the anatomy of different organs and draw up tables of comparison as done in anatomical investigations.
- Sample and mount material for scanning electron microscopy, manipulate a scanning electron microscope so as to study, explain and record plant surface features.

- Describe how plant material is sampled, processed, sectioned, mounted and stained for transmission electron microscopy, in order to study, explain and record cell structures.
- Use and apply the knowledge and competencies acquired in this module to select and carry out appropriate investigations of plant material for identification and related purposes, and to interpret and communicate the results.

SC.12.3.5 BOTANY LEVEL 8 (HONOURS)

Module BOT8X05	Advanced Plant Taxonomy and Economic Botany
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	BSc with Botany as a major subject, or equivalent. A minimum average mark of 60% is required in the final year.
Purpose	The primary purpose of the module is to provide the students with a well-rounded and broad education that equips them with the necessary taxonomic, nomenclatural and floristic knowledge base, theory and methodology that will allow them to do independent research in the field of taxonomy and ecology.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Explain, evaluate and apply the principles and methods of plant classification (both phenetic and cladistic approaches).
- Explain and apply the principles and methods of plant nomenclature and typification, and solve nomenclature and typification problems.
- Generate and appraise data from the various types of taxonomic evidence used in plant classification. Read and assess modern scientific publications (papers) where these types of evidence have been used in practice.
- Determine the correct identify all of the indigenous and exotic seed plant species, genera and families that occur in gardens and parks, and formulate their diagnostic characters at species, genus and family level.
- Determine the identity and scientific name of species and families of well-known commercially important plants and explain the plant parts used the main uses, main properties and major chemical constituents. Assess global market trends, the regulation and registration of herbal medicine in various countries and the principles and methods of quality control.
- Describe the major classes of chemical compounds that occur in medicinal plants, give the names and chemical structures of well-known examples in each class, and explain their chemical and biological properties.
- Use basic chromatographic techniques (thin-layer chromatography and high performance liquid chromatography) to study the main compounds and chemical fingerprints in extracts from medicinal plants and phytomedicines.

SC.12.3.6 BOTANY LEVEL 8 (HONOURS)

Module BOT8X00	Project
NQF Level	8
Credits	24
Presentation	Year module
Prerequisites	BSc with Botany as a major subject, or equivalent. A minimum average mark of 60% is required in the final year.
Purpose	The purpose of this module as an integral part of the BSc Hons (Botany and Plant Biotechnology) programme is to provide the student with a well-rounded and broad education that equips them with a practical knowledge base in research that could serve as a basis for entry into higher postgraduate studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate a hypothesis.
- Draw up a research plan.
- Logically execute the research plan to an acceptable conclusion.
- Work safely in the laboratory with regard to fellow workers and the environment.
- Generate, assimilate and interpret data in the context of existing literature on the subject.
- Correctly present data in oral and written form.

SC.12.4 CHEMISTRY HONOURS CEM

The Head of the Department must approve admission to the Honours programme in Chemistry. The BSc Honours in Chemistry (H2004Q) programme consists of **eight modules and a Research Project**. A BSc Degree with a major in Chemistry and at least 60% in third-year chemistry is required.

SC.12.4.1 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X01	Advanced Organic Chemistry: Reaction Mechanisms and Theoretical aspects
NQF Level	8
Credits	18
Presentation	Semester 1
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02A3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02B3).
Purpose	To advance the students understanding, theoretical and practical knowledge of topics such as photo- and radical chemistry, MO theory and organometallic and organo-main group chemistry as applied to organic systems. This comprehensive module serves to acquaint the student with advanced aspects of theoretical and practical organic synthesis and to provide him/her with the necessary skills to compile a comprehensive written and oral report based on topical research subjects and an in-depth literature study.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Illustrate the various theoretical aspects of FMO theory, photochemistry and radical chemistry.
- Predict the outcomes of diverse reactions.
- Propose acceptable mechanisms of such reactions.
- Generate applicable transition state models with supporting evidence.
- Display a sound theoretical knowledge of the application of organometallic materials in organic synthesis, in homogeneous catalysis as well as in some metal-mediated reactions, and apply said knowledge to propose/formulate solutions to and construct mechanisms of certain synthetic chemistry problems.
- Display a competence in the execution of tasks revolving around organic synthesis in the laboratory. The student should be able to compile the results of this laboratory work into a comprehensive report that includes results and supporting analytical details and a conclusion illustrating the successes/failure of the experiments.
- Show the ability to compile and summarise a literature study in the form of both a written report and an oral presentation.

SC.12.4.2 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X02	Advanced Organic Chemistry: Creativity in Organic Chemistry
NQF Level	8
Credits	18
Presentation	Semester 1
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	To provide the students with understanding, theoretical and practical knowledge of advanced aspects of organic synthesis as required in Advanced Organic Chemistry.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Explain the reaction mechanisms of organic compounds containing various functional groups, including alkenes, alkynes, alkyl halides, alcohols and selected carbonyl compounds.

- Predict and compare the chemical reactivity of variously functionalised organic compounds.
- Propose syntheses for multi -functional organic materials.
- Predict the products of given organic reactions.
- Demonstrate the ability to carry out the synthesis and analysis of some organic compounds in the laboratory.

SC.12.4.3 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X03	Atomic Spectroscopy
NQF Level	8
Credits	18
Presentation	Semester 1
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry(CEM01A3), Advanced Organic Chemistry(CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	To develop an understanding of the principles and practice of analytical chemistry, in particular instrumental analysis. To develop laboratory skills and practical knowledge in the application of atomic spectroscopy and hyphenated analytical techniques to solve chemical problems in trace element analysis.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand the analytical process and statistically evaluate analytical data and apply hypothesis testing to make judgements on sets of analytical data.
- Explain the underlying theory of the atomic spectroscopy techniques (AAS including GF-AAS, HG-AAS, and CV-Hg-AAS; ICP-OES; ICP-MS; XRF) and selected hyphenated techniques (e.g., HPLC-ICP-MS, CE-ICP-MS, and GC-ICP-MS).
- Explain the origins of atomic spectra and the processes of absorption, emission and fluorescence.
- Identify the different instrument components of flame atomic absorption, flame atomic emission, X-ray fluoresce, inductively coupled plasma optical emission, and inductively coupled plasma mass spectrometers.
- Compare and contrast sample introduction techniques in atomic spectroscopy.
- Understand strategies for correcting sample matrix effects in atomic spectroscopic measurements.
- Demonstrate proficiency in the laboratory application of atomic spectroscopic and selected hyphenated analytical techniques to solve problems in major and trace elemental analysis.

SC.12.4.4 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X04	Instrumental Analysis
NQF Level	8
Credits	18
Presentation	Semester 1
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	To develop an understanding of the principles and practice molecular and physical characterization techniques as applied in the field of chemistry, in particular instrumental analysis. To develop knowledge in the principles, instrumentation and applications of molecular (UV/VIS, IR, NMR and mass spectrometry) and surface characterization techniques (physisorption, chemisorption and microscopy).

Module learning outcomes: On completion of this learning event, the student should be able to:

- Demonstrate understanding of the major components of instrumentation associated with molecular and surface characterization techniques;

- Demonstrate proficiency in determining functional groups and molecular mass of unknown molecules based on molecular spectral data.
- Utilize combined molecular spectral data to elucidate the structure of unknown molecules.
- Determine material characteristics, e.g. surface area, porosity, crystallinity and aggregate size, based on combined physical techniques.

SC.12.4.5 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X05	Quantum Chemistry and Spectroscopy
NQF Level	8
Credits	18
Presentation	Semester 2
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	The purpose of the module is to develop an understanding of scientific principles and methods as applied to theoretical chemistry and spectroscopy, and to develop laboratory and practical skills in the application of physical methods to solve problems in physical chemistry.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Apply the principles of quantum mechanics to chemical systems.
- Determine molecular symmetry and use point groups to predict molecular properties.
- Apply the concepts of atomic and molecular orbitals to explain molecular properties and the features of atomic and molecular spectra.
- Use the concepts of statistical thermodynamics to relate microscopic descriptions of molecular systems to their bulk properties.
- Use computational chemistry techniques to model molecular structures and reaction dynamics.

SC.12.4.6 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X06	Structural Chemistry
NQF Level	8
Credits	18
Presentation	Semester 2
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	The purpose of the module is to develop an understanding of scientific principles and methods as applied to the chemistry of materials and to develop laboratory and practical skills in the application of physical methods to solve problems in physical chemistry.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discriminate between the structures and properties of solids, liquids and surfaces.
- Determine crystallographic symmetry.
- Determine the crystal and molecular structures of chemical compounds by diffraction methods.
- Use thermal analytical techniques to classify physical changes in materials.
- Apply principles of crystal engineering and supramolecular chemistry to design novel crystalline solids with interesting new properties.

SC.12.4.7 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X07	Organometallic Chemistry
NQF Level	8
Credits	18
Presentation	Semester 2
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	The purpose of the module is to advance students' knowledge in the theory and practical applications of organometallic chemistry. An integrated practical that would equip students with laboratory skills in organometallic chemistry; and report writing that introduces students to format required for articles in chemistry journals.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Demonstrate a thorough knowledge of metal-hydrocarbon chemistry, including ligand substitution and redox reactions.
- Compare binary metal complexes, cyclopentadienyl complexes, transition metal alkyls and transition metal-carbene complexes.
- Demonstrate stereochemical non-rigidity in organometallic chemistry.
- Discuss inorganic macromolecules.
- Apply the isolobal principle.
- Be able to collate information from scientific literature and present such information.
- Demonstrate laboratory skills in performing integrated experiments in a practical and write the results of the experiments in a report suitable for publication in a chemistry journal.

SC.12.4.8 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X08	Catalysis
NQF Level	8
Credits	18
Presentation	Semester 2
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	To advance students' knowledge in the theory and practical applications of catalysis. Industrial examples of both will be treated, as well as the application of nanotechnology to catalysis. To develop laboratory skills and practical knowledge in catalysis. To develop report writing that introduces students to the format required for articles in chemistry journals.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe ligands, compare ligand field effects and predict how they will occur in homogeneous catalysis.
- Distinguish between elementary steps and propose how they occur in homogeneous catalysis.
- Compare hydroformylation, alkene oligomerisation, polymerization and alkene metathesis.
- Describe the nature of heterogeneous catalysts and predict the mechanisms that are involved.
- Differentiate between the processes that are involved in the characterization of catalysts, for example XRD, XPS, EXFS, electron microscopy, Mossbauer spectroscopy, Ion microscopy and others.
- Apply catalytic processes over a wide spectrum, for example hydrogen reactions, petrochemistry and environmental catalysis, including Fischer-Tropsch and automotive exhaust catalysis.
- Categorize nanomaterials and their application in catalysis.
- Appraise state-of-the-art developments in metal-organic frameworks and hybrid catalysis.
- Demonstrate the correct, safe and responsible use of standard laboratory techniques and laboratory instrumentation associated with this module and write down the results of the experiments in a report, suitable for publication in a chemistry journal.

SC.12.4.9 CHEMISTRY LEVEL 8 (HONOURS)

Module CEM8X00	Chemistry Research Project
NQF Level	8
Credits	30
Presentation	Year
Prerequisites	BSc degree with chemistry as major subject, minimum of 60% for Advanced Physical Chemistry (CEM01A3), Advanced Organic Chemistry (CEM02B3), Instrumental Chemical Analysis (CEM01B3) and Coordination Chemistry (CEM02A3).
Purpose	The purpose of the module is for students to undertake an independent research project and gain skills in independent research and research reporting.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Conduct independent research
- Have skills in sourcing data, either in the field, in the library or on-line pertaining to the research project
- Submit a coherent, well written research report
- Make a coherent verbal presentation pertaining to the research project topic.

SC.12.5 COMPUTER SCIENCE HONOURS IT

The Honours Degree in Computer Science (H2005Q) consists of **SEVEN semester modules** and a **compulsory practical year project** IT28X87 Project (2 modules):

The following core semester module is compulsory:
IT28X47 Ethical and legal aspects of IT

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

The scope of the practical year project is a minimum of 200 hours. The year project spans two consecutive semester modules. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering (ACSSE).

A research component contributing at least 25% to the final mark will form part of all of the following courses with the exception of the Project (2 modules), which will have a research component of 100%.

Elective semester modules:

IT08X27	Computer Forensics
IT08X30	Software Factories
IT08X31	Services Computing
IT08X32	Critical Information Infrastructure Protection
IT08X37	Systems Programming
IT08X47	Information Security
IT08X57	Information Security in WWW
IT08X77	Introduction to IT Project Management
IT08X87	Compiler Construction
IT08X97	Artificial Intelligence
IT18X07	Optimisation
IT18X17	Functional Programming
IT18X37	Mobile Programming

IT18X47	Network Information Security
IT18X57	Advanced Artificial Intelligence
IT18X77	Graphics
IT18X87	New Systems Development Paradigms
IT28X07	Biometrics
IT28X17	Information Security Risk Analysis
IT28X27	IT aspects of Knowledge Management
IT28X47	Ethical and legal aspects of IT
IT28X67	E-Business Strategy
IT28X69	Advanced Information Technology Project Management
IT28X80	Information Security Governance
IT28X97	Data Communications
IT8X030	WWW Programming: Big Data Analytics
IT8X031	Cyber-social Computing – Techniques and emerging trends

With special permission semester modules from related subject areas may replace one or two lectured modules.

The contents of the lectured semester modules are determined annually by the Academy of Computer Science and Software Engineering. The contents of the modules are not included in the regulation book but may be obtained directly from the Academy of Computer Science and Software Engineering. Module outcomes follow.

Rules of Access
The student must have:
- An NQF 7 Degree qualification obtained with a pass mark of at least 60% in Computer Science.
- The mathematical ability to understand and apply advanced algorithms in problem solutions.
- The insight to design advanced algorithms for implementation in a computer system.
- The ability to program and implement algorithms using a recognized programming language.
- A deep insight into the representation of data structures in a computer system and the functioning of data models.
- A broad insight into the latest developments in the IT industry.
- A broad insight into the role and meaning of IT systems in modern society.

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

Assessment Criteria
A student needs a semester mark of 40% to gain entrance to the final assessment opportunity. The semester and final assessment mark weight is 50:50. A student needs a final mark of 50% to pass a module. The semester mark also contributes to the result of a supplementary assessment. The final result of a supplementary assessment is capped on 50%.

SC.12.5.1 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X87	Project (2 modules)
NQF Level	8
Credits	28
Presentation	Year module
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system. The main objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques.
- Produce a deployment strategy for the system and produce a live prototype of the system.
- Develop an alpha version of a software system.
- Develop a beta version of a software system.
- Demonstrate and discuss the final fully operational system in a live environment.

Also refer to Information Technology Honours for outcomes of other modules.

SC.12.5 COMPUTER SCIENCE with specialization in ARTIFICIAL INTELLIGENCE HONOURS IT

The Honours Degree in Computer Science specializing in Artificial Intelligence (H2018Q) consists of **Seven semester modules** of which 5 are compulsory and a **compulsory practical year project** IT28X87 Project (2 modules) with approved project in the Artificial Intelligence problem domain):

The following core semester module is compulsory:

IT08X97 Artificial Intelligence
IT18X07 Optimisation
IT18X57 Advanced Artificial Intelligence
IT8X030 WWW Programming: Big Data Analytics
IT28X47 Ethical and Legal Aspects of IT

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

The scope of the practical year project is a minimum of 200 hours. The year project spans two consecutive semester modules. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering (ACSSE).

A research component contributing at least 25% to the final mark will form part of all of the following courses with the exception of the Project (2 modules), which will have a research component of 100%.

Elective semester modules:

IT08X27	Computer Forensics
IT08X30	Software Factories
IT08X31	Services Computing
IT08X32	Critical Information Infrastructure Protection
IT08X37	Systems Programming
IT08X47	Information Security
IT08X57	Information Security in WWW
IT08X77	Introduction to IT Project Management
IT08X87	Compiler Construction
IT08X97	Artificial Intelligence
IT18X07	Optimisation
IT18X17	Functional Programming
IT18X37	Mobile Programming
IT18X47	Network Information Security
IT18X57	Advanced Artificial Intelligence
IT18X77	Graphics
IT18X87	New Systems Development Paradigms
IT28X07	Biometrics
IT28X17	Information Security Risk Analysis
IT28X27	IT aspects of Knowledge Management
IT28X47	Ethical and legal aspects of IT
IT28X67	E-Business Strategy
IT28X69	Advanced Information Technology Project Management
IT28X80	Information Security Governance
IT28X97	Data Communications
IT8X030	WWW Programming: Big Data Analytics
IT8X031	Cyber-social Computing – Techniques and emerging trends

With special permission semester modules from related subject areas may replace one or two lectured modules.

The contents of the lectured semester modules are determined annually by the Academy of Computer Science and Software Engineering. The contents of the modules are not included in the regulation book but may be obtained directly from the Academy of Computer Science and Software Engineering. Module outcomes follow.

Rules of Access

The student must have:

- An NQF 7 Degree qualification obtained with a pass mark of at least 60% in Computer Science.
- The mathematical ability to understand and apply advanced algorithms in problem solutions.
- The insight to design advanced algorithms for implementation in a computer system.
- The ability to program and implement algorithms using a recognized programming language.
- A deep insight into the representation of data structures in a computer system and the functioning of data models.
- A broad insight into the latest developments in the IT industry.
- A broad insight into the role and meaning of IT systems in modern society.

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

Assessment Criteria

A student needs a semester mark of 40% to gain entrance to the final assessment opportunity. The semester and final assessment mark weight is 50:50. A student needs a final mark of 50% to pass a module. The semester mark also contributes to the result of a supplementary assessment. The final result of a supplementary assessment is capped on 50%.

SC.12.5.2 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X87	Project (2 modules)
NQF Level	8
Credits	28
Presentation	Year module
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system. The main objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques.
- Produce a deployment strategy for the system and produce a live prototype of the system.
- Develop an alpha version of a software system.
- Develop a beta version of a software system.
- Demonstrate and discuss the final fully operational system in a live environment.

Also refer to Information Technology Honours for outcomes of other modules.

SC.12.5 COMPUTER SCIENCE with specialization in CYBER SECURITY HONOURS IT

The Honours Degree in Computer Science specializing in Cyber Security (H2019Q) consists of **Seven semester modules** and a **compulsory practical year project** IT28X87 Project (2 modules) with approved project in the Cyber Security problem domain:

The following core semester module is compulsory:
IT28X47 Ethical and legal aspects of IT
IT08X47 Information Security

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

The scope of the practical year project is a minimum of 200 hours. The year project spans two consecutive semester modules. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering (ACSSE).

At least three of the following must be chosen:

IT08X27	Computer Forensics
IT08X32	Critical Information Infrastructure Protection
IT08X57	Information Security in WWW
IT18X47	Network Information Security
IT28X80	Information Security Governance
IT28X17	Information Security Risk Analysis

A research component contributing at least 25% to the final mark will form part of all of the following courses with the exception of the Project (2 modules), which will have a research component of 100%.

Elective semester modules:

IT08X27	Computer Forensics
IT08X30	Software Factories
IT08X31	Services Computing
IT08X32	Critical Information Infrastructure Protection
IT08X37	Systems Programming
IT08X47	Information Security
IT08X57	Information Security in WWW
IT08X77	Introduction to IT Project Management
IT08X87	Compiler Construction
IT08X97	Artificial Intelligence
IT18X07	Optimisation
IT18X17	Functional Programming
IT18X37	Mobile Programming
IT18X47	Network Information Security
IT18X57	Advanced Artificial Intelligence
IT18X77	Graphics
IT18X87	New Systems Development Paradigms
IT28X07	Biometrics
IT28X17	Information Security Risk Analysis
IT28X27	IT aspects of Knowledge Management
IT28X47	Ethical and legal aspects of IT
IT28X67	E-Business Strategy
IT28X69	Advanced Information Technology Project Management
IT28X80	Information Security Governance
IT28X97	Data Communications
IT8X030	WWW Programming: Big Data Analytics
IT8X031	Cyber-social Computing – Techniques and emerging trends

With special permission semester modules from related subject areas may replace one or two lectured modules.

The contents of the lectured semester modules are determined annually by the Academy of Computer Science and Software Engineering. The contents of the modules are not included in the regulation book but may be obtained directly from the Academy of Computer Science and Software Engineering. Module outcomes follow.

Rules of Access

The student must have:

- An NQF 7 Degree qualification obtained with a pass mark of at least 60% in Computer Science.
- The mathematical ability to understand and apply advanced algorithms in problem solutions.
- The insight to design advanced algorithms for implementation in a computer system.
- The ability to program and implement algorithms using a recognized programming language.
- A deep insight into the representation of data structures in a computer system and the functioning of data models.
- A broad insight into the latest developments in the IT industry.
- A broad insight into the role and meaning of IT systems in modern society.

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

Assessment Criteria
A student needs a semester mark of 40% to gain entrance to the final assessment opportunity. The semester and final assessment mark weight is 50:50. A student needs a final mark of 50% to pass a module. The semester mark also contributes to the result of a supplementary assessment. The final result of a supplementary assessment is capped on 50%.

SC.12.5.3 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X87	Project (2 modules)
NQF Level	8
Credits	28
Presentation	Year module
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system. The main objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques.
- Produce a deployment strategy for the system and produce a live prototype of the system.
- Develop an alpha version of a software system.
- Develop a beta version of a software system.
- Demonstrate and discuss the final fully operational system in a live environment.

Also refer to Information Technology Honours for outcomes of other modules.

SC.12.6 ENERGY STUDIES HONOURS ENS

A potential candidate should hold a relevant Bachelor's degree in Science, Commerce, Humanities or an equivalent B Tech degree. In order to be considered for acceptance into the programme the applicant should have achieved a minimum result of 60% for the major modules in the final year of the undergraduate degree. Relevant experience in the energy industry would be an advantage.

Admission to the programme requires the approval of the Programme Co-ordinator of Energy Studies and the Head of Department of Geography, Environmental Management and Energy Studies.

The BSc Honours in Energy Studies (H2006Q) programme is presented on full-time basis (2 semesters) or on part-time basis (4 semesters). The programme comprises SIX modules (including a research project):

1 Energy Economics
2 Energy Technology
3 Energy Modelling
4 The International, Geographical and Political Aspects of Energy
5 Energy Policy Formulation
6 Research Project

Assessment Criteria
There is a written examination for each module, except the research project.
For modules ENS8X01 – ENS 8X05, the year mark and the examination mark each contribute 50% to the final mark. A minimum year mark of 40% is required for admission to the examination.

SC.12.6.1 ENERGY STUDIES LEVEL 8 (HONOURS)

Module ENS8X01	Energy Policy Formulation
NQF Level	8
Credits	20
Presentation	Year module
Prerequisites	A Bachelor's degree in Science or Commerce, or any other appropriate Bachelor's or B Tech degree. Suitable experience in the energy industry will be considered.
Purpose	This advanced module focuses on the logical process for formulating energy policy. The energy policies and energy regulations of South Africa are presented, discussed and assessed in this module. Selected policies are compared with current international practise.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Define and analyse the fundamental concepts applicable to, and approaches used, in formulating and implementing energy policies.
- Discuss and appraise national and international energy policies.
- Construct a logical, coherent, argumentative research assignment (essay) relating energy policy formulation which displays evidence of analysis and synthesis.

Accreditation/moderation: Satisfactory completion of all written assignments, including class tests.

SC.12.6.2 ENERGY STUDIES LEVEL 8 (HONOURS)

Module ENS8X02	International, geographical and political aspects of energy
NQF Level	8
Credits	20
Presentation	Year module
Prerequisites	A Bachelor's degree in Science or Commerce, or any other appropriate bachelor's or B Tech degree. Suitable experience in the energy industry will be considered.
Purpose	This advanced module considers the politics and geography of global energy resources, the producing and consuming countries, transport structures, and international physical and political constraints, protocols and general issues that influence global energy trade.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Demonstrate through explanation an understanding of the knowledge and subject matter associated with international aspects of the energy industry.
- Discuss and analyse the physical and geo-political factors affecting current and future internationally traded energy.
- Construct a logical, coherent, argumentative research assignment (essay) relating to the international, geographical and political aspects of the energy industry and displays evidence of analysis and evaluation.

Accreditation/moderation: Satisfactory completion of all written assignments, including class tests

SC.12.6.3 ENERGY STUDIES LEVEL 8 (HONOURS)

Module ENS8X03	Energy Economics
NQF Level	8
Credits	30
Presentation	Year module
Prerequisites	A Bachelor's degree in Science or Commerce, or any other appropriate Bachelor's or B Tech degree and suitable experience in the energy industry will be considered.
Purpose	This module examines the energy economic relationship and other economic concepts pertinent to the supply and demand for energy. Detailed examination and assessment of the structures of the South African energy economy is included in the module content.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and explain the principle concepts involved in an understanding of the knowledge and subject matter associated with energy economics.
- Discuss and comment on the implications of energy economic principles and industry structures to the energy industry and society.
- Construct a logical, coherent, argumentative research assignment (essay) relating to the rules and standards of energy economics and displays evidence of analysis and synthesis.

Accreditation/moderation: Satisfactory completion of all written assignments, including class tests

SC.12.6.4 ENERGY STUDIES LEVEL 8 (HONOURS)

Module ENS8X04	Energy Technology
NQF Level	8
Credits	30
Presentation	Year module
Prerequisites	A Bachelor's degree in Science or Commerce, or any other appropriate Bachelor's or B Tech degree. Suitable experience in the energy industry will be considered.
Purpose	This advanced module deals with energy technology. It focuses on the fundamental natural laws governing the technical utilisation of energy sources, on the technologies used to provide energy to power the economy, on alternatives to currently used energy sources and on the environmental implications of energy technology options. The ultimate aim of the module is knowledge about energy technologies, their operation, alternatives and the impacts on the natural environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and compare the basic terminology and concepts involved in an understanding of the knowledge and subject matter associated with energy technologies, both conventional and alternate, and to identify the challenges, utilization and environmental impacts relevant to Energy Technology.
- Discuss and compare the technical operation and environmental impacts pertaining to different energy technology options and apply them to analysing and comparing suitable options for future energy supply.
- Construct a logical, coherent, argumentative research assignment (essay) relating to the rules and standards of energy technologies which displays evidence of analysis and synthesis.

Accreditation/moderation: Satisfactory completion of all written assignments, including class tests

SC.12.6.5 ENERGY STUDIES LEVEL 8 (HONOURS)

Module ENS8X05	Energy Modelling
NQF Level	8
Credits	20
Presentation	Year module
Prerequisites	A Bachelor's degree in Science or Commerce, or any other appropriate Bachelor's or B Tech degree. Suitable experience in the energy industry will be considered.
Purpose	This module deals with the necessity for timeous and accurate energy supply and demand data, understanding different systems for analysing the data and different modelling techniques that can be used to support policy and decision making within the energy sector.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define, examine and compare the concepts involved in an understanding of the knowledge and subject matter associated with energy data collection and analysis and energy modelling techniques.
- Discuss and compare the methods and operation of different energy data analysis and energy modelling techniques and apply them to analysing, comparing and assessing proposing suitable options.
- Construct a logical, coherent, argumentative research assignment (essay) relating to energy data collection and analysis and to energy modelling which displays evidence of analysis and synthesis.

Accreditation/moderation: Satisfactory completion of all written assignments, including class tests

SC.12.6.6 ENERGY STUDIES LEVEL 8 (HONOURS)

Module ENS8X00	Research Project
NQF Level	8
Credits	30
Presentation	Year module
Prerequisites	A Bachelor's degree in Science or Commerce, or any other appropriate Bachelor's or B Tech degree. Suitable experience in the energy industry will be considered.
Purpose	To acquaint students with the principles of research, to guide them in the execution of a full-scale data collection and analysis as well as to develop their skills in writing and in the exposition of the conclusions of their research.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Plan and execute in an integrated manner a full-scale study in an Energy related field.
- Present results and conclusions in both written and verbal format.

Accreditation/moderation: Satisfactory completion of a written research report with a pass mark at 50%.

SC.12.7 GEOGRAPHY HONOURS GGR

For admission to the Honours Programme, a Bachelor's degree with Geography or Environmental Management as one major (65% in each 3rd year module) is required. The Head of the Department approves admission to the Honours programme.

Five semester modules are required for the Honours in Geography (H2007Q/H2H15Q) degree, of which **Module 3 (Philosophy and Methodology) and Module 7 (Research Project) are compulsory**. **Each module has an equal number of credits.** Examination is at the end of the semester of presentation, except Module 7, which is a year module. Module 3 and every other semester module must be passed with 50% in order to continue with study towards the Honours Degree.

A student must pass at least two modules per semester. Semester modules to be presented in a particular year of study are determined annually. *One approved semester module* from an Honours Degree other than Geography may also be followed in the Faculty of Science, Faculty of Humanities or Faculty of Management.

This degree programme is ONLY offered on a full-time basis and is a one-year programme.

SC.12.7.1 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X17	Ethics, Justice and the South African Environment
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year
Purpose	This module aims to engage with environmentalism and environmental management on a theoretical, ideological and ethical level, in the context of the South African environment. The aim of including this module in the geography honours programme is to increase the depth of understanding of the localized and situated nature of the environmental knowledge base and to interrogate the contesting perspectives and competing interests imbedded in the South African environment. Environmental ethics and values are debated with an aim to question and learn to justify ones individual environmental perspective, while expanding an awareness of the power relations and environmental justice issues surrounding the debates.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Engage with environmental ethics, values and issues of environmental justice.
- Develop an ethical perspective on issues of environmental justice.
- Examine differing economic and political philosophies of environmentalism.
- Examine the power relations inherent in environmental decision making, both within South Africa and on a global scale.
- Identify and understand how environmental ideology and ethics impact on environmental policy, law and management in practice.
- Examine contentious environmental histories of South Africa
- Apply principles of environmental justice to applied aspects of the environment such as land and resource distribution
- Critically assess current South African environmental policy and law and its applications.

SC.12.7.2 GEOGRAPHY LEVEL8 (HONOURS)

Module GGR8X27	Tourism Geography
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year
Purpose	Tourism Geography is a new and growing sub-discipline within Geography. The student will be introduced to the basic content of tourism geography as well as the geographic structure of the tourism industry.

Module learning outcomes: On completion of this learning event, the student should be able to:

- To describe the basic phenomena and theories concerning man and his environment and the impact on tourism as well as the development potential of tourism.
- Identify and evaluate tourist areas and regions.
- Evaluate South Africa's tourist areas and tourist potential.
- Plan, construct and present a well drafted and edited essay that demonstrates academic literacy and referencing.
- Take responsibility for continuous learning in terms of planning, managing and executing of module-specific assignments and oral and written communication.

SC.12.7.3 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X37	Geography Philosophy and Methodology
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year
Purpose	This module is a key, compulsory module for Geography Honours which examines the history of the discipline, the perspectives that have dominated it at different points and takes cognisance of the philosophy and ideology which underlies each school of thought. It is a core module of Geography Honours because a student at this level of study needs to have a firm grasp of their discipline and the methodologies and perspectives associated with it, as well as an ability to critique the different approaches to research. In addition, it is vital that they are aware of various methodologies available to them and have a firm grasp of the process of objective scientific research and rational argument. Thus, this module will instruct the student, firstly, in the philosophy underlying the development of Geography as a science, allowing them to situate their own research in a theoretical framework, and secondly, in the research methodologies in Geography to prepare him/her to embark on his/her own spatial research process independently.

Module learning outcomes: On completion of this learning event, the student should be able to:

PHILOSOPHY:

- Give a detailed review of the development of Geographic thought and research philosophies over time.
- Critically assess the contributions and limitations of each of the paradigms which have dominated geography as a discipline.
- Engage with the history of geographic thought and interrogate the process of knowledge production within the academic discipline of geography.
- Recognize the influence of a dominant paradigm in legitimizing certain knowledge.

METHODOLOGY:

- Define, explain, and motivate the fundamental steps encountered in the research process.
- Identify research methodologies employed during the past 40 years in the development of this science.
- Identify and give details (including specific examples) of current research methodologies used by fellow scientists in this field of science.
- Write a scientific report.

SC.12.7.4 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X47	Geomorphology
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year
Purpose	The aim of the course is to familiarise you with the role of geomorphology as an important branch of physical earth sciences. To instruct the student on an advanced level in the physical processes and patterns of geomorphic systems which form an integral part of the Biosphere in which all life on Earth function, by means of detailed study of rock weathering, gravitational, fluvial, coastal, and aeolian erosion and depositional processes.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Give a review of the development of Geomorphic thought from ancient times up to the present, including the shift to more process-oriented studies and a range of new methodologies (micro-geomorphology) over the past few decades.
- Define and explain in detail gravitational, fluvial, coastal and aeolian erosional and depositional processes.
- Apply the processes mentioned above to the proper planning of the human environment.
- Elaborate on possible future Ice Ages and Global Warming and the implication thereof for humankind.
- Demonstrate proper understanding of Quaternary geomorphology, particularly in the context of southern Africa

SC.12.7.5 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X57	Geo-Informatics 1 : Geographic Information Systems (GIS)
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	Bachelor's degree with Geography as major (that includes at least one module in GIS or Remote Sensing) or related spatial field of specialisation. Average pass 65% in 3rd year
Purpose	To enable the student to study the theory and practice of Geographical Information Systems (GISs), and to expose him/her to GIS, GIS-concepts and GIS-software.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe general concepts of Geographical Information Systems.
- Discuss data models and related structures of Geographical Information Systems.
- Execute data-capturing and database design.
- Describe the importance of map projections.
- Discuss manipulation of data used in Geographical Information Systems.
- Define, illustrate and discuss various types of analysis in Geographical Information Systems.
- Discuss the different data output products, metadata and assessment of Geographical Information Systems.
- Assess social implications of Geographical Information Systems.

SC.12.7.6 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X67	Geo-Informatics 2 : Remote Sensing and Image
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	Bachelor's degree with Geography as major (that includes at least one module in GIS or Remote Sensing) or related spatial field of specialisation. Average pass 65% in 3rd year

Purpose	To instruct the student in the use of RS data as a source of spatial data for research purposes by emphasising the methods of obtaining the data, as well as image processing and classification techniques to acquire usable information.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define the concept of Remote Sensing and explain its usefulness as a tool to gather data for researching several investigative fields.
- Define image processing and explain the different ways of manipulation of remotely-sensed data to acquire useful information.
- Explain the process of acquiring remotely-sensed data of specific electromagnetic wave bands and specifically-designed satellite platforms for various research themes and relate this data to their spatial and temporal characteristics.
- Explain the characteristics of radar imagery and its application value.
- Explain the process to convert processed images into digital and paper maps

SC.12.7.7 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X77	Research Project
NQF Level	8
Credits	30
Presentation	Year module
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year.
Purpose	To acquaint students with the principles of research, to guide them in the execution of a full-scale data collection and analysis as well as to develop their skills in writing and in the exposition of the conclusions of their research. At honours level students are required to complete an independent research project

Module learning outcomes: On completion of this learning event, the student should be able to:

- To conceptualise research within current debates
- To apply appropriate methods
- To conduct fieldwork
- To analyse data
- To draw conclusions from data, methods and literature

SC.12.7.8 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X87	Strategic Environmental Planning
NQF Level	8
Credits	24
Presentation	Semester 1
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year.
Purpose	This advanced module deals with strategic environmental planning, planning strategies, policy formulation, and programme developments in South Africa so that the biophysical, social and economic resources of manmade and natural regions can be managed sustainably. It focuses on the concept of regions and regional development where the emphasis is on the identification of issues and impacts caused by human activities and their impact on the environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and interpret key concepts involved in an understanding of the subject matter associated with the field of strategic environmental planning and to identify the theories, research methodologies and techniques relevant to Strategic Environmental Planning.
- Understand and explain how SEA addresses EIA failures and shortcomings.
- Critically discuss various decision-making models and how they interface with environmental planning processes.
- Demonstrate a detailed understanding of the theoretical conceptualisation of the sustainability concept within SEA planning (drawing in some international perspectives).

- Contextualise SEA within the integrated environmental framework (IEM) in South Africa.
- Critically discuss, examine and appraise the most important developmental and strategic environmental planning tools currently available in South Africa as applied to political or manmade regions on a provincial or small scale regional level.
- Critically discuss the main steps involved in any South African SEA process.
- Construct a logical, coherent, and argumentative research essay relating to how specific development policy, programmes and plan should follow the rules and standards of strategic environmental planning discourses while displaying evidence of analysis and synthesis

SC.12.7.9 GEOGRAPHY LEVEL 8 (HONOURS)

Module GGR8X97	Urban Geography
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	Bachelor's degree with Geography as major. Average pass 65% in 3rd year.
Purpose	An advanced study on selected issues of sustainability in cities of the global South with particular emphasis on Southern Africa. Themes that will be explored include: economic informality in the city, greening of the built environment, climate change, food security and housing.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand and contextualize the broad international debates relating to sustainable urban development.
- Ability to apply these debates to the African and South African context

SC.12.8 GEOLOGY HONOURS GLG

To earn an Honours Degree in Geology (H2008Q), a student must successfully complete all **nine modules** (including a project) outlined below or some of those, plus equivalent level modules from other related fields of earth or material sciences (at the discretion of the Head of the Department) to add up to a minimum of 170 credits. A minimum of 60% in all geology core modules and for all three field schools (UJ students) is required in order to apply to be considered for the Geology Honours programme.

Assessment
Assessment of the modules will take place on a continuous basis throughout the year. Results will be published as it becomes available. The Academic Regulations with regard to continuous assessment will apply.

SC.12.8.1 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X01	Sedimentary Basin Analysis and Palaeontology
NQF Level	8
Credits	28
Presentation	Semester 1
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	The purpose of the module is to enable students to understand the applied aspects of sedimentology and basin analysis, and how these relate to larger scale processes such as unravelling the origin and formation of clastic and carbonate sedimentary sequences in the rock record.

Module learning outcomes: On completion of this learning event, the student should be able to:

FACIES ANALYSIS:
- Subdivide sedimentary rocks into facies types.
- Interpret environments of deposition using facies models.
- Evaluate ancient sedimentary successions using facies models.
- Interpret sedimentary successions based on their mode of deposition.
- Critical evaluate the concept and application of facies models for modern and ancient sedimentary sequences.

PALAEONTOLOGY AND EARTH HISTORY:
- Evaluate the significance of the biosphere for the rock record.
- Understand the morphologies of important guide fossils.
- Understand geological processes as function of plate tectonics.

PROVENANCE STUDIES:
- Apply different quantitative methods to sedimentary rocks to decipher the origin of the components.
- Evaluate the results from quantitative analytical methods regarding a provenance analysis.
- Understand the principle of different analytical methods to approach sedimentary rocks and to decide which ones would be the most appropriates.

CARBONATE SEDIMENTOLOGY:
- Understand the origin and controls on composition of carbonate rocks and relationships between different carbonate facies on basinal scale.

SEQUENCE STRATIGRAPHY:
- Understand the basic principles of sequence stratigraphy and its application in basinal analyses.

FIELD EXCURSION:
- The field excursion is planned in such a way that students would get an impression of the dynamics of processes responsible for filling a basin with sediments.

SC.12.8.2 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X02	Tectonic Evolution of Mountain Building Areas
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	BSc in Geology and a minimum average mark of 60% for all 3 years BSc core geology modules
Purpose	The main purpose of this module is to teach the student the application of structural geological principles in geological scenarios, emphasising the important link between deformations, metamorphism and age-related processes in a Plate tectonic framework.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Demonstrate an understanding and successful application of the principles of Structural Geology.
- Compare different deformational events in Orogenic terrains.
- Write reports on structural geological settings within Orogenic terrains.
- Appraise the genesis of Mountain building processes.

SC.12.8.3 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X03	Geochemistry of Igneous Rocks
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	The primary purpose of this module as an integral part of the BSc honours qualification is to provide the students with a well-rounded and broad education on the fundamental concepts of the geochemistry of igneous rocks. Students will develop theoretical and practical knowledge in applying geochemical data, including major, trace and rare-earth element, and radiogenic and stable isotope data, in evaluating the origin of common igneous rocks that will serve as a fundamental basis for their further development in geology.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Recognize, categorize and interpret the origin of the most common types of igneous rocks.
- Apply mineral chemistry data to the study of igneous rocks.
- Apply major, trace end rare-earth element geochemical data to the study of igneous rocks.
- Apply radiogenic and stable isotope data to the study of igneous rocks.
- Apply geochemical modelling to decipher the petrogenesis of igneous rocks.

SC.12.8.4 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X04	Chemical Thermodynamics and Metamorphic Rocks
NQF Level	8
Credits	20
Presentation	Semester 1
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	The purpose of this module is to teach the student the application of chemical thermodynamics to geological situations, emphasising on the application of the Gibb's phase rule and the calculation of pressure-temperature paths.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Demonstrate an understanding of the fundamentals of chemical thermodynamics.
- Demonstrate an understanding of the Gibb's phase rule in geology.
- Demonstrate and understanding of metamorphic fluids.
- Apply metamorphic principles to high-grade metamorphic terrain.

SC.12.8.5 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X05	Applied and Environmental Mineralogy
NQF Level	8
Credits	28
Presentation	Semester 1
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	The purpose of this module is to teach the student the value of applied mineralogical studies as opposed to more theoretical elements learned as an undergraduate. The purpose is fundamental to the geology honours programme as mineralogy, and its applications, are one of the pillars of all geology curricula.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand sampling procedures.
- Prepare samples for various analytical assessments.
- Operate the X-ray diffraction machine to analyse mineral samples.
- Understand the role of mineralogy related to environmental issues.
- Understand the fundamentals of thermodynamics related to mineralogy.

SC.12.8.6 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X06	Economic Geology and Exploration Management
NQF Level	8
Credits	28
Presentation	Semester 1
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	The purpose of this module is to apply all the collective knowledge gained relating to geology and apply this to economic geology concepts - where (in what rocks and what geological regimes), when (in what age of rocks) and how (what type of economic deposit) economic mineral deposits occur. This module therefore is an integral part of the BSc Geology Honours programme as it draws together all geological concept and principals gained during the programme and applies these to economic geology concepts.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Show how certain economic deposits relate to certain geological settings.
- Compare the different geological settings of economic deposits.
- Write reports on economic geology deposits.
- Discriminate between the different ages and setting of different economic deposits.
- Contrast the different types of economic deposits.
- Appraise the genesis of different types of economic deposits.
- Understand the theory and application of geophysical techniques such as gravity, radiometric, seismic, electrical, and borehole wire line methods.

SC.12.8.7 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X07	Advanced Field Mapping
NQF Level	8
Credits	8
Presentation	Semester 2
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	To expose students to geological field mapping techniques and how the resultant map applies to understand the regional geological history of a specific terrain. Terrains or areas chosen are such that the student will learn how to practically integrate sedimentary, structural, igneous and metamorphic geological principles and processes for constructing geological history.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Make use of various field geological methods and measurements.
- Map geological phenomena on various scales.
- Produce a regional geological map, including cross sections and a stratigraphic column and from that a geo-tectonic and historical geological interpretation.
- Write a report on the results.

SC.12.8.8 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X08	Mining Geology
NQF Level	8
Credits	24
Presentation	Semester 2
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.

Purpose	The Mining Geology module will give the student an understanding of the *practical application* of geological knowledge and skills to situations and processes within the mining industry. The module will focus on the role of a geologist in mining operations and the geological inputs to the design, planning and implementation of different mining methods both surface and underground.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Demonstrate an understanding of the various mining methods and the geotechnical characteristics that influence the applicability of these different mining methods.
- Formulate a Rock Mass Rating and use this classification to decide on an applicable mining method.
- Demonstrate an understanding of the importance of slope stability study in the design and viability of an open pit mining operation.
- Evaluate an area of potential economic viability and report the resources and reserves in accordance with the SAMREC Code.
- Determine the possible economic and technical feasibility of mining an area of mineral resources by conducting a pre-feasibility study.
- Give advice for and direct underground mining operations so that development and stoping remains in the desired area of the orebody.
- Advise on and carry out ground water control measures to prevent ground water inflow into mining operations.
- Demonstrate an understanding of current legislation that impacts on the mining industry and the nature of compliance with legislation during mining operations.

SC.12.8.9 GEOLOGY LEVEL 8 (HONOURS)

Module GLG8X00	Geology Honours Research Project
NQF Level	8
Credits	30
Presentation	Year
Prerequisites	BSc Geology and a minimum average mark of 60% for all 3 years BSc core geology modules.
Purpose	The purpose of the module is for students to undertake an independent research project and gain skills in independent research and research reporting.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Conduct independent research
- Have skills in sourcing data, either in the field, in the library or on-line pertaining to the research project
- Submit a coherent, well written research report
- Make a coherent verbal presentation pertaining to the research project topic.

SC.12.9 INFORMATICS HONOURS IT

The Honours Degree in INFORMATICS (H2009Q (BSc Hons)/H2C07Q (BCom Hons)) consists of **SEVEN semester modules and a compulsory practical year project** IT28X87 Project (2 modules).

The following core semester module is compulsory: IT00247 Ethical and legal aspects of IT.
The scope of the practical year project is a minimum of 200 hours. The year project spans two consecutive semester modules. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering.

A research component contributing at least 25% to the final mark will form part of all of the following courses with the exception of the Project (2 modules), which will have a research component of 100%.

Elective semester modules:

IT08X27	Computer Forensics
IT08X30	Software Factories
IT08X31	Services Computing
IT08X32	Critical Information Infrastructure Protection
IT08X32	Systems Programming
IT08X47	Information Security
IT08X57	Information Security in WWW
IT08X77	Introduction to IT Project Management
IT08X87	Compiler Construction
IT08X97	Artificial Intelligence
IT18X07	Optimisation
IT18X17	Functional Programming
IT18X37	Mobile Programming
IT18X47	Network Information Security
IT18X57	Advanced Artificial Intelligence
IT18X77	Graphics
IT18X87	New Systems Development Paradigms
IT28X07	Biometrics
IT28X17	Information Security Risk Analysis
IT28X27	IT aspects of Knowledge Management
IT28X47	Ethical and Legal aspects of IT
IT28X67	E-Business Strategy
IT28X69	Advanced Information Technology Project Management
IT28X80	Information Security Governance
IT28X97	Data Communications
IT8X030	WWW Programming: Big Data Analytics
IT8X031	Cyber-social Computing – Techniques and emerging trends

With special permission one or two lectured modules may be replaced by semester modules from related subject areas.

The content of the lectured modules is determined annually by the Academy of Computer Science and Software Engineering. The content is not included in the regulation book but may be obtained directly from the Academy of Computer Science and Software Engineering.

Rules of Access:

- An NQF 7 Degree qualification obtained with a pass mark of at least 60% in Informatics.
- The ability to identify a business problem in industry and to develop a computer programme to solve it.
- A deep insight into the architecture of IT systems, including computers and networks.
- A deep insight into the representation of data structures in a computer system and the functioning of data models.
- A deep insight into the use of IT network systems in the execution of electronic commerce transactions.
- The ability to design web pages for the Internet serving as interfaces for electronic systems.
- A broad insight into the latest developments in the IT industry.
- A broad insight into the role and meaning of IT systems in modern society.

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

Assessment Criteria

A student needs a semester mark of 40% to gain entrance to the final assessment opportunity. The semester and final assessment mark weight is 50:50. A student needs a final mark of 50% to pass a module. The semester mark also contributes to the result of a supplementary assessment. The final result of a supplementary assessment is capped on 50%.

SC.12.9.1 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X87	Project (2 modules)
NQF Level	8
Credits	28
Presentation	Year module
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system. The main objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques.
- Produce a deployment strategy for the system and produce a live prototype of the system.
- Develop an alpha version of a software system.
- Develop a beta version of a software system.
- Demonstrate and discuss the final fully operational system in a live environment.

SC.12.10 INFORMATION TECHNOLOGY HONOURS IT

The Honours Degree in Information Technology (H2010Q) consists of SEVEN semester modules AND a **compulsory** practical year project.

Rules of Access: A BSc BSIT01/B2I01Q Degree or a BSc BSIT02/ B2I02Q degree.
A pass mark of at least 60% in Computer Science or Informatics in the final year.

Please note: Applicants may be required to pass a practical programming examination as set annually by the Academy.

The following core semester module is compulsory: IT28X47 Ethical and legal aspects of IT.

The scope of the compulsory practical year project (IT28X30 Project (3 modules)) is a minimum of 200 hours. The year project spans two consecutive semester modules. The continuation of the project in the second semester is dependent on satisfactory progress during the first semester. The project must be developed strictly according to the project development methodology as prescribed by the Academy of Computer Science and Software Engineering. The project development methodology subscribes to the software engineering systems life cycle as endorsed by the British Computer Society (BCS). The following phases are differentiated:

- Business modelling
- Requirements elicitation
- Design
- Development
- Testing
- Implementation (Deployment)

Relevant deliverables to support each stage constitutes:

- Draft proposal
- Project proposal deliverable
- Preliminary Design Review
- Detailed design review
- Deployment and Prototype System
- Development of alpha version
- Development of beta version
- Critique of the project
- Demonstration of final fully operational system and final project document

The above is in line with the threshold benchmarks pertaining to system development as set by the BCS. The body of knowledge within the BSc Honours degree in Information Technology encompasses/overlaps the following major areas as constituted by the lectured semester modules which include:

A research component contributing at least 25% to the final mark will form part of all of the following courses with the exception of the Project (2 modules) and Project (3 modules), where applicable, which will have a research component of 100%.

IT08X27	Computer Forensics
IT08X30	Software Factories
IT08X31	Services Computing
IT08X32	Critical Information Infrastructure Protection
IT08X32	Systems Programming
IT08X47	Information Security
IT08X57	Information Security in WWW
IT08X77	Introduction to IT Project Management
IT08X87	Compiler Construction
IT08X97	Artificial Intelligence
IT18X07	Optimisation
IT18X17	Functional Programming
IT18X37	Mobile Programming
IT18X47	Network Information Security
IT18X57	Advanced Artificial Intelligence
IT18X77	Graphics
IT18X87	New Systems Development Paradigms
IT28X07	Biometrics
IT28X17	Information Security Risk Analysis
IT28X27	IT aspects of Knowledge Management
IT28X30	IT Project (3 Modules)
IT28X47	Ethical and Legal aspects of IT
IT28X67	E-Business Strategy
IT28X69	Advanced Information Technology Project Management
IT28X80	Information Security Governance
IT28X97	Data Communications
IT8X030	WWW Programming: Big Data Analytics
IT8X031	Cyber-social Computing – Techniques and emerging trends

The above constitutes the core elective modules offered by the Academy. New electives may be introduced as new developments in Information Technology arise.

The above is in line with the modal benchmarks pertaining to the body of knowledge as set by the BCS.

With special permission semester modules from related subject areas may replace one or two lectured modules.

The content of the lectured modules is determined annually by the Academy of Computer Science and Software Engineering. The content is not included in the regulation book, but may be obtained from the Academy of Computer Science and Software Engineering.

Assessment Criteria
A student needs a semester mark of 40% to gain entrance to the final assessment opportunity. The semester and final assessment mark weight is 50:50. A student needs a final mark of 50% to pass a module. The semester mark also contributes to the result of a supplementary assessment. The final result of a supplementary assessment is capped on 50%.

SC.12.10.1 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X27	Computer Forensics
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The Computer Forensics module teaches students the basic terminology and legal aspects as they pertain to a computer forensic investigation. Furthermore, the procedure that must be followed in an investigation is described in detail as well as practically demonstrated. Computer forensics therefore contributes to the program by allowing students to further specialise their knowledge in information security, particularly in computer forensics and digital investigations.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Discuss the role of the digital investigator.
- Identify key aspects of digital evidence and computer crime.
- Discuss the relative aspects of the law as it applies to digital investigations.
- Demonstrate the ability to undertake a digital investigation by following a set investigative process.
- Apply the necessary skills to manage, organize and deliver digital forensic research results individually and/or in a team relation.

SC.12.10.2 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X30	Software Factories
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics. In addition, the module requires that the student has completed the following module: IT Project Management (IT08X77).
Purpose	This module exposes the student to the implementation and day-to-day operation of a large scale software development facility. Themes from software development, software engineering and other disciplines will be covered.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Understand the technical aspects of software delivery.
- Understand the management aspects of software delivery.
- Understand the people aspects of software delivery.
- Appreciate the personal disciplines needed to achieve higher levels of professionalism and productivity.
- Appreciate the role of complexity and the effect thereof on delivery.
- Understand how to manage different stakeholders.
- Explain how to affect change in different settings.

SC.12.10.3 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X31	Services Computing
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise in web services. Service-oriented architecture (SOA) presents an approach for building distributed systems that deliver application functionality as services to either end-user applications or other services. Web services are a technology that is well suited to implementing a service-oriented architecture. This module will give students the knowledge, understanding and skill to implement SOAs with web services technology.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe the contemporary concept of service-oriented architecture.
- Explain the principles of service-oriented design.
- Apply the principles of service-oriented design to service-oriented applications.
- Integrate extended web services specifications into service-oriented applications.
- Apply extended web services specifications in complex service-oriented applications.
- Use appropriate technologies to implement service-oriented applications.

SC.12.10.4 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X32	Critical Information Infrastructure Protection
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics. In addition, the following module is required: Information Security (IT08X47).
Purpose	This module exposes the student to the concepts relating to Critical Information Infrastructure Protection (CIIP) and the role CIIP plays in IT systems. This module will include discussions on the effects of cyber-threats on IT and critical systems, and associated methods to protect these systems. Furthermore, other themes relating to critical information infrastructures will be discussed.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand the technical aspects of Critical Information Infrastructure Protection.
- Understand what constitutes a critical information infrastructure.
- Understand what constitutes a critical system.
- Understand the methods and models of protecting critical information infrastructures.
- Discuss the threats which are associated critical information infrastructures.
- Explain the role critical information infrastructure plays in critical systems.

SC.12.10.5 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X37	Systems Programming
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with systems programming expertise. To module enable the student to understand the implementation issues surrounding Operating Systems and the implementation of concepts relating to Operating Systems. To allow the student to write software that operate at kernel level, and to write software that interacts with this kernel level software.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Recognise the different architectures used in an operating system.
- Explain several of the key components of an operating system.
- Demonstrate an understanding of the internal workings of an operating system by writing programs that interact with the operating system.
- Develop a device driver or modify an operating system to support new features.
- Critique on the device driver developed by the student.

SC.12.10.6 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X47	Information Security
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The aim of this module is to introduce students to the concepts relating to information security and to the technical aspects of information security with specific reference to the five security pillars as one of the basic components of the IT profession. Furthermore, students will be instructed on how to use the five security pillars to ensure that information is safe guarded. The inner workings of Identification & Authentication, Integrity, Confidentiality, Non-Repudiation, and Authorization will be discussed.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Indicate and explain the importance of securing information using the five information security pillars, as well as the impact on the market.
- Demonstrate the various techniques needed to enforce Confidentiality.
- Demonstrate the various techniques needed to enforce Integrity.
- Demonstrate the various techniques needed to enforce Authorization.
- Demonstrate the various techniques needed to enforce Non-Repudiation.
- Research of various topics relating to information security.

SC.12.10.7 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X57	Information Security in the WWW
NQF Level	8
Credits	13
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree. In addition, the following module is required: Information Security (IT08X47).
Purpose	The aim of this module is to introduce students to information security concepts that relate to securing networked and Internet-facing information systems, as well as other socio-technical systems. Students will be introduced to the fundamentals of defensive security as well as techniques for bypassing information security processes in an effort to recognize and counteract the threats.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Assess and measure threats to information assets
- Evaluate where information networks are most vulnerable
- Critique and propose security plans designed at protecting information systems against attacks
- Perform penetration tests into networks for evaluation purposes
- Develop an ongoing security strategy
- Discuss the legal implications of ethical security circumvention

SC.12.10.8 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X77	Introduction to IT Project Management
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	This module exposes students to the discipline of IT project management. By looking at all the areas involved in IT project management, a holistic view can be formed. The idea is not to make students into project managers at the end of the module, but rather for the student to have an appreciation for the discipline and understand the mechanics involved. This will be helpful in fulfilling the role of a team member working on an IT project or in leading or managing a project.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Apply the theoretical principles of problem identification and solving in the field of Information Technology project management.
- Plan and execute research in relevant fields in IT project management.
- Demonstrate communication competence with different role players.
- Accountably develop macro vision of Information Technology Project Management.
- Effectively organise and co-ordinate resources and opportunities.
- Practice social sensitivity in the relationships with others in self-directed teams.
- Utilise appropriate Information Technology systems effectively in the project management environment.

SC.12.10.9 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X87	Compiler Construction
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics.
Purpose	The goal of this module is to empower the student to be able to understand and apply the building blocks of Compiler Construction. The module is designed to use well-established techniques to construct compilers. These techniques also form the basis of programs in a number of related Information Technologies fields, such as text processing.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Design a simple programming language using a suitable notation.
- Implement a lexical analyser, parser and semantic analyser.
- Describe error detection and recovery strategies.
- Discuss machine code generation.
- Discuss modern compiler features such as garbage collection and optimisation.

SC.12.10.10 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT08X97	Artificial Intelligence
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics. Knowledge of a suitable programming language is required as practical work will entail the implementation of an intelligent agent-based system.
Purpose	The module introduces students to important concepts for implementing Artificial Intelligence in Information Technology systems. A number of fields in Artificial Intelligence will also be discussed.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discuss what Artificial Intelligence is and the role of Artificial Intelligence in Information Technology and society as a whole.
- Describe the concepts and theories related to Artificial Intelligence.
- Research, design and implement an intelligent agent-based system.
- Identify the components needed for an intelligent agent-based system.
- Demonstrate exposure to Artificial Intelligence principles.
- Apply skills to manage, organize and deliver research results.

SC.12.10.11 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X07	Optimisation
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.

Purpose	The primary purpose of this module is to provide Information Technology professionals with experience and expertise in Optimization to enable them to solve one or more problem types by formulating them using a suitable representation. Solutions are then provided by implementing algorithms for optimising these programming problems.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate problems in a suitable notation.
- Explain the principles for solving optimisation problems.
- Apply these principles in the design of algorithms.
- Analyse algorithms that are used in optimisation programming problems.
- Develop algorithms which perform such optimisation.

SC.12.10.12 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X17	Functional Programming
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	To enable to the student to formulate and apply functional solutions as opposed to the conventional imperative solutions. A functional solution often simplifies the task of proof of correctness of a program and is thus of great value to the Information Technology industry. The module challenges the student to solve problems in new ways, providing further new tools and experience of problem solving.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Recognise the fundamental differences between functional and imperative programming languages.
- Demonstrate their knowledge of functional languages.
- Research and develop new algorithms in a functional language to solve problems efficiently.
- Design functional programming algorithms by choosing the appropriate data structures for implementing a solution.
- Critique on the efficiency of algorithms in a functional language.

SC.12.10.13 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X37	Mobile Programming
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with mobile programming experience. The aim of this module is to introduce students to mobile application architecture and development with suitable mobile development frameworks. Furthermore, the module aims to instruct students on how to use the selected framework for application development.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Indicate the importance of mobile application design principles, infrastructure and technology as well as its impact on the market.
- Describe and utilize the architecture of current mobile platforms.
- Demonstrate a thorough grasp of the mobile Application Models for various platforms.

- Discuss the use of various User Interface options available for application development on multiple platforms.
- Demonstrate a thorough knowledge of existing mobile Security models.
- Demonstrate a thorough understanding of various other functionality available to mobile platforms.
- Discuss the mobile application deployment models that exist for various mobile platforms.

SC.12.10.14 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X47	Network Information Security
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree. In addition, the following module is required: Information Security (IT08X47)
Purpose	The primary purpose of this module is to provide IT professionals who are competent in network information security. The module enabled the student to explain wireless security concepts and design decisions. The student should be able to evaluate the weaknesses and strengths of current standards and non-standardised techniques. Throughout the module the security implications are discussed for both wireless environments and wired environments that are wirelessly enabled.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Explain the foundations of wireless networks.
- Describe the functions of the different types of LAN hardware.
- Describe the principles of security design.
- Explain wireless network security protections, principles, models and vulnerabilities.
- Explain future trends in wireless networks and their security.
- Appraise current or future trends in wireless networks.

SC.12.10.15 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X57	Advanced Artificial Intelligence
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics. In addition, the following module is required: Artificial Intelligence (IT08X97).
Purpose	The module introduces students to important concepts of one or more specialisations in the field of Artificial Intelligence and the importance of these to Information Technology.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Discuss specialisations in Artificial Intelligence and the relevance of the above in Artificial Intelligence and Information Technology as a whole.
- Describe the fundamental concepts and theories related to the specialisations of Artificial Intelligence.
- Research and report on open questions in Artificial Intelligence in any specialisation.
- Demonstrate an exposure to Artificial Intelligence principles.
- Apply skills to manage, organize and deliver research results.

SC.12.10.16 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X77	Graphics
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	This module will enable the student to write software to realistically render three-dimensional representations of scenes. In addition it will enable the student to decide which computer graphics rendering algorithms are appropriate for a particular problem, enabling skills associated with Information Technology problem solving.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Develop a program to represent a scene.
- Develop a program that renders a scene.
- Apply transforms including rotations, translations and projections for a given problem.
- Apply lighting models in theory and in a project.
- Explain the use of texturing.
- Describe global illumination techniques.
- Evaluate curves.

SC.12.10.17 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT18X87	New Systems Development Paradigms
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals who can identify, evaluate and solve problems associated with the Information Technology discipline in South Africa as well as in the international context. Through the acquisition of appropriate competence and research ability they will be able to enter into a range of professional and entrepreneurial opportunities in Information Technology. The module focuses on one or more selected emerging technologies and techniques for developing software systems.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discuss emerging technologies and techniques for developing software systems.
- Describe the fundamental concepts and theories related to emerging technologies.
- Research and report on the application of emerging technologies on a software system of their choice.
- Demonstrate a sufficient exposure to emerging technologies and techniques for developing software systems.
- Apply the necessary skills to manage, organize and deliver research results individually and/or in a team relation.

SC.12.10.18 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

(Not currently offered)

Module IT18X97	Parallel Programming
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to develop Information Technology professionals with parallel programming expertise as part of the IT discipline in South-Africa. The main objective of this module is to empower the student to be able to understand the architecture and advantages of distributed and parallel computer systems. The objective includes empowering the student to design and implement parallel algorithms.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Differentiate between distributed and parallel computing.
- Describe the different parallel architectures.
- Apply performance measures to parallel algorithms.
- Critique on the different message passing models.
- Develop parallel algorithms for a multi-computer.
- Evaluate the efficacy and efficiency of the proposed parallel programming solution.

SC.12.10.19 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X07	Biometrics
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	Biometrics is an important field in establishing secure Information Technology systems. The aim of this module is to introduce students to Strong Authentication technologies by utilizing Biometrics, introduce students to the technical aspects of the various Biometric approaches and Instruct students on how to use Biometrics for various levels of secure Authentication.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Indicate and discuss the importance of Biometric application infrastructure and technology as well as the impact on the market.
- Discuss the architecture of a generic Biometric system.
- Demonstrate knowledge of various Biometric Models.
- Demonstrate knowledge of using Liveness testing to facilitate the authenticity measurement of biometric subjects.
- Demonstrate knowledge of Biometrics used in large systems.
- Demonstrate knowledge of concerns relating to biometrics in political, ethical and religious areas.
- Implement a working Biometric system.

SC.12.10.20 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X17	Information Security Risk Analysis
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree. In addition, the following module is required: Information Security (IT08X47).
Purpose	The module in Information Security Risk Analysis will show students how to use cost-effective risk analysis techniques to identify and quantify the threats - both accidental and purposeful - that an organization faces. The module steps you through the qualitative risk analysis process using techniques such as PARA (Practical Application of Risk Analysis) and FRAP (Facilitated Risk Analysis Process). This module furthers the student's knowledge of Information Security Risk Analysis contributing to the student's development as an IT professional.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discuss the role of risk management and the risk management process in an organisation.
- Identify key aspects of risk management.
- Undertake a risk management analysis by following a set risk management process.
- Apply risk management analysis and implementation thereof in the various organisational environments.

SC.12.10.21 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X27	IT Aspects of Knowledge Management
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	This module in the IT aspects of knowledge management aims to introduce students to the theory and practice behind the information and communication technologies used to support knowledge management.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discuss what knowledge management is as well as the role of knowledge management systems in the organization and society as a whole.
- Describe the fundamental concepts and theories related to the Information Technology aspects of Knowledge Management Systems.
- Research and design a knowledge management strategy and system with emphasis on the role of technology and tools in the knowledge management process.
- Identify the key components needed for a knowledge management solution.
- Demonstrate they have the required knowledge, skills and attitudes that will allow them to operate effectively as a member of a knowledge management team.
- Demonstrate a sufficient exposure to selected management principles that will facilitate the establishment of a knowledge management program in an organisation.
- Apply the necessary skills to manage, organize and deliver research results individually and/or in a team relation.

SC.12.10.22 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X30	Project (3 modules)
NQF Level	8
Credits	42
Presentation	Year module
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise to develop and implement a working IT system. The main objective of this module is to allow the student to research and develop a programmable project in a wide variety of fields endorsed by the lecturers in the University of Johannesburg's Academy of Computer Science and Software Engineering, thereby enriching and opening job opportunities in the specialised research field. The module is designed to give students more freedom in the choice of their research topic. The module also includes a critique of the project, where students are expected to critically evaluate the project developed.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Draft a project proposal for a software system in a specialized field.
- Produce a revised project proposal deliverable after completion of further research and collaboration with a study leader.
- Research and evaluate existing solutions and prepare a preliminary design using appropriate design techniques.
- Produce a detailed design using relevant design techniques.
- Produce a deployment strategy for the system and produce a live prototype of the system.
- Develop an alpha version of a software system.
- Develop a beta version of a software system.
- Critically evaluate their software system.
- Demonstrate and discuss the final fully operational system in a live environment.

SC.12.10.23 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X47	Ethical and Legal Aspects of IT
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	IT ETHICS: This module in IT ethics is designed to create awareness of the ethical dimension of IT and to prepare students to manage this dimension effectively as there is a wide consensus that rapid developments in IT have outstripped our human capacity to deal responsibly with these developments. Thus, it is alleged that there exists a moral vacuum in cyberspace. LEGAL ASPECTS OF INFORMATION SECURITY: The module is also aimed at gaining an understanding of legal challenges in the IT field and why traditional mechanisms of law creation are, and will increasingly be, rigorously challenged.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define ethics and its importance in the IT industry.
- Identify moral dilemmas and apply suitable strategy/strategies for moral decision making.
- Identification and distinction between the two main forms of ethical codes.
- Understanding of the Law of Copyright, Trademarks and Contracts.

SC.12.10.24 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X67	E-Business Strategy
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The objective of this module is to allow the student to be able to understand the main building blocks of the development and implementation of electronic commerce strategies which forms an important part of Information Technology strategies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe the concept of e-business.
- Explain strategic planning for e-business organizations.
- Appreciate the role of managing IT as an investment.
- Describe the importance of the strategic management of the applications for e-business organizations.
- Research and develop an IS/IT strategy for e-business organizations.

SC.12.10.25 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X69	Advanced Information Technology Project Management
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics. In addition, the module requires that the student has completed the following module: IT Project Management (IT08X77)
Purpose	The module also enables the student to investigate Information Technology areas of the Project Management Body of Knowledge in more detail and to augment the student's understanding by introducing concepts from other management disciplines.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Apply the CMMI to the improvement of project quality.
- Understand what it means to be a professional and how it applies to his or her role as a project manager.
- Apply negotiation techniques to real-world situations.
- Discuss supplier management and how it applies to project management.
- Appreciate the subtleties of our multi-cultural society as well as the role of women therein.
- Explain why personal networking is important in the modern workplace.
- Propose how modern Web 2.0 technologies can be used in project communications management.

SC.12.10.26 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X80	Information Security Governance
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics. In addition, the module requires that the student has successfully completed the following modules: Information Security (IT08X47).
Purpose	The module serves to introduce the student to the fundamental and best practice aspects of Information Security Governance. The student is introduced to theoretical, technical, practical and international best practice considerations of good Information Security Governance, as a vital component of Information Technology.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Appraise the paradigm of ISG.
- Discuss the importance of best practices in ISG.
- Analyse the components of a good ISG plan.
- Assess the process to implement a good ISG plan and formulate such a plan.

SC.12.10.27 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT28X97	Data Communications
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The module enables students to explain data communications concepts and the components of the Internet and Intranets. Each service available on the Internet/Intranet is studied and practical sessions allow the student to install, configure, secure and study how each service works. A practical problem-solving session is also integrated to empower the student to identify and correct fault. The student then has to apply the knowledge with a practical semester project that addresses data communication issues related to IT.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Install and configure basic network facilities in the concerned operating system.
- Configure routers.
- Install and configure several network services.
- Diagnose network problems.
- Independently research and implement a network service or combination of services.
- Explain the operation of a service or combination of services.

SC.12.10.28 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT8X030	WWW Programming: Big Data Analytics
NQF Level	8
Credits	13
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	This module serves to enable the student to understand the implementation of solutions to issues related to Big Data. The focus will be on the implementation of Advanced Big Data Management and Analytics Mechanisms. This will allow the student to deploy Big Data Infrastructure and write software that interacts with these data stores to extract useful information from them.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Articulate the challenges and opportunities faced by Data Scientists and organizations in an era of Big Data.
- Explain the computational complexity placed on algorithms and data structures as a result of Big Data requirements.
- Deploy leading edge Big Data infrastructures and provision data in them.
- Implement and execute big data analytics algorithms on Big Data.
- Disseminate information extracted from performing Big Data analytics.

SC.12.10.29 INFORMATION TECHNOLOGY LEVEL 8 (HONOURS)

Module IT8X031	Cyber-social Computing – Techniques and Emerging trends
NQF Level	8
Credits	14
Presentation	Semester 2
Prerequisites	To be admitted to any honours module, the student must have an average of at least 60% in his/her final year of study for Computer Science/Informatics in a relevant BSc/BCom degree.
Purpose	The primary purpose of this module as an integral part of the BSc Honours (Information Technology) programme is to provide Information Technology professionals with expertise in cyber social computing. Social computing is a broad research area situated at the intersection of computer science and the social sciences. The module approaches the field of social computing from the cyber world perspective. It considers both human behaviour and interaction with computational systems, and the design of computational systems to support social behaviour and interactions. The aim of the module is to provide an overview of the variety of cyber social computing applications of which some are current, and some are emerging. This module will give students the knowledge, understanding and skill to implement cyber social computing applications in a variety of domains.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe and understand the contemporary concept of cyber social computing, appropriate cyber social computing applications, key principles, and emerging trends.
- Understand and apply concepts of cyber social computing models and techniques.
- Understand simple forms of cyber social analytics and apply existing analytics tools on cyber social information.
- Design and implement cyber social computing applications.
- Evaluate emerging cyber social computing applications, concepts and techniques in terms of key principles.

SC.12.11 MATHEMATICS HONOURS MAT

The Honours programme in Mathematics (**H2020Q**) (*H2016Q phasing out*) consists of **7 semester modules and a short, written Project**. The project is done under the supervision of a member of the Department and must be presented as a lecture. It has the weight of two subject modules and is examined internally. Modules are selected in consultation with the Department and may be exchanged with modules from other departments, for example from Applied Mathematics, Statistics and Economics and Econometrics.

Admission to the Honours programme is subject to approval by the Department. A prospective candidate must have a minimum average mark of at least 60% for Pure Mathematics on the third year level and pass an entrance exam as set by the Department.

Internal candidates with an average mark of at least 65% for Pure Mathematics on the third year level may be exempted from writing the entrance exam, at the sole discretion of the Department.

The final mark for each of the theory modules in the Mathematics Honours programme is calculated as follows: The semester mark contributes 40% and the examination mark 60% towards the final mark.

SC.12.11.1 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X01	Honours Graph Theory
NQF Level	8
Credits	12
Presentation	Semester 1
Prerequisites	- Bachelor's degree with Mathematics as major. - A minimum average of 60% in the final year of undergraduate Mathematics. - Pass the entrance exam (internal candidates with an average mark of at least 65% in the final year of undergraduate Mathematics may be exempted from writing the entrance exam, at the sole discretion of the Department).
Purpose	To familiarize and equip students with the basic concepts, principles and methods of Graph Theory. This knowledge will be a basis for the second semester Graph theory module and a possible master study in the field. It forms part of a well-rounded honour's degree in mathematics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate core concepts of the abovementioned topics in Graph Theory.
- Prove selected major theorems of the topics mentioned above.
- Apply integrated knowledge on the topics above to solve problems.

SC.12.11.2 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X03	Honours Topology
NQF Level	8
Credits	12
Presentation	Semester 1
Prerequisites	- Bachelor's degree with Mathematics as major. - A minimum average of 60% in the final year of undergraduate Mathematics. - Pass the entrance exam (internal candidates with an average mark of at least 65% in the final year of undergraduate Mathematics may be exempted from writing the entrance exam, at the sole discretion of the Department).
Purpose	Topology is a universal language used by analysts to solve problems in mathematics and industry. At the end of this module students will be able to define and explain all notions in general topology. They will also be able to apply the principles of topology to solve problems in general topology and related mathematical fields.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and give examples of metric and topological spaces.
- Investigate the different properties of topological spaces and the relationships between them.
- Construct new topological spaces from existing spaces using subspaces, finite and infinite products.
- Define and discuss the concepts of connectedness and compactness in topological spaces.
- Describe and give examples of continuous functions between topological spaces.
- Interpret topological concepts in terms of sequences.

SC.12.11.3 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X04	Honours Group and Field Theory
NQF Level	8
Credits	12
Presentation	Semester 1
Prerequisites	- Bachelor's degree with Mathematics as major. - A minimum average of 60% in the final year of undergraduate Mathematics. - Pass the entrance exam (internal candidates with an average mark of at least 65% in the final year of undergraduate Mathematics may be exempted from writing the entrance exam, at the sole discretion of the Department).
Purpose	The main purpose of this module is to conduct a comprehensive study of the concepts, principles and theories involved in abstract algebra. Furthermore, students are prepared for research orientated problem solving and a basis of knowledge is formed that would be necessary for further studies in Mathematics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Grasp and apply the theory of groups, homomorphisms and factor groups, advanced group theory, rings and fields.
- Do some calculations, analyse and solve problems in the above mentioned topics.
- Synthesize their knowledge in essays about the abovementioned topics.

SC.12.11.4 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X06	Honours Further Topics in Graph Theory
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Graph Theory (MAT8X01)
Purpose	To familiarize and equip students with an integrated and engaged knowledge of the fundamental concepts, principles and methods of Graph Theory. This knowledge will be a basis for a possible master study in the field. It forms part of a well-rounded honour's degree in mathematics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate core concepts of the abovementioned topics in Graph Theory,
- Prove selected major theorems of the topics mentioned above,
- Apply integrated knowledge on the topics above to solve problems.

SC.12.11.5 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X08	Measure and Integration Theory
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	- Bachelor's degree with Mathematics as major. - A minimum average of 60% in the final year of undergraduate Mathematics. - Pass the entrance exam (internal candidates with an average mark of at least 65% in the final year of undergraduate Mathematics may be exempted from writing the entrance exam, at the sole discretion of the Department).
Purpose	Measure and Integration theory is a universal language used by analysts to solve problems in mathematics and industry. At the end of this module students will be able to define and explain all notions of measure and Integration theory. They will also be able to apply the principles of measure and Integration theory to solve problems in measure and Integration theory and related mathematical fields.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define sigma algebras of sets and measures on sigma algebras.
- Describe measurable sets and measurable functions.
- Develop the Lebesgue integral systematically, starting with simple functions.
- Use the strong Convergence Theorems associated with the Lebesgue integral.
- Understand why the Lebesgue integral is more powerful than the Riemann integral.
- Solve problems involving the classical Lp function spaces.
- Understand and use the Hahn Decomposition Theorem, and the Radon Nikodym Theorem

SC.12.11.6 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X11	Honours Ring Theory
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Algebra (MAT8X04)
Purpose	To familiarize and equip students with an integrated and engaged knowledge of the fundamental concepts, principles and methods of Ring T the theory of partially ordered sets and lattices. This knowledge will be a basis for a possible master study in the field. It forms part of a well-rounded honour's degree in mathematics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate core concepts of the abovementioned topics in Ring Theory.
- Prove selected major theorems of the topics mentioned above.
- Apply integrated knowledge on the topics above to solve problems.

SC.12.11.7 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X13	Honours Set Theory and Logic
NQF Level	8
Credits	12
Presentation	Semester 1
Prerequisites	- Bachelor's degree with Mathematics as major. - A minimum average of 60% in the final year of undergraduate Mathematics. - Pass the entrance exam (internal candidates with an average mark of at least 65% in the final year of undergraduate Mathematics may be exempted from writing the entrance exam, at the sole discretion of the Department).
Purpose	To equip students with an integrated and engaged knowledge of the main concepts, techniques, methods and results from set theory and logic, up to and including the completeness theorems for first-order logic, thus contributing to a knowledge base which: • Forms part of a well-rounded honour's degree in mathematics, • Prepares students to continue with modal logic in the second semester and further studies in mathematical logic, and • Provides students with the necessary set-theoretical background to solve problems in topology, functional analysis and algebra.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Display an integrated knowledge of the fundamental concepts, techniques, methods and results of set theory and first-order logic.
- Construct mathematically sound proofs of given seen and unseen theorems and propositions in first-order logic.
- Apply a working knowledge of the expressive capabilities of first-order logic in order to formalise statements and inferences about given application domains.
- Demonstrate the knowledge that set-theoretical results are developed from definitions, axioms and mathematical logic.
- Apply set theory to relations, functions and infinite sets.
- Prove the equivalence of different forms of the Axiom of Choice and identify its use in other branches of mathematics.

SC.12.11.8 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X14	Honours Modal Logic
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Set Theory and Logic (MAT8X13)
Purpose	To equip students with an integrated and engaged knowledge of the fundamental concepts, techniques, methods and results from modal logic, thus contributing to a knowledge base which: • Forms part of a well-rounded honour's degree in mathematics, • Prepares students to continue with masters studies in mathematical and non-classical logic, and • Is valuable in terms of its applicability in related fields such as artificial intelligence and theoretical computer science.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Display an integrated knowledge of the fundamental concepts, techniques, methods and results of modal logic.
- Construct mathematically sound proofs of given seen and unseen theorems and propositions in modal logic.
- Comparatively evaluate modal and first-order languages in terms of expressivity and other logical properties.

SC.12.11.9 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X99	Honours Project
NQF Level	8
Credits	30
Presentation	Year module
Prerequisites	• Bachelor's degree with Mathematics as major. • A minimum average of 60% in the final year of undergraduate Mathematics. • Pass the entrance exam (internal candidates with an average mark of at least 65% in the final year of undergraduate Mathematics may be exempted from writing the entrance exam, at the sole discretion of the Department).
Purpose	To equip a student with the required skills to conduct a literature survey on a chosen mathematical topic and to integrate the knowledge so gathered into a research report as a coherent whole.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Research a chosen mathematical topic independently by utilizing and engaging appropriate scientific literature.
- Synthesize scientific information from diverse sources.
- Write a research report about a selected mathematical topic, where gathered information is integrated in such a way that that the result forms a coherent whole.
- Present a lecture on the project as part of the assessment.

SC.12.11.10 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X15	Lattice Theory
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Set theory and Logic (MAT8X13)
Purpose	To equip students with an integrated and engaged knowledge of the main concepts, techniques, methods and results from lattice theory, thus contributing to a knowledge base which: • Forms part of a well-rounded honour's degree in Mathematics, • Prepares students to continue with post-graduate studies in abstract Mathematics in related fields such as Universal Algebra, Algebraic Logic and Category theory.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate core concepts related to order theory and lattice theory.
- Prove selected major theorems of the topics mentioned above,
- Apply integrated knowledge of the topics above to solve problems.

SC.12.11.11 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X16	Honours Functional Analysis
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Topology (MAT8X03)
Purpose	To equip students with a coherent and critical understanding of the basic concepts, principles and methods of Functional Analysis; and to familiarize students with the four fundamental theorems of Functional Analysis. Upon completion of the module the students should have a comprehensive knowledge base of the basic principles of Functional Analysis, be able to solve problems in this area, and to think epistemologically.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discuss and define the basic notions of metric, normed and inner product spaces.
- Relate inner product spaces and normed spaces to special spaces considered at undergraduate level.
- Assemble a basic knowledge of the theory of bounded linear operators defined on normed and inner product spaces, with emphasis placed on dual spaces.
- Prove the Hahn Banach Theorems, the Uniform Boundedness Theorem, the Open Mapping Theorem and the Closed Graph Theorem.
- Solve problems related to the Hahn Banach Theorems, the Uniform Boundedness Theorem, the Open Mapping Theorem and the Closed Graph Theorem.

SC.12.11.12 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X17	Honours Commutative Algebra
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Set theory and Logic (MAT8X13) Honours Topology (MAT8X03)
Purpose	To equip students with an integrated and engaged knowledge of the main concepts, techniques, methods, and results from commutative algebra, thus contributing to a knowledge base which: • Forms part of a well-rounded honour's degree in Mathematics, • Prepares students to continue with post-graduate studies in abstract Mathematics in related fields such as: algebraic geometry, algebraic number theory, homological algebras, algebraic K-theory, theory of motives, finite field theory, local algebras, non-commutative algebras and geometry, and category theory.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate core concepts related to rings, modules, and k-algebras.
- Prove selected major theorems of the topics mentioned above,
- Apply integrated knowledge on the topics above to solve problems.

SC.12.11.13 MATHEMATICS LEVEL 8 (HONOURS)

Module MAT8X18	Honours Topics in Geometry
NQF Level	8
Credits	12
Presentation	Semester 2
Prerequisites	Honours Set theory and Logic (MAT8X13) Honours Topology (MAT8X03) Honours Group and Field Theory (MAT8X04)
Purpose	To equip students with an integrated and engaged knowledge of the main concepts, techniques, methods, and results from algebraic topology and differential geometry, thus contributing to a knowledge base which: • Forms part of a well-rounded honour's degree in Mathematics, • Prepares students to continue with post-graduate studies in abstract Mathematics in related fields such as: algebraic topology, differential topology, differential geometry, hyperbolic geometry, homological algebras, topological K-theory, low-dimensional topological spaces, and the theory of motives.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate core concepts related to fundamental groups, homology groups, cohomology groups, homotopy groups, bundles, and manifolds.
- Prove selected major theorems of the topics mentioned above.
- Apply integrated knowledge on the topics above to solve problems.

SC.12.12 MATHEMATICAL STATISTICS HONOURS STA

Applicants must hold a BSc degree in Mathematical Statistics as a major, i.e. Mathematical Statistics at third year level, and at least two years of pure Mathematics. Acceptance will depend on the majors as well as the marks obtained. Students that do not comply with this requirement may be admitted at the discretion of the Head of the Department. Such students may be required to complete additional work as prescribed by the Head of the Department.

The Honours degree in Mathematical Statistics (H2012Q) consists of:

1. A compulsory Project (**STA8X00**). The topic of the project, chosen in consultation with the Head of the Department, must be beyond the scope of undergraduate level course work and must have a strong theoretical component. The student must demonstrate an ability to understand and record statistical theory (without plagiarising).
   Please note that a project topic already used for another degree or work purposes, may not be used.

2. **EIGHT semester** modules chosen in consultation with the Head of the Department from the following: (*descriptions follow hereafter*)

   STA8X01 **STA8X06**
   STA8X02 **STA8X07**
   STA8X03 **STA8X08**
   STA8X04 **STA8X09**
   STA8X05 **STA8X11**

SC.12.12.1 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X01	Derivative Securities 1
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	-
Purpose	To expose students to advanced concepts of continuous time finance.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and apply advanced concepts of continuous time finance to the pricing and hedging of derivate instruments in a Black-Scholes market model.

SC.12.12.2 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X02	Methods of Multivariate Analysis
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	-
Purpose	To acquaint the student with the principles, techniques and applications of methods of the statistical analysis of multivariate data.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe and apply the principles and techniques of a variety of multivariate statistical techniques, both in their inferential and data analysis aspects.

SC.12.12.3 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X03	Non-parametric Statistics
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	-
Purpose	To acquaint the student with the basic principles, methods and applications of non-parametric and distribution-free statistical techniques.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe and apply advanced concepts of non-parametric statistical inference to data analysis problems.

SC.12.12.4 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X04	Stochastic Processes
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	-
Purpose	To acquaint the student with the basic principles, techniques and applications of stochastic processes, with special reference to Markov models.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and apply advanced concepts of stochastic process theory to theoretical and practical problems in statistical inference and data analysis.

SC.12.12.5 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X05	Time Series Analysis
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	-
Purpose	To give the student an in depth perspective of Time Series analysis in the time domain and the ability to identify specific processes, fit time series models to data, estimate model parameters and predict future values of time series in various fields of application.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe and apply linear time series models to the statistical analysis and interpretation of time series data drawn from finance and other substantive fields.

SC.12.12.6 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X06	Stochastic Calculus
NQF Level	8
Credits	16
Presentation	Semester 1
Prerequisites	-
Purpose	To give the student an in depth perspective of stochastic integration, Ito's Lemma and stochastic differential equations. Application to finance.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and apply advanced concepts of stochastic calculus to theoretical and practical finance problems.

SC.12.12.7 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X07	Statistical Inference
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	-
Purpose	To acquaint students with advanced concepts of parametric Statistical Inference.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe and apply likelihood and least squares methods to the solution of parametric statistical problems drawn from a variety of substantive fields of application.

SC.12.12.8 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X08	Design and Analysis of Experiments
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	-
Purpose	To provide the student with a basic knowledge of experimental design, particularly completely randomized designs, randomized complete and incomplete blocks designs, Latin square and Greco-Latin square designs, factorial and fractional factorial designs, split-plot designs, response surface methodology, and introduction to optimal designs.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define standard experimental designs and analyse associated statistical models.
- Construct non-standard designs for fitting response surfaces.
- Write down the model for standard designs and derive analytically expressions for estimating parameters of interest.
- Use statistical packages for analytically and graphically analysing data from an experimental design.
- Interpret results obtained in data analysis and draw conclusions and recommendations.

SC.12.12.9 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X09	Probability Theory
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	-
Purpose	To acquaint the learner with the basic principles and techniques of probability theory, with special references to probability spaces, random variables, convergence of random variables, conditional expectation, martingales, Brownian motion and stochastic integration.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and apply advanced concepts of probability theory to theoretical and practical problems in statistical inference and data analysis.

SC.12.12.10 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X11	Derivative Securities 2
NQF Level	8
Credits	16
Presentation	Semester 2
Prerequisites	Derivative Securities 1 (STA8X01)
Purpose	To provide the student with an advanced perspective of Interest Rate Derivative instruments and to illustrate its application to the solution of practical problems.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Define and apply advanced concepts of continuous time finance to interest rate modeling and the pricing and hedging of interest rate dependent securities.

SC.12.12.11 MATHEMATICAL STATISTICS LEVEL 8 (HONOURS)

Module STA8X00	Project
NQF Level	8
Credits	16
Presentation	Year module
Prerequisites	-
Purpose	To acquaint students with the principles of statistical research, to guide them in the execution of a full-scale statistical analysis of data and to develop their skills in writing and in the exposition of the conclusions of their research.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Apply the theory (to data and/or using simulation) and interpret it.
- Present the results and conclusions in both written and verbal format.

SC.12.13 PHYSICS HONOURS PHY

Admission to the Honours programme is subject to the permission of the Head of the Department. A minimum summative mark of 60% in Physics on NQF level 7 (third year) plus 50% in Mathematics on NQF level 6 (second year) is the standard entrance requirement.

Completion of the Physics Honours programme (H2013Q) requires **passing the project (PHY8X00), 5 compulsory modules** (as listed below) **and 4 elective modules** selected from the list below.

Compulsory modules:

PHY8X00 Physics Project
PHY8X01 Advanced Classical Mechanics
PHY8X04 Advanced Quantum Mechanics A
PHY8X11 Advanced Quantum Mechanics B
PHY8X12 Advanced Statistical Physics A
PHY8X14 Advanced Electromagnetism

Elective modules (select 4 from the list below):
Not all modules may be offered in any particular year.

PHY8X02 Nuclear Physics 2

PHY8X03	Particle Physics 1
PHY8X05	Quantum Field Theory
PHY8X06	General Relativity
PHY8X07	Particle Physics 2
PHY8X08	Computational Physics
PHY8X09	Astrophysics 1
PHY8X10	Astrophysics 2
PHY8X13	Advanced Solid State Physics A
PHY8X15	Advanced Solid State Physics B
PHY8X16	Nuclear Physics 1

In the case of modules that are spread across two semesters, the first semester module serves as a prerequisite for the second semester module.

As part of the electives, a student may choose a maximum of **two** modules from Faculty of Science Departments other than Physics, with permission from the Head of the Physics Department.

The final mark for each of the theory modules in the Physics Honours programme is calculated as follows: The semester mark contributes 40% and the examination mark 60% towards the final mark.

Further Examination entrance requirements

1. If a student is found to have attended less than 70% of lectures during a semester in a particular course, such a student may be refused entrance to the exam for that course.
2. A student needs a semester mark of 40% in a module to gain entrance to the final assessment opportunity for that module. The semester and final assessment mark weight is 40:60 as described above. A student needs a final mark of 50% to pass a module. The semester mark also contributes to the result of a supplementary assessment. The final result of a supplementary assessment is capped on 50%.

SC.12.13.1 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X01	Advanced Classical Mechanics
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	The purpose of this module is to extend the formulations of Classical Mechanics beyond that taught at undergraduate level. In particular, the Hamilton formulation that was introduced is developed further, with reference to variational calculus. That aspect of calculus is introduced and discussed at length. Also discussed are the Euler-Lagrange Equation and Liouville's Theorem. Applications of Hamilton Mechanics and variational calculus are introduced and discussed, in particular symmetries with respect to Noether's Theorem and Poisson Brackets. The connections to Quantum Mechanics will be discussed.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand and manipulate variational calculus in problems involving such;
- Understand and describe the use of variational calculus in Hamilton Mechanics;
- Understand the deep connection between the mechanics of Hamilton and Lagrange;
- Solve problems involving Hamilton mechanics;
- Understand and describe symmetries in Classical Mechanics.

SC.2.13.2 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X02	Nuclear Physics 2
NQF Level	8
Credits	10
Presentation	Semester 2
Prerequisites	PHY8X16
	PHY8X05 (Quantum Field Theory), while not a prerequisite, is highly desirable.
Purpose	Nuclear Reaction Theory is developed further with considerations of other reactions (electromagnetic, nucleon-induced, nuclear-induced), with nuclear structure considerations developed as central. Relativistic heavy-ion physics is introduced with regards to data coming from the heavy-ion colliders such as the LHC at CERN. Nuclear Astrophysics is also introduced with reference to the p-p chain and CNO cycles, and r-process, and their relevance to stellar astrophysics.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand and use nuclear reaction models to analyses reaction data and extract details of nuclear structure;
- Understand and explain aspects of nuclear reactions induced by various probes;
- Understand and discuss aspects of relativistic heavy-ion physics;
- Understand and discuss aspects of nuclear astrophysics and the reactions involved.

SC.2.13.3 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X03	Particle Physics 1
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to provide qualifying students with intellectual and practical skills to understand experimental techniques in high-energy physics and to obtain deeper understanding of the phenomenology of elementary particle physics. To introduce students to research problems in modern particle physics by either a research project or by a critical review of an area of contemporary research interest. To introduce students the concept of the electromagnetic, charged and neutral current, weak and strong interactions, gauge symmetries and conservation laws, the production and acceleration of particles in the laboratory, interaction of particles with matter, particle detectors, electron-positron collisions, proton-(anti)-proton collisions. Electron proton and heavy ion colliders.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Classify the fundamental subatomic particles by their possible interactions
- Use Feynman diagrams and conservation laws to analyse interactions qualitatively
- Describe the Standard Model of particle physics
- Explain how particles can be detected and their properties determined by exploiting their interactions with matter. Demonstrate the limitations of different detection techniques
- Combine their theoretical knowledge of particle interactions with their more practical knowledge of detection techniques to understand the construction of contemporary experiments
- Perform dimensional analysis to investigate physical relationships in particle physics
- Interpret data from figures published in the scientific literature and use this to perform calculations and develop conclusions
- Select and critically research a particle physics sub-topic of their choice and present their work to other members of the class during the student seminar day.

SC.2.13.4 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X04	Advanced Quantum Mechanics A
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	The purpose of this module is to provide qualifying students with intellectual and practical skills to analyse interpret and apply scientific laws and methods in the following: time-independent perturbation theory, the propagator formalism, the classical limit and Ehrenfest's theorem, introductory path integrals and how symmetry and translations lead to the conservation of energy, momentum and result in the quantisation of orbital angular momentum. Through the acquisition of appropriate skills the student will discover the application of advanced quantum mechanics and will be able to reflect upon the application thereof in physics and in the technological environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate, discuss and explain the basic principles and methods of advanced Quantum Mechanics A.
- Use advanced mathematical skills to derive equations, explain, interpret and evaluate theoretical models in advanced Quantum Mechanics A.
- Integrate advanced concepts and theory to solve problems in advanced Quantum Mechanics A.
- Recognize and explain aspects of the application of advanced Quantum Mechanics A in other branches of physics and in technology.

SC.12.13.5 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X05	Quantum Field Theory
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	The purpose of this module is to introduce relativistic quantum mechanics and the concepts of quantum field theory. Introduction to the Dirac Equation and Dirac matrices. Lagrangian field theory is developed first classically, then quantised leading to Quantum Field Theory. The theory of scalar fields and the Klein-Gordon equation are developed. As example, Quantum Electrodynamics is developed, using Feynman diagrams to tree level. For extensions beyond that, renormalisation techniques are introduced and utilised. Applications of QFT are discussed and developed.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Understand and solve the Dirac Equation;
- Understand and use classical and quantised Lagrangians in field theory;
- Understand and describe scalar fields and solve the Klein-Gordon equation;
- Understand and use Quantum Electrodynamics and Feynman diagrams;
- Understand applications of Quantum Field Theory.

SC.12.13.6 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X06	General Relativity
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to provide qualifying students with basic understanding of general relativity and cosmology so that they will be able to apply this to elementary phenomena. To introduce students to the field of general relativity and to the evolution, composition and structure of the Universe. To provide conceptual skills and analytical tools necessary for astrophysical and cosmological applications of the theory.

Module learning outcomes: On completion of this learning event, the student should be able to:

- understand the meaning and significance of General Relativity
- compute basic differential geometric quantities
- use Einstein's field equations and handle some important solutions of these equations and their applications eg Gravitational wave radiation)
- compute the orbits (geodesics) in specific curved space-times
- have some familiarity with cosmological models, including the system of equations for the evolution of the Universe and its solutions
- apply the mathematical and physical ideas of the theory of general relativity for the study of various systems in astrophysics and cosmology

SC.12.13.7 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X07	Particle Physics 2
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to provide qualifying students with a solid knowledge in theoretical particle physics, including underlying mathematical methods, applications to particle astrophysics, particle phenomenology and particle cosmology. Students will be introduced to research problems in modern particle physics by either a research project or by a critical review of an area of contemporary research interest. Students will be introduced to a wide range of topics in modern particle physics and provided with a range of transferable skills such as problem-solving and mathematical skills, investigative skills, presentation and communication skills, and computer skills

Module learning outcomes: On completion of this learning event, the student should be able to:

- know and describe Standard Model of particle physics
- compute decay rates and cross-sections with the help of relativistic kinematics
- use symmetries to restrict the form of the S-matrix, for example, isospin, discrete symmetries, and space-time symmetries
- give an account of and describe the static properties of hadrons from the quark model
- know the basic principles of the electroweak theory
- have knowledge about how deep inelastic scattering shows the existence of quarks in the nucleons
- know about basic neutrino physics and describe neutrino oscillations
- know beyond the Standard Model theories, such as super-symmetry and grand unified theories
- compare analytical calculations to predictions of simulation programs
- calculate, using Feynman techniques, cross-sections for various processes, as well as decay widths or lifetimes of particle resonances
- interpret experimental results within or beyond the Standard Model
- write project reports and prepare and hold short presentations.

SC.12.13.8 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X08	Computational Physics
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to give an introduction to computational physics and its application to experimental physics and theoretical physics. This includes methods for numerical integration, solution of differential equations, data fitting and random processes.

Module learning outcomes: On completion of this learning event, the student should be able to:

- understand the difference between simulations and other approximative and analytical methods
- perform simulations and computations using available programs
- write simple programs and make modifications of available programs
- understand the importance and limitations of a number of basic models with very broad applicability
- critically judge the published results, taking into account the limitations of the model and the statistical nature of several of the methods.

SC.12.13.9 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X09	Astrophysics 1
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	The purpose of this module is to familiarise students with the theory of stellar structure and evolution, including: fundamental equations of stellar structure; energy transport, stellar atmospheres; the mechanism of star formation; evolution from the main sequence through the giant branch and up to the asymptotic giant branch; endpoints of stellar evolution (white dwarfs, neutron stars and black holes); stellar pulsation, rotation and mass loss; binary stars.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Solve the fundamental equations of stellar structure for simplistic models.
- Display appropriate understanding of the internal processes and observable features accompanying the various stages of stellar development, ranging from stellar formation to stellar death.
- Display appropriate understanding of the internal processes and observable features accompanying the three major endpoints of stellar evolution: white dwarfs, neutron stars and black holes.
- Explain the major effects of binarity, pulsation, rotation and mass loss, respectively, on stellar properties and evolution.

SC.12.13.10 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X10	Astrophysics 2
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to familiarize students with basic radiation physics in the astrophysical context. Students will learn about Basic theory of radiation fields; Radiation from moving charges; Relativistic covariance and kinematics; Bremsstrahlung; Synchrotron radiation; Compton scattering.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Develop understanding of basic processes responsible for electromagnetic radiation from astrophysical sources.
- Formulate and discuss models for astrophysical sources and environment of the radiative zones.
- Discuss and explain astrophysical data over the electromagnetic spectrum, as collected by space- and ground-based instruments.

SC.12.13.11 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X11	Advanced Quantum Mechanics B
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	Building on Advanced Quantum Mechanics A, this module provides qualifying students with additional intellectual and practical skills to analyse interpret and apply scientific laws to develop quantum mechanical approximation methods, time-dependent scenarios and scattering theory.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate, discuss and explain the basic principles and methods of advanced Quantum Mechanics B.
- Use advanced mathematics skills to derive equations, explain, interpret and evaluate theoretical models in advanced Quantum Mechanics B.
- Integrate advanced concepts and theory to solve problems in advanced Quantum Mechanics B.

SC.12.13.12 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X12	Advanced Statistical Physics A
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to provide qualifying students with intellectual and practical skills to analyse interpret and apply scientific concepts and principles related to statistical ensemble theory and thermodynamics, including classical and quantum statistics, and to solve corresponding problems involving real physical systems. Through the construction of understanding and the acquisition of appropriate skills, the student will discover the application of advanced statistical physics and will be able to reflect on the role thereof in physics and in the technological environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate the concepts and principles encountered in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Discuss the concepts and principles encountered in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Explain the concepts and principles encountered in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Formulate theoretical models constructed in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Discuss theoretical models constructed in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Explain theoretical models constructed in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Solve problems in the framework of statistical ensemble theory and its relation to thermodynamics, including classical and quantum statistics.
- Explain aspects of the application of statistical ensemble theory to other branches of physics and in technology.

SC.12.13.13 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X13	Advanced Solid State Physics A
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	The purpose of this module is to provide qualifying students with intellectual and practical skills to analyse, interpret and apply scientific laws and methods in working with crystal structures as well as the complex acoustic, optic, magnetic and electric properties of materials. Through the acquisition of appropriate skills the student will discover the application of advanced solid state physics and will be able to reflect upon the application thereof in other branches of physics and in the technological environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate, discuss and explain the complex definitions of physical quantities, the complex principles and laws in advanced solid-state physics.
- Derive equations in, explain, interpret and evaluate advanced theoretical models in solid-state physics.
- Integrate advanced concepts and theories to solve problems in advanced solid-state physics.
- Recognize and explain aspects of the application advanced solid-state physics in everyday life and in technology.

SC.12.13.14 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X14	Advanced Electromagnetism
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	To equip students with intellectual and practical skills to analyse, interpret and apply the laws, techniques and methods of electromagnetism, including electrostatics, magnetostatics, wave propagation, in media (free space, non-conducting media, conductors, dielectrics), gauge transformations, generation of radiation and relativistic electrodynamics. The student shall be able to discover and recognize the principles and applications of electromagnetic wave propagation.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Interpret and apply the laws, techniques and methods of electromagnetism.
- Interpret and apply the laws, techniques and methods of electrostatics, magnetostatics, wave propagation, in media (free space, non-conducting media, conductors and dielectrics), gauge transformations, generation of radiation and relativistic electrodynamics.

SC.12.13.15 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X15	Advanced Solid State Physics B
NQF Level	8
Credits	10
Presentation	Semester 2
Purpose	The purpose of this module is to provide qualifying students with intellectual and practical skills to analyze, interpret and apply scientific laws and methods in working with salient features regarding advanced topics in condensed matter physics. These include the electronic structure of solids, the BCS theory of superconductivity, the Fermi liquid model, quasiparticle excitations, and the Hubbard model. Through the acquisition of appropriate skills the student will discover the application of advanced solid state physics and will be able to reflect upon the application thereof in other branches of physics and in the technological environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Formulate, discuss and explain the complex definitions of physical quantities, the complex principles and laws encountered in advanced solid state physics.

- Derive equations in, explain, interpret and evaluate advanced theoretical models in solid state physics.
- Integrate advanced concepts and theories to solve problems in advanced solid state physics.
- Recognize and explain aspects of the application advanced solid state physics in everyday life and in technology.

SC.12.13.16 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X16	Nuclear Physics 1
NQF Level	8
Credits	10
Presentation	Semester 1
Purpose	The purpose of this module is to provide qualifying students with intellectual and practical skills to analyse, interpret and apply scientific insight to nuclear physics. The course covers the understanding of nuclei by first considering fundamental properties of nuclei, and the insights gained by them. Starting then with the nucleon-nucleon interaction, it builds many-body theory starting with the deuteron, leading to more complex nuclei. Isospin is developed as a symmetry of nature, from which then models of nuclear structure are developed, with reference to the understanding of nuclear spectra. The Nuclear Shell Model is introduced and developed, as well as the collective model for heavier nuclei. Nuclear Reaction theory, in particularly nucleon and electron scattering, is introduced.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Formulate, discuss, and develop ideas with regards to nuclear structure and nuclear reactions;
- Understand and explain nuclear spectra and symmetries;
- Understand and use the Nuclear Shell Model in analyses of nuclear data;
- Understand and use the collective model in analyses of nuclear spectra;
- Be able to discuss aspects of nuclear reactions and use appropriate models in descriptions of reaction data.

SC.12.13.17 PHYSICS LEVEL 8 (HONOURS)

Module PHY8X00	Physics Project
NQF Level	8
Credits	30
Presentation	Year
Purpose	The purpose of this module is to provide qualifying students with the practical skills appropriate to the execution of mini-research projects in physics, using cutting-edge technology and principles of physics. The module will provide students with skills for managing their own advanced projects, and with skills in comprehensive report writing, including the incorporation of information gleaned from the research literature and internet sources.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Manage mini-research projects on a variety of research topics. These projects should be effectively and responsibly managed, using cutting-edge technology and principles of physics.
- Execute mini-research projects on a variety of research topics. These projects should be effectively and responsibly executed, using cutting-edge technology and principles of physics.
- Experimental projects must include collecting, analysing and interpreting data with advanced theories in physics.
- Projects of theoretical nature must include necessary calculations/derivations and must demonstrate understanding of the relevant theoretical concepts.
- Write clear and comprehensive reports on mini-research projects.

SC.12.14 PHYSIOLOGY HONOURS PHS

The BSc Hons Physiology (H2021Q) (H2015Q *phasing out)* comprises 7 modules and a Project which prepares the student for further postgraduate study. (PHS8X09) Scientific Methodology is a prerequisite for the Research Project (PHS8X00).

The department annually determines the availability of modules.
NQF Level: 8
Credits: 120
Rules of access: BSc degree with Physiology as major or equivalent.

Conditions of acceptance
A restricted number of students (approx. 12) will be admitted annually. This number is determined by the available places in the department.

Admission requirement

a) A BSc degree with Physiology as major or equivalent.
b) At least an average of 65% in Physiology or equivalent at graduate level in each of the third-year modules
c) **In specific cases, obtaining a minimum of 65 % in an English proficiency test and the outcome of a written essay type application, evaluated by academic staff of the Department of Zoology.**

Assessment
Assessment of the modules will take place on a continuous basis throughout the year. Results will be published as it becomes available. The Academic Regulations with regard to continuous assessment will apply.

SC12.14.1 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X03	Cell Physiology
NQF-level	8
Credits	8
Presentation	Semester 1
Prerequisites	BSc degree with Physiology as major or equivalent.
Purpose	The purpose of this module is to describe the relationship between the structure and the specialized functions of cells and tissues, compare the different transport mechanisms and explain the effect of toxicants on different cells and tissue types.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Discuss the relationship between the structure and the functions of the cell membrane.
- Explain and compare the processes of various transport mechanisms in the cell to facilitate the absorption or removal of substances.
- Explain the origin and significance of the transmembrane potential.
- Discuss the relationship between the structure and the functions in different tissue types.
- Assess the changes in the cell structure after the exposure to toxicants.

SC12.14.2 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X04	Morphometrics
NQF-level	8
Credits	8
Presentation	Semester 2
Prerequisites	BSc degree with Physiology as major or equivalent.
Purpose	As analytical methods, morphometric techniques are highly versatile. They can be applied on normal, pathological (abnormal), animate, inanimate, homogenous, and heterogeneous structures at gross or microscopic levels. This part of the course will expose students to techniques of nonbiased sampling of biological tissues and the various methods of determining sample size adequacy. It will comprise of 36 hours of lectures and 9 hours of practicals. The theoretical bases of morphometry will be presented in the lectures while hands on exposure to the analytical techniques will be given in the sessions. The various methods of volume density determination like planimetry, line integration, and point counting will be outlined and the limitations and strengths inherent in them highlighted. Histological sections will be analysed using ocular graticules and electron micrographs using quadratic overlay acetate grids. Absolute volume will be calculated from volume densities. Surface area will be determined by intersection counting. It will done on light microscopic sectional tissue preparations and electron micrographs. Numerical- and length densities will be determined by counting sectional profiles of discrete structures. The ways and means of avoiding bias during sampling and tissue analysis will be presented.

Module learning outcomes: At the end of the series of lectures, it will be expected that students will:

- Appreciate the importance of quantitation of organisms and their tissues in understanding function.
- Be able to critically define the parameters in an organism or tissue that are needed to understand specific functions.
- Be able to critically sample and analyse an organism or its tissue components in a nonbiased way in order to generate concrete results.

SC12.14.3 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X05	Endocrinology
NQF-level	8
Credits	16
Presentation	Semester 2
Prerequisites	BSc degree with Physiology as major or equivalent.
Purpose	The purpose of this module is to develop student's reasoning in the functioning and application of the Endocrine and Nervous system's role as a mayor regulatory system in living organisms.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Describe the importance and functioning of the four classes of chemical messengers.
- Critically discuss the functioning and characteristics of hormones.
- Explain the control of hormone secretion and the receptors and mechanisms of action.
- Critically discuss endocrine glands, their hormones, functions and possible pathophysiology eg. endocrine disruption.

SC12.14.4 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X06	Cardiorespiratory Physiology
NQF-level	8
Credits	16
Presentation	Semester 1
Prerequisites	BSc degree with Physiology as major or equivalent.
Purpose	The purpose of this module is to develop student's reasoning in the functioning and importance of the Cardiorespiratory system's role and application in animals.

Module learning outcomes: On completion of this learning event, the learner should be able to:

- Discuss the macro-, micro anatomy and histology of the heart.
- Critically discuss the electrical activity of the heart.
- Describe the cardiac cycle with reference to the pressure in each chamber, phases of the ECG and the heart sounds under load.
- Discuss and interpret the physiology of circulation.
- Discuss the macro-, micro anatomy and histology of the respiratory system.
- Critically discuss the physiology of respiration.
- Argue the effects of increased stress on the cardiovascular and respiratory systems and oxygen transport.

SC12.14.5 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X07	Neurology
NQF-level	8
Credits	16
Presentation	Semester 2
Prerequisites	BSc degree with Physiology as major or equivalent.
Purpose	A learner credited with this module will be able to understand the specialized functions of neurons, specify the routes by which different ions and molecules enter or leave a cell and understand how the brain functions. The objective of this module is also to enable the learner to explain the chemical, biochemical and cellular processes involved in the effects of drugs (i.e. pharmacology; integration with the nervous system). The practical work will enable learners to evaluate results obtained during practical work, analyse the results and compile a report on the results.

Module learning outcomes: On completion of this learning event, the learner should be able to:

- Explain the role and structure of ion channels in signalling.
- Explain the transport of ions across the membrane and its role in determining the ionic basis of resting and membrane potentials.
- Explain how neurons act as conductors of electricity and the functions and properties of neuroglial cells.
- Explain the cellular and molecular biochemistry processes involved in direct and indirect synaptic transmission, transmission release, and synaptic plasticity.
- Explain the functioning of the autonomic nervous system.
- Explain the transduction of mechanical and chemical stimuli, processing of somatosensory and auditory signals.
- Specific outcomes: The objective of this module is to enable the learner to explain the chemical, biochemical and cellular processes involved in signal generation and conductance in the nervous system and to discuss the integrative processes involved in the nervous system. The mechanisms and effects of drugs (i.e pharmacology) will be studied as part of the module.
- Demonstrate a workable knowledge of the pharmacology of the neuromuscular junction, signalling in the nervous system and all integrative mechanisms.

SC12.14.6 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X08	Environmental Physiology
NQF-level	8
Credits	16
Presentation	Semester 2
Prerequisites	BSc degree with Physiology as major or equivalent.
Purpose	The physiological responses of animals in the field to changes in the environment are important for their survival. This course focuses on the physiological adaptations by organisms in different environments with the emphasis on extreme environments such as deserts, polar regions and the ocean depths. Questions were asked on how animals survive under these extreme conditions e.g. very cold, little water and great depths. Physiological adaptations take place to ensure survival and growth under these environmental conditions. The mechanisms used by the different organs and organ systems to maintain homeostasis in the body, are studied.

Module learning outcomes: After successfully completing the course a candidate will:

- Understand the nature and levels of adaptation of animals in their environment.
- Explain the fundamental mechanisms of adaptation.
- Identify the problems animals experience with size and scale in adaptation.
- Discuss how organisms survive in special aquatic habitats.
- Discuss physiological adaptations by organisms in terrestrial habitats
- Demonstrate an understanding of animal survival in extreme terrestrial habitats.
- Explain the mechanisms used to adapt to habitats in the marine, shoreline and estuarine environments.
- Identify and describe the mechanisms of adaptation used by organisms to survive in fresh water environments.

SC12.14.7 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X09	Scientific Methodology
NQF-level	8
Credits	10
Presentation	Semester 1
Prerequisites	BSc degree with Physiology as major or equivalent
Purpose	The purpose of this module is to prepare students for scientific research methods and scientific reasoning. The aspects of scientific methods will include animal housing for research, preparing and analysing tissue samples, photographic techniques in the field and in the laboratory, working with data sets and scientific writing. The aspects of scientific reasoning will include the origin and development of the the scientific method and its application in biological studies.

Module learning outcomes:

- Criticize and evaluate the use, function and management of the aquarium and controlled environmental facilities and other animal housing methods.
- Practically demonstrate techniques for preparing animal tissues for microscopic investigation employing standard techniques. Discuss other tissues used in scientific study
- Demonstrate photographic techniques in the laboratory and in the field, show awareness of GIS applications.
- Create a data set in excel.
    - Distinguish between nominal, ordinal and continuous graphs.
    - Interpret univariate and multi-variate descriptive statistics and graphs.
    - Formulate a null and alternative hypothesis.
    - Test basic statistical hypotheses and interpret the results.
    - Determine a simple linear regression equation and interpret the results.
    - Interpret the results of logistic regression and chaid.

- Discuss the origin and further development of ideas and concepts related to the scientific methods and the contributions of 21st century science philosophers to the modern scientific method.
- Write a scientific manuscript according to the prescriptions of the scientific method, create figures and tables and add it to the manuscript.

SC12.14.8 PHYSIOLOGY LEVEL 8 (HONOURS)

Module PHS8X00	Research Project
NQF-level	8
Credits	30
Presentation	Year module
Prerequisites	BSc degree with Physiology as major or equivalent. PHS8X09
Purpose	Students have the opportunity to select a project of their choice, plan a project, generate and collect experimental data on a specific research topic in the research focus areas of the department, interpret results in terms of current subject information, make inferences and recommendations and present it as a written report and an oral presentation.

Module learning outcomes: On completion of this learning event, the student should be able to:
- Gain theoretical and practical knowledge of the field of the specific project.
- Collect experimental data on the aspects motivated in the project proposal.
- Interpret the results obtained.
- Generate inferences and recommendations.
- Present the results in an understandable format at a colloquium.

A written and oral presentation of the project and results will have to be prepared and compiled.

SC.12.15 ZOOLOGY HONOURS ZOO

The BSc Hons in Zoology **(H2022Q) (**H2017Q *phasing out*) comprises **8 modules**: ZOO8X03, ZOO8X04, ZOO8X06, ZOO8X07, ZOO8X08, ZOO8X09, ZOO8X10; ZOO8X13 **and a Project** ZOO8X00.

The department annually determines the availability of modules.
NQF Level: 8
Credits: 124
Rules of access: BSc degree with Zoology as major

Conditions of acceptance
- A restricted number of students will be accepted annually. This number is determined by the available places in the department.
- Final acceptance will be based on final year results, obtaining a minimum of 65% in Zoology on third year level.
- In specific cases, obtaining a minimum of 65% in an English proficiency test and the outcome of a written essay type application, evaluated by academic staff of the Department of Zoology.

Assessment
Assessment of the modules will take place on a continuous basis throughout the year. Results will be published as it becomes available. The Academic Regulations with regard to continuous assessment will apply.

Summary of modules in Zoology:

CODE	MODULE NAME
ZOO8X03	Population Genetics and Biosystematics
ZOO8X04	Ecophysiology
ZOO8X06	Fish Histology and Histopathology
ZOO8X07	Mammal Diversity
ZOO8X08	Conservation Genetics
ZOO8X09	Indices for the Biotic Integrity of Aquatic Ecosystems
ZOO8X10	Aquatic Parasitology
ZOO8X13	Scientific Methodology
ZOO8X00	Research Project

SC.12.15.1 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X03	Population Genetics and Biosystematics
NQF-level	8
Credits	12
Presentation	Semester 2
Prerequisites	BSc degree with Zoology as a major.
Purpose	A student credited with this module will be able to effectively assess levels of biodiversity variation within- and differentiation between taxa. Results are interpreted correctly and logically compared to other data sets. Genetic markers are defined population stock identification, geographic variation, gene flow, hybridisation and speciation and identify the processes that are involved in evolutionary changes. Phenetic and Cladistic methods of data analyses are applied to define phylogenetic relationships; and predict the cumulative effects of evolutionary processes on successive generations.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Effectively assess levels of biodiversity variation and differentiation.
- Interpret and analyse results correctly and compare them logically with other data sets.
- Show an understanding and ability to identify appropriate methods used to define genetic markers.
- Critically review phenetic and cladistic methods to analyse data for phylogenetic inferences.
- Use rigorous interpretations of appropriate methods to predict the effects of evolutionary processes on successive generations.

SC.12.15.2 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X04	Ecophysiology
NQF-level	8
Credits	12
Presentation	Semester 2
Prerequisites	BSc degree with Zoology as a major.
Purpose	To provide an opportunity to students to study the effect of the direct environment on the physiology of organisms, from invertebrates to vertebrates. Adaptations to extreme conditions e.g. from polar regions to deserts and adaptations in the functioning of different organs and organ systems of the organisms inhabiting these environments. Animal physiology is integrated into a holistic approach that includes the environment or habitat and the range of behavioural responses of individual organisms before a range of physiological responses need to be activated. An appreciation for the successful survival of organisms in different ecological settings is promoted amongst students.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Compare the available mechanisms of ion regulation and water balance in organisms in moderate to extreme environmental conditions.
- Demonstrate knowledge and insight in the mechanisms of feeding in different habitats.
- Identify and describe nutritional and nutrient requirements in moderate and extreme natural environments.
- Estimate the energy cost to organisms for survival in specific environments.
- Understand the role of metabolism in the survival of organisms under extreme climatic conditions.
- Summarise the patterns and control mechanisms of reproduction in animals in different terrestrial and aquatic environments.
- Demonstrate an understanding of temperature regulation and heat balance in organisms in moderate to extreme environmental conditions.
- Analyse the effect of the physics of heat exchange during different environmental conditions.
- Assess anthropogenic effects on environmental quality and organism survival.

SC.12.15.3 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X06	Fish Histology and Histopathology
NQF-level	8
Credits	12
Presentation	Semester 1
Prerequisites	BSc degree with Zoology as a major
Purpose	This module serves as an introduction to fish histology and fish histopathology and the techniques used to examine fish tissues. A student credited with this module will be able to distinguish normal fish tissue from diseased or abnormal tissue, discuss artefactual changes in tissues not related to a disease process, describe basic pathological processes, identify possible causes for the pathology found during microscopic examination and be able to collect, prepare and stain fish tissue for histopathological investigation.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Distinguish normal fish tissue from diseases or abnormal tissue.
- Distinguish and discuss artefactual changes in tissues not related to a disease process.
- Describe and discuss the features and characteristics of normal fish histology.
- Describe basic pathological processes in fish tissue.
- Describe about the possible causes for the pathology found during microscopic examination.

SC.12.15.4 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X07	Mammal Diversity
NQF-level	8
Credits	12
Presentation	Semester 1
Prerequisites	BSc degree with Zoology as a major
Purpose	This mammal diversity module, which forms part of the Biodiversity Programme, equips the student with a working knowledge of the diversity and taxonomy of the mammals of southern Africa. To familiarise the student with aspects concerning the origin, radiation, adaptations and distribution of mammals. To demonstrate the dynamic relationship between mammals and their environment.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Identify the most important mammal species of southern Africa.
- Explain mammal classification.
- Describe how the typical mammalian characteristics were acquired.
- Describe the origin and diversification of mammals.
- Interpret the distribution of mammals, behaviour and adaptation to habitats.
- Explain the influence of mammals on their environment.

SC.12.15.5 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X08	Conservation Genetics
NQF-level	8
Credits	12
Presentation	Semester 2
Prerequisites	BSc degree with Zoology as a major
Purpose	To enable learners to gather genetic and general conservation information and data, assess these critically applying the latest conservation genetic principles, and apply the outcomes to conservation and management issues.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Gain an understanding of the theoretical approaches to and the placement of genetics in the context of conservation biology;
- Understanding genetic diversity and its characterization;
- Understanding the effects of population reduction and loss of genetic diversity in small or fragmented populations;
- Defining management units and understanding the genetic management of wild and captive populations.

SC.12.15.6 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X09	Indices for the Biotic Integrity of Aquatic Ecosystems
NQF-level	8
Credits	12
Presentation	Semester 2
Prerequisites	BSc degree with Zoology as major
Purpose	To develop intellectual competence and practical skills in the analysis, interpretation and evaluation of the biotic integrity of aquatic ecosystems by using abiotic and biotic indices.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Analyse integrity of an aquatic ecosystem using abiotic aspects in the form of indices.
- Evaluate integrity of aquatic ecosystems using biotic aspects in the form of indices.
- Assess the integrated biotic integrity of aquatic ecosystems using both abiotic and biotic indices.
- Apply alternative bio-monitoring protocols to assess ecosystem integrity.

SC.12.15.7 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X10	Aquatic Parasitology
NQF-level	8
Credits	12
Presentation	Semester 1
Prerequisites	BSc degree with Zoology as major
Purpose	To provide students with an understanding of factors that have an influence on parasite ecology and distribution and to equip them with an understanding of the application of this knowledge in environmental studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Explore and explain host-parasite interactions.
- Explore and explain the effects of ecological niche and parasite community structures on parasite distribution.
- Reflect on the use of parasite distribution as an indicator of environmental health.

SC.12.15.8 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X13	Scientific Methodology (new code)
NQF-level	8
Credits	10
Presentation	Semester 1
Prerequisites	BSc degree with Zoology as a major
Purpose	The purpose of this module is to prepare students for scientific research methods and scientific reasoning. The aspects of scientific research methods will include animal housing for research, preparing and analysing tissue samples, photographic techniques in the field and in the laboratory, working with data sets and scientific writing. The aspects of scientific reasoning will include the origin and development of the scientific method and its application in biological studies.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Criticize and evaluate the use, function and management of the aquarium and controlled environmental facilities and other animal housing methods.
- Practically demonstrate techniques for preparing animal tissues for microscopic investigation employing standard techniques. Discuss other tissues used in scientific study
- Demonstrate photographic techniques in the laboratory and in the field, show awareness of GIS applications.
- Create a data set in excel.
    - Distinguish between nominal, ordinal and continuous graphs.
    - Interpret univariate and multi-variate descriptive statistics and graphs.
    - Formulate a null and alternative hypothesis.
    - Test basic statistical hypotheses and interpret the results.
    - Determine a simple linear regression equation and interpret the results.
    - Interpret the results of logistic regression and chaid.
- Discuss the origin and further development of ideas and concepts related to the scientific methods and the contributions of 21st century science philosophers to the modern scientific method.
- Write a scientific manuscript according to the prescriptions of the scientific method, create figures and tables and add it to the manuscript.

SC.12.15.9 ZOOLOGY LEVEL 8 (HONOURS)

Module ZOO8X00	Research Project
NQF-level	8
Credits	30
Presentation	Year module
Prerequisites	BSc degree with Zoology as a major
Purpose	Students have the opportunity to select a project of their choice, plan a project, generate and collect experimental data on a specific research topic in the research focus areas of the department, interpret results in terms of current subject information, make inferences and recommendations and present it as a written report and an oral presentation.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Gain theoretical and practical knowledge of the field of the specific project.
- Collect experimental data on the aspects motivated in the project proposal.
- Interpret the results obtained.
- Generate inferences and recommendations.
- Present the results in an understandable format at a colloquium.

A written and oral presentation of the project and results will have to be prepared/compiled.

PSYCHOLOGY HONOURS PSY

Kindly refer to the Faculty of Humanities Rules and Regulations book for further detail on this programme.

SPORT SCIENCE HONOURS SPB

Kindly refer to the Faculty of Health Science Rules and Regulations book for further detail on this programme.

PART 13

SC.13 MASTERS PROGRAMMES

MASTER OF SCIENCE (MSc or M Phil) by Minor Dissertation and/or Coursework – LEVEL 9

Purpose and characteristics of the programme
The primary purpose of the MSc minor-dissertation with coursework is to provide students with specialised advanced education and training while meeting the requirements of a specific research component so that students can master the required experimental and technological skills and necessary fieldwork competencies such as innovation, decision-making, strategic thinking and organizational skills. A minor-dissertation with coursework Master of Science degree consists of a minimum of 120 credits of research at level 8 in the form of a research project, written up as a minor-dissertation. The degree demands a high level of intellectual and theoretical knowledge and insight into problems related to the field of study and of critical reasoning, formulation, analysis and evaluation of a specific problem in the field of study.

MASTER OF SCIENCE (MSc) DISSERTATION – LEVEL 9

Purpose and characteristics of the programme
The primary purpose of the MSc dissertation is to provide students with specialised advanced education and training while meeting the requirements of a specific research component so that students can master the required experimental and technological skills and necessary fieldwork competencies such as innovation, decision-making, strategic thinking and organisational skills. A dissertation-based Master of Science degree consists of a comprehensive study of a specialized area in the field of specialisation, reported on and submitted in the form of a dissertation at the end of the programme. The degree demands a high level of intellectual and theoretical knowledge and insight into problems related to the field of study and of critical reasoning, formulation, analysis and evaluation of a specific problem in the field of study.

Exit level outcomes

Students should be able to:
- Use a range of specialized skills to identify, analyse and deal with complex problems and issues drawing systematically and creatively on the theories, research methodologies, methods/techniques, literature and materials of their discipline/field of specialisation
- Operate autonomously and take responsibility for their own work and be accountable for the work of others when working with others in a team
- Manage learning tasks autonomously and professionally and continue and sustain independent learning and academic professional development
- Demonstrate advanced information retrieval and processing skills to identify, analyse, synthesise and independently evaluate quantitative and/or qualitative data, using appropriate Information Communication Technology (ICT)
- Demonstrate a comprehensive, systematic and integrated specialist knowledge of the discipline/field with a coherent and critical understanding of the theories, research methodologies, epistemologies, and methods/techniques relevant to their science discipline/ field of specialisation
- Evaluate their own and others' academic work and initiatives against a range of criteria
- Present and communicate the results of research by appropriate academic/professional discourse, and produce a dissertation or research report which meets the standards of scholarly/ professional writing/presentation
- Operate in specialised science contexts and utilize ethical decision-making skills in dealing with complex ethical and professional issues and make informed judgements on such issues
- Critique and evaluate current research and participate in scholarly debates, addressing both theory and practice, in the science area of specialisation

- Develop a mastery of the application of research methodologies, methods/techniques and technologies applicable to the science area of specialisation
- Plan, execute and write up research, investigation or development in the science area of specialisation under some supervision

Assessment
In the case of the research master's degree the dissertation is the only assessment requirement that has to be fulfilled. The final assessment mark (which carries a weight of 100%) will be the average of the marks given by the external assessors. Refer to Regulations part of this booklet.

In the case of the master's degree by coursework the minor dissertation, as well as the successful completion of additional courses, are the assessment requirements that have to be met. Calculation of the final mark in the case of the minor or course-work dissertation is department specific and set out in this section. The minor dissertation mark (determined as for the research dissertation) and the average of the course-work modules will each contribute 50% to the final mark.

DEGREE CODE	PROGRAMME	SC NR
APM	APPLIED MATHEMATICS	13.1
BIC	BIOCHEMISTRY	13.2
BTN	BIOTECHNOLOGY	13.3
BOT	BOTANY	13.4
CEM	CHEMISTRY	13.5
CSC	COMPUTER SCIENCE	13.6
ENS	ENERGY STUDIES	13.7
ENM	ENVIRONMENTAL MANAGEMENT	13.8
FTN	FOOD TECHNOLOGY	13.9
GGR	GEOGRAPHY	13.10
GLG	GEOLOGY	13.11
IFM	INFORMATICS	13.12
IT	INFORMATION TECHNOLOGY	13.13
MAT	MATHEMATICS	13.14
STA	MATHEMATICAL STATISTICS	13.15
NAN	NANOSCIENCE	13.16
PHY	PHYSICS	13.17
PSY	PSYCHOLOGY (*Refer to Faculty of Humanities Rules and Regulations book*)	
AQH	AQUATIC HEALTH	13.18.1 & 2
BDB	BIODIVERSITY AND CONSERVATION	13.18.3
ZOO	ZOOLOGY	13.18.4

MASTER OF SCIENCE – LEVEL 9

SC.13.1	MASTER OF SCIENCE IN APPLIED MATHEMATICS	APM

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

Master's degree studies consist of a guided research project that must be submitted in the form of a dissertation at the end of the study period.

SC.13.1.1 APPLIED MATHEMATICS LEVEL 9 (MASTERS)

Qualification Code	M2041Q
Module APM9X18	Applied Mathematics: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 1

SC.13.1.2 APPLIED MATHEMATICS LEVEL 9 (MASTERS)

Qualification Code	M2041Q
Module APM9X28	Applied Mathematics: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 2

SC.13.2	MASTER OF SCIENCE IN BIOCHEMISTRY	BIC

Master's degree studies consist of a guided research project that must be submitted in the form of a dissertation at the end of the study period.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

Please note: Admission to the master's programme is subject to approval by the Department.

SC.13.2.1 BIOCHEMISTRY LEVEL 9 (MASTERS)

Qualification Code	M2003Q
Module BIC9X18	Biochemistry: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 1

SC.13.2.2 BIOCHEMISTRY LEVEL 9 (MASTERS)

Qualification Code	M2003Q
Module BIC9X28	Biochemistry: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 2

SC.13.3 MASTER OF SCIENCE IN BIOTECHNOLOGY BTN

Admission requirements
A B Tech in Biotechnology or an equivalent qualification at an equivalent standard.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

Please note:
Standard entrance requirements for admission to Masters studies are subject to approval by the Department. A prospective candidate must have a minimum average mark of at least 65% for the Hons degree, while a motivation by a potential supervisor for a mark of 60-64% will need to be submitted to the Dean for approval. Where the major is not in Biochemistry but relevant to a research field, a motivation by a potential supervisor will need to be submitted to the Dean for approval.

SC13.3.1 BIOTECHNOLOGY LEVEL 9 (MASTER)

Qualification Code	M2004Q
Module BTN9X18	Dissertation: Biotechnology
NQF-level	9
NQF credits	180
Presentation	Semester 1
Prerequisites	B Tech or RPL
Purpose	The qualifying student will be able to conduct research under guidance in a chosen field and contribute to knowledge production in that field. The research problem, its justification, process and outcome is reported in a dissertation which complies with the generally accepted norms for research at this level.

Outcomes: On completion of this learning event, the student should be able to:
- Demonstrate knowledge and understanding of the field/area of investigation.
- Apply a range of research methods and techniques appropriately and correctly to investigate, modify and improve or innovating Biotechnology processes.

SC13.3.2 BIOTECHNOLOGY LEVEL 9 (MASTER)

Qualification Code	M2004Q
Module BTN9X28	Dissertation: Biotechnology
NQF-level	9
NQF credits	180
Presentation	Semester 2
Prerequisites	B Tech or RPL
Purpose	The qualifying student will be able to conduct research under guidance in a chosen field and contribute to knowledge production in that field. The research problem, its justification, process and outcome is reported in a dissertation which complies with the generally accepted norms for research at this level.

Outcomes: On completion of this learning event, the student should be able to:
- Demonstrate knowledge and understanding of the field/area of investigation.
- Apply a range of research methods and techniques appropriately and correctly to investigate, modify and improve or innovating Biotechnology processes.

SC.13.4 MASTER OF SCIENCE IN BOTANY BOT

The degree will be awarded following the successful completion of a dissertation based on an approved research topic.

In addition to the above, one or more additional modules may be required by the Departmental Head. The general regulations for Master's degrees are also applicable.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.4.1 BOTANY LEVEL 9 (MASTERS)

Qualification Code	M2029Q
Module BOT9X18	Botany: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 1

SC.13.4.2 BOTANY LEVEL 9 (MASTERS)

Qualification Code	M2029Q
Module BOT9X28	Botany: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 2

SC.13.5 MASTER OF SCIENCE IN CHEMISTRY CEM

The Masters study programme comprises a research project based on an approved topic. A dissertation, which gives evidence of the research capability of the candidate, is required.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.5.1 CHEMISTRY LEVEL 9 (MASTERS)

Qualification Code	M2006Q
Module CEM9X18	Chemistry: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 1

SC.13.5.2 CHEMISTRY LEVEL 9 (MASTERS)

Qualification Code	M2006Q
Module CEM9X28	Chemistry: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 2

SC.13.6 MASTER OF SCIENCE IN COMPUTER SCIENCE CSC

The Masters study programme comprises a dissertation based on an approved topic. In addition, **a minimum result of 65% in the preceding Honours Degree is required for admission. Furthermore**, the general rules for master's degrees are applicable.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.6.1 COMPUTER SCIENCE LEVEL 9 (MASTERS)

Qualification Code	M2032Q
Module CSC9X18	Computer Science: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 1

SC.13.6.2 COMPUTER SCIENCE LEVEL 9 (MASTERS)

Qualification Code	M2032Q
Module CSC9X28	Computer Science: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 2

SC.13.7 MASTER OF PHILOSOPHY IN ENERGY STUDIES ENS

Admission to the Masters in Energy Studies preferably requires an Honours Degree in Energy Studies, although a student with Honours in a related subject, together with appropriate experience in the energy industry, may be considered for admission. It may be required of a student in the latter category to register for, and successfully complete, one or more of the modules for the Honours programme in Energy Studies *before* the master's study is commenced.

A **dissertation** on a subject, chosen after consultation with the Programme Coordinator for Energy Studies, is required for the Master's degree. The degree conferred will be an MPhil (Energy Studies).

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.7.1 ENERGY STUDIES LEVEL 9 (MASTERS)

Qualification Code	M2205Q
Module ENS9X18	Energy Studies: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 1

SC.13.7.2 ENERGY STUDIES LEVEL 9 (MASTERS)

Qualification Code	M2205Q
Module ENS9X28	Energy Studies: Dissertation
NQF-level	9
Credits	180
Presentation	Semester 2

SC.13.8 MASTER IN ENVIRONMENTAL MANAGEMENT ENM

The coursework Master's in Environmental Management consists of ***three modules***. For admission to this programme, an Honours Degree in Geography or Environmental Management or any relevant equivalent Honours degree is required.

Full-time students and *part-time students* follow theory Module 1 (ENM9X03) and 2 (ENM9X04) during the first and second semesters of the first study year. Research Module 3 (ENM9X81 and ENM9X82) must, in both cases, be completed at the end of the study, as specified above.

The relative weights of the minor dissertation and course work modules are set out Regulation 17.7.8.

Admission to the master's programme in Environmental Management is subject to approval by the Head of the Department. General rules of admission, as set by Faculty of Science and the University, apply.

SC.13.8.1 ENVIRONMENTAL MANAGEMENT (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2016Q (MSc) and M2H68Q (MA)
Module ENM9X81	Environmental Management: Minor Dissertation
NQF Level	9
Credits	90
Presentation	Semester 1
Prerequisites	• *BSc Honours* degree in any discipline relevant and applicable to Environmental Management. To be accepted a pass mark in the preceding degree of at least 65% is required. • *BA Honours* degree in any discipline relevant and applicable to Environmental Management. To be accepted a pass mark in the preceding degree of at least 65% is required.
Purpose	To acquaint students with the principles of research, to guide them in the execution of a full-scale data collection and analysis as well as to develop their skills in writing and in the exposition of the conclusions of their research.

Outcomes: On completion of this learning event, the student should be able to:

- Define a problem in Environmental Management and formulate a hypothesis to address the problem.
- Find relevant and appropriate literature, evaluate or interpret it and be able to supply reference lists in the correct format.
- Formulate an appropriate programme to address the research problem and carry it out successfully.
- Generate acceptable results through the use of appropriate methods and technologies and integrate these results into the body of existing information, or find, interpret and evaluate significant findings, showing insight into the discipline of Environmental Management; and
- Present the results in a style and terminology appropriate to the discipline of Environmental Management, with due regard for correctness of language and the scientific conventions of the discipline.

SC.13.8.2 ENVIRONMENTAL MANAGEMENT (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2016Q (MSc) and M2H68Q (MA)
Module ENM9X82	Environmental Management: Minor Dissertation
NQF Level	9
Credits	90
Presentation	Semester 2
Prerequisites	- *BSc Honours* degree in any discipline relevant and applicable to Environmental Management. To be accepted a pass mark in the preceding degree of at least 65% is required. - *BA Honours* degree in any discipline relevant and applicable to Environmental Management. To be accepted a pass mark in the preceding degree of at least 65% is required.
Purpose	To acquaint students with the principles of research, to guide them in the execution of a full-scale data collection and analysis as well as to develop their skills in writing and in the exposition of the conclusions of their research.

Outcomes: On completion of this learning event, the student should be able to:

- Define a problem in Environmental Management and formulate a hypothesis to address the problem.
- Find relevant and appropriate literature, evaluate or interpret it and be able to supply reference lists in the correct format.
- Formulate an appropriate programme to address the research problem and carry it out successfully.
- Generate acceptable results through the use of appropriate methods and technologies and integrate these results into the body of existing information, or find, interpret and evaluate significant findings, showing insight into the discipline of Environmental Management; and
- Present the results in a style and terminology appropriate to the discipline of Environmental Management, with due regard for correctness of language and the scientific conventions of the discipline.

SC.13.8.3 ENVIRONMENTAL MANAGEMENT (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2016Q (MSc) and M2H68Q (MA)
Module ENM9X03	Environmental Management 1: The Biosphere and Environmental Studies
NQF Level	9
Credits	120
Presentation	Semester 1
Prerequisites	- *BSc Honours* degree in any discipline relevant and applicable to Environmental Management. To be accepted a pass mark in the preceding degree of at least 65% is required. - *BA Honours* degree in any discipline relevant and applicable to Environmental Management. To be accepted a pass mark in the preceding degree of at least 65% is required.
Purpose	The purpose of this module is to increase the exposure of the student to the discipline of Environmental Management. It emphasizes the concepts of environmental awareness and associated environmental perspectives. This will enable the student to develop an insight into the biosphere and how it is structured and functions, as well as into environmental studies that relate to Environmental Management. The ecological relationships between people and the natural environment will also be examined. The student will be made aware that for successful Environmental Management to occur, economic, business and legal perspectives have to be taken into account. This illustrates the interdisciplinary approach to this discipline.

Outcomes: On completion of this learning event, the student should be able to:

- Demonstrate understanding of key concepts and terms within the discipline of Environmental Management.
- Analyse and examine the structure and function of the biosphere and associated ecosystems and discuss the nature and functioning of the guiding background principles and their relationship to environmental management.

- Critically assess the use of the biophysical resources by people using various theoretical lenses and relating understanding of these theories to various case studies.
- Explain the contentious relationship that exists between business and the environment in particular how sustainable development needs to be implemented by the private sector.
- Demonstrate an understanding of the application of key South African Environmental Laws in terms of air, water, soil and biodiversity.
- Briefly explore the critical role resource economics, plays in assisting the implementation of sustainable development, with a focus on instruments that can be used to regulate environmental practice e.g. command & control instruments, economic instruments & planning and other instruments.
- Appraise the nature and impacts of pollution on air, water, soil and biodiversity.
- Understand how urban settlements and the built environment need to be managed in a manner that promotes sustainable development, such as: integrated land use planning, integrated management of solid waste, the role of municipal by-laws.

SC.13.8.4 ENVIRONMENTAL MANAGEMENT (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2016Q (MSc) and M2H68Q (MA)
Module ENM9X04	Environmental Management 2: Environmental Management skills and techniques
NQF Level	9
Credits	120
Presentation	Semester 2
Prerequisites	Environmental Management 1: The Biosphere and Environmental Studies (ENM9X03)
Purpose	The purpose of this module is to orientate the student to the basic discipline of environmental management and as a result this module places an emphasis on the basic skills, tools and techniques and environmental perspectives needed to facilitate successful and meaningful environmental management and to promote the concept of sustainability. To develop the student's understanding and insight into the skilful application of a wide variety of environmental dimensions, fields and environmental skill, tools and techniques in order to facilitate informed decision making based on sound information and expert judgment spanning a wide variety of scientific disciplines.

Outcomes: On completion of this learning event, the student should be able to:

- Define the concepts associated with Integrated Environmental Management (IEM) and discuss and outline the nature, philosophy, underlying principles and process used in South Africa to facilitate IEM and in addition to illustrate how in South Africa IEM is being strongly supported by the development of Environmental Management Frameworks (EMF's).
- Define the concepts and terminology relating to terrain evaluation and discuss and explain the nature, associated principles, approaches, methods and the process of terrain evaluation. In addition, the importance of terrain evaluation to Environmental Impact Assessment (EIA) will be stressed.
- Clearly and competently indicate, explain and apply the theoretical background and the main functions and elements related to Environmental Impact Assessment (EIA) in South Africa, to understand the EIA process adopted by and followed in South Africa, to relate EIA application in South Africa to applicable legislation and to write suitable EIA reports and to submit this report for reviewing by the relevant government authority.
- Discuss the nature, aims, principles, application and methods of Social Impact Assessment (SIA) in South Africa and explain the relationships between SIA and EIA.
- Understand the role of public participation and stakeholder engagement in environmental decision-making processes.
- Discuss the key concepts and associated terminology relative to impact mitigation, environmental management plans and management systems, describe what process can be followed to develop and generate an EMP and relate the associated success factors.
- Understand the role of environmental monitoring and auditing in environmental impact management.
- Define the key terminology related to risk assessment, differentiate between true and perceived risks, discuss and explain the nature, purpose, objectives and methods of risk assessment and to determine the significance probability and severity associated with risks. In addition to

ascertain the importance of risk assessment in relation to Environmental Impact Assessment (EIA).
- Review and apply quality assurance measures in environmental assessments and EIAs in particular
- Construct two logical, coherent, argumentative research assignments (essays) which follow the rules and standards of environmental management discourse and display evidence of analysis and synthesis.
- Deliver a power point presentation in seminar form which uses a range of specialized skills to identify, analyse and address complex problems while drawing systematically on the body of knowledge and methods appropriate to environmental management and the presentation of a cooperative group research report relative to a subject of own choice but where emphasis is placed on visual display and oral presentation.

SC.13.9 MASTER OF SCIENCE IN FOOD TECHNOLOGY FTN

Admission requirements
A B Tech in Food Technology or an equivalent qualification at an equivalent standard.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.9.1 FOOD TECHNOLOGY LEVEL 9 (MASTER)

Qualification Code	M2007Q
Module FTN9X18	Dissertation: Food Technology
NQF-level	9
NQF credits	180
Term of presentation	Semester 1
Prerequisites	B Tech or RPL
Purpose	The qualifying student will be able to conduct research under guidance in a chosen field and contribute to knowledge production in that field. The research problem, its justification, process and outcome is reported in a dissertation which complies with the generally accepted norms for research at this level.

Outcomes: On completion of this learning event, the student should be able to:
- Demonstrate knowledge and understanding of the field/area of investigation.
- Apply a range of research methods and techniques appropriately and correctly to investigate, modify and improve or innovate food or food processes.

SC.13.9.2 FOOD TECHNOLOGY LEVEL 9 (MASTER)

Qualification Code	M2007Q
Module FTN9X28	Dissertation: Food Technology
NQF-level	9
NQF credits	180
Term of presentation	Semester 2
Prerequisites	B Tech or RPL
Purpose	The qualifying student will be able to conduct research under guidance in a chosen field and contribute to knowledge production in that field. The research problem, its justification, process and outcome is reported in a dissertation which complies with the generally accepted norms for research at this level.

Outcomes: On completion of this learning event, the student should be able to:
- Demonstrate knowledge and understanding of the field/area of investigation.
- Apply a range of research methods and techniques appropriately and correctly to investigate, modify and improve or innovate food or food processes.

SC.13.10 MASTER IN GEOGRAPHY GGR

For admission to the Master's degree in Geography, a BSc/BA Honours degree in Geography is required. A research dissertation dealing with a topic chosen by the candidate, under the supervisor of his choice, but within the field of specialisation of that supervisor. Approved by the Departmental Head and the Faculty of Science. General rules of admission, as set out by the Faculty of Science and the University, apply.

SC.13.10.1 GEOGRAPHY LEVEL 9 (MASTERS)

Qualification Code	M2015Q (MSc) and M2H45Q (MA)
Module GGR9X18	Geography: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1
Purpose	To enable the student to prepare a research dissertation on an approved research topic in Geography under the supervision of a supervisor, in which the student must prove that he/she can independently conduct original scientific research in Geography.

Outcomes: On completion of this learning event, the student should be able to:

- Identify and formulate a research problem related to the science of Geography.
- Conduct research in this problem independently.
- Prepare a research dissertation according to the requirements of the Department of Geography, Environmental Management and Energy Studies.
- Prepare a publication of his/her research results (or part thereof) for an accredited scientific journal.

SC.13.10.2 GEOGRAPHY LEVEL 9 (MASTERS)

Qualification Code	M2015Q (MSc) and M2H45Q (MA)
Module GGR9X28	Geography: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2
Purpose	To enable the student to prepare a research dissertation on an approved research topic in Geography under the supervision of a supervisor, in which the student must prove that he/she can independently conduct original scientific research in Geography.

Outcomes: On completion of this learning event, the student should be able to:

- Identify and formulate a research problem related to the science of Geography.
- Conduct research in this problem independently.
- Prepare a research dissertation according to the requirements of the Department of Geography, Environmental Management and Energy Studies.
- Prepare a publication of his/her research results (or part thereof) for an accredited scientific journal.

SC.13.11 MASTER OF SCIENCE IN GEOLOGY GLG

A research dissertation dealing with a topic chosen by the candidate under a supervisor of his choice; approved by the Departmental Head and the Faculty of Science. General rules of admission, as set out by the Faculty of Science and the University, apply.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.11.1 GEOLOGY LEVEL 9 (MASTERS)

Qualification Code	M2018Q
Module GLG9X18	Geology: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.11.2 GEOLOGY LEVEL 9 (MASTERS)

Qualification Code	M2018Q
Module GLG9X28	Geology: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.12 MASTER IN INFORMATICS IFM

The Masters study programme comprises a dissertation based on an approved topic. In addition, **a minimum result of 65% in the preceding Honours Degree is required for admission. Furthermore**, the general rules for master's degrees are applicable.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.12.1 INFORMATICS LEVEL 9 (MASTERS)

Qualification Code	M2021Q (MSc) and M2C21Q (MCom)
Module IFM9X18	Informatics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.12.2 INFORMATICS LEVEL 9 (MASTERS)

Qualification Code	M2021Q (MSc) and M2C21Q (MCom)
Module IFM9X28	Informatics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.13 MASTER OF SCIENCE IN INFORMATION TECHNOLOGY IT

The Masters study programme comprises a dissertation based on an approved topic. In addition, **a minimum result of 65% in the preceding Honours Degree is required for admission. Furthermore**, the general rules for master's degrees are applicable.

Rules of Access: An HBS310 Degree (BSc Hons Information Technology)

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.13.1 INFORMATION TECHNOLOGY LEVEL 9 (MASTERS)

Qualification Code	M2013Q
Module IT09X18	Information Technology: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.13.2 INFORMATION TECHNOLOGY LEVEL 9 (MASTERS)

Qualification Code	M2013Q
Module IT09X28	Information Technology: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.14 MASTER OF SCIENCE IN MATHEMATICS MAT

The Masters study programme comprises a dissertation based on an approved topic.

A minimum of 65% for a relevant Honours degree is required for admission, in addition to the approval of the application by the Department.

SC.13.14.1 MATHEMATICS LEVEL 9 (MASTERS)

Qualification Code	M2044Q
Module MAT9X18	Mathematics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.14.2 MATHEMATICS LEVEL 9 (MASTERS)

Qualification Code	M2044Q
Module MAT9X28	Mathematics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.15 MASTER OF SCIENCE IN MATHEMATICAL STATISTICS STA

The Master's degree in Mathematical Statistics (M2047Q) consists of a dissertation, based on an approved topic, chosen in consultation with the Head of the Department. The topic must be beyond the scope of honours level course work and must have a strong theoretical component. The student must demonstrate the ability to understand and record (without plagiarising) advanced topics in mathematical statistics.

Applicants must hold a BSc honours degree with Mathematical Statistics. Acceptance will depend on the completed course work as well as the marks obtained. Students that do not comply with this requirement may be admitted at the discretion of the Head of the Department. Such students may be required to do additional work as prescribed by the Head of the Department.

SC.13.15.1 MATHEMATICAL STATISTICS LEVEL 9 (MASTERS)

Qualification Code	M2047Q
Module STA9X18	Mathematical Statistics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.15.2 MATHEMATICAL STATISTICS LEVEL 8 (MASTERS)

Qualification Code	M2047Q
Module STA9X28	Mathematical Statistics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.16 MASTER OF SCIENCE IN NANOSCIENCE NAN

Admission to the Masters in Nanoscience requires an Honours Degree (or equivalent) in Chemistry, Physics or Biotechnology, with an aggregate final mark of 60% or higher. Admission is subject to approval by the relevant Head of Department and the Faculty of Science.

The coursework Masters in Nanoscience consists of ***six modules*** and a minor dissertation. The three modules Fundamentals of Nanoscience (NAN9X02), Instrumentation in Nanoscience (NAN9X10) and Management and Entrepreneurship (NAN9X09) are compulsory for all students and the remaining three modules are chosen in consultation with the Head of Department. The ratio of the course work modules to the research component is 40:60.

SC.13.16.1 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X81	Nanoscience: Minor Dissertation
NQF Level	9
Credits	90
Presentation	Semester 1
Prerequisites	Completion of coursework modules

Purpose	Through a masters dissertation a student would demonstrate their ability to carry out independent research by mastering the required experimental and technological skills and necessary fieldwork competencies. The dissertation would also demonstrate the students" level of intellectual and theoretical knowledge and insight into the application of nanoscience to solving relevant problems. This would reveal the student's ability in critical reasoning, formulation, analysis and evaluation of relevant literature and the application of methodologies to solving a particular problem. It would also demonstrate reflexive competencies such as innovation, decision making, strategic thinking and organizational abilities.

Outcomes: On completion of this learning event, the student should be able to:

- Define a problem in the relevant discipline. Assemble the relevant and appropriate literature.
- Formulate an appropriate programme to address the problem.
- Generate acceptable results through the use of appropriate methods and technologies.
- Produce the results in a style and terminology appropriate to the discipline.
- Discuss results and formulate conclusions and recommendations.

SC.13.16.2 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X82	Nanoscience: Minor Dissertation
NQF Level	9
Credits	90
Presentation	Semester 2
Prerequisites	Completion of coursework modules
Purpose	Through a master's dissertation a student would demonstrate their ability to carry out independent research by mastering the required experimental and technological skills and necessary fieldwork competencies. The dissertation would also demonstrate the students" level of intellectual and theoretical knowledge and insight into the application of nanoscience to solving relevant problems. This would reveal the student's ability in critical reasoning, formulation, analysis and evaluation of relevant literature and the application of methodologies to solving a particular problem. It would also demonstrate reflexive competencies such as innovation, decision making, strategic thinking and organizational abilities.

Outcomes: On completion of this learning event, the student should be able to:

- Define a problem in the relevant discipline. Assemble the relevant and appropriate literature.
- Formulate an appropriate programme to address the problem.
- Generate acceptable results through the use of appropriate methods and technologies.
- Produce the results in a style and terminology appropriate to the discipline.
- Discuss results and formulate conclusions and recommendations.

SC.13.16.3 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X02	Fundamentals of Nanoscience
NQF Level	9
Credits	6
Presentation	Semester 1
Prerequisites	Hons in Chemistry/Physics/Biotechnology
Purpose	This module introduces concepts in nanoscience, including the history and development of the field especially with respect to "natural nanomaterials" and "engineered nanomaterials". Health and safety considerations are explored, as well as regulations and legislation being developed worldwide, but with a particular focus on the South African context. An overview of where nanoscience is applied, how nanomaterials are constructed via either a top-down or bottom-up approach, and broadly what applications are currently being considered is also part of this module.

Outcomes: On completion of this learning event, the student should be able to:

- Use scientific language to effectively define and describe concepts of nanomaterials, their properties and applications.
- Explain the mechanisms by which the nanomaterials interact with the environment, their safety and health effects on man and his surroundings.
- Critically discuss how nanomaterials are constructed via either a top-down or bottom-up approach,
- Discuss the broad applications of the nanomaterials and their future or potential uses for future technology.

SC.13.16.4 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X03	Fundamentals of Nanochemistry
NQF Level	9
Credits	6
Presentation	Semester 1
Prerequisites	Hons in Chemistry/Physics/Biotechnology
Purpose	This module will be mostly for the benefit of students who did not complete an Honours-level chemistry course. Areas of materials chemistry will be taught, both from Inorganic chemistry and organic chemistry. The focus is mostly on advancing students" knowledge in the theory and practical applications of chemistry, especially as it applies to materials. Aspects of materials characterization, materials synthesis, spectroscopy, electrochemistry, and properties will be explored. An integrated practical would to equip students with laboratory skills in materials chemistry; and report writing in a format similar to that required for scientific articles in a chemistry journal.

Outcomes: On completion of this learning event, the student should be able to:

- Define chemistry concepts that show understanding of structural, bonding, physical and chemical properties of classes of nanomaterials.
- Classify organic and inorganic nanomaterials and identify their various structural aggregations.
- Demonstrate and explain sufficient skills in practical applications of chemistry, especially as it applies to materials.
- Synthese and characterize materials in the areas of spectroscopy, electrochemistry, and properties.
- Use an integrated skills approach in carrying out experiments in material chemistry and report writing in a format similar to that required for scientific articles in a chemistry journal.

SC.13.16.5 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X04	Advanced Nanochemistry
NQF Level	9
Credits	64
Presentation	Semester 2
Prerequisites	Fundamentals of Nanochemistry
Purpose	This is an elective module. The purpose of this module is to advance the students' knowledge in nanoscience from a chemistry perspective. This includes the synthesis, characterization and application of nanomaterials. Various industrially relevant examples will be used throughout the module. It is intended for students whose research topic is in nanochemistry.

Outcomes: On completion of this learning event, the student should be able to:

- Demonstrate advanced knowledge in nanoscience from a chemistry perspective.
- Discuss various industrially relevant examples throughout the module.
- Independently carry out synthesis, characterization and application of nanomaterials with minimal guidance from the module instructor.
- Analyse data and write scientific reports on the data collected during laboratory activities.

SC.13.16.6 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X05	Fundamentals of Nanophysics
NQF Level	9
Credits	6
Presentation	Semester 1
Prerequisites	Hons in Chemistry/Physics/Biotechnology
Purpose	The purpose of this module is to provide students who do not have an Honours-level physics qualification an appreciation of some of the knowledge in this area. Students will be equipped with the skills to analyse interpret and apply scientific laws and methods in quantum mechanics, crystal-field theory, as well as the synthesis and characterization of nanomaterials, including materials used for acoustic, optic, magnetic and electric applications.

Outcomes: On completion of this learning event, the student should be able to:

- Demonstrate acquisition of adequate skills to analyse interpret and apply scientific laws and methods in quantum mechanics and crystal-field theory.
- Carry out laboratory synthesis and characterization of nanomaterials, including materials used for acoustic, optic, magnetic and electric applications.
- Analyse data and write scientific reports on the data collected during laboratory activities.

SC.13.16.7 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X06	Advanced Nanophysics
NQF Level	9
Credits	64
Presentation	Semester 2
Prerequisites	Fundamentals of Nanophysics
Purpose	This is an elective module. The purpose of this module is to advance the students' knowledge in nanoscience from a physics perspective. This includes the synthesis, characterization and application of nanomaterials, with a particular emphasis on the use of physics principles. Various industrially relevant examples will be used throughout the module. It is intended for students whose research topic is in nanophysics.

Outcomes: On completion of this learning event, the student should be able to:

- Demonstrate acquisition of adequate knowledge in nanoscience from a physics perspective
- Discuss various industrially relevant examples throughout the module.
- Carry out synthesis, characterization and application of nanomaterials, with a particular emphasis on the use of physics principles.
- Analyse data and write scientific reports on the data collected during laboratory activities.

SC.13.16.8 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X07	Fundamentals of Nanobiotechnology
NQF Level	9
Credits	6
Presentation	Semester 1
Prerequisites	Hons in Chemistry/Physics/Biotechnology
Purpose	The primary purpose of this module is to serve students who do not have an Honours-level qualification in biochemistry or biotechnology. Since many applications of nanomaterials involve interactions with biological systems, students will learn to integrate aspects of biochemistry with other nanoscience theory and methodology. This module emphasizes the techniques of the biotechnological processes as well as their application in molecular biology.

Outcomes: On completion of this learning event, the student should be able to:

- Define biotechnology concepts that show sufficient understanding of interactions of nanomaterials with biological systems.
- Demonstrate and explain sufficient skills in practical applications of chemistry, especially as it applies to materials.
- Use an integrated approach to demonstrate sufficient skills in understanding of the theory and methodology in biochemistry and other interconnected science modules.
- Carry out experiments in biotechnological processes as well as their application in molecular biology.
- Analyse data and write scientific reports on the data collected during laboratory activities.

SC.13.16.9 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X08	Advanced Nanobiotechnology
NQF Level	9
Credits	64
Presentation	Semester 2
Prerequisites	Fundamentals of Nanobiotechnology
Purpose	This is an elective module. The purpose of this module is to advance the students' knowledge in nanoscience from a biotechnology or biomedical technology perspective. This includes the synthesis, characterization and application of nanomaterials that will be applied in biotechnology. Various industrially relevant examples will be used throughout the module. It is intended for students whose research topic is in nanobiotechnology.

Outcomes: On completion of this learning event, the student should be able to:

- Demonstrate advanced knowledge in nanoscience from a biotechnology or biomedical technology perspective.
- Discuss various industrially relevant examples throughout the module.
- Independently carry out synthesis, characterization and application of nanomaterials with minimal guidance from the module instructor.
- Analyse data and write scientific reports on the data collected during laboratory activities.

SC.13.16.10 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X09	Management and Entrepreneurship
NQF Level	9
Credits	16
Presentation	Semester 1
Prerequisites	Hons in Chemistry/Physics/Biotechnology
Purpose	The primary purpose of this module as an integral part of the MSc Nanoscience programme is firstly to provide students with project management skills and knowledge that would enable them to successfully complete a research project in an area of nanoscience. Secondly this module aims to provide professional nanoscientists who can identify, evaluate and solve problems using the nanoscience tools they acquire throughout the programme. The application of solutions is strongly rooted in a South African context and serves to develop the appropriate competences in entrepreneurship that would enable graduates to take advantage of some of the opportunities in nanoscience and nanotechnology, including opening businesses, operating spin-out companies and exploiting intellectual property.

Outcomes: On completion of this learning event, the student should be able to:

- Use scientific language to effectively define and describe concepts in management and entrepreneurship.
- Demonstrate acquisition of management skills and knowledge that would enable the student to successfully complete a research project in an area of nanoscience.
- Show competence as professional nanoscientists who can identify, evaluate and solve problems using the nanoscience tools acquired throughout the programme.

- Show evidence of appropriate developed competences in entrepreneurship that would enable the student to take advantage of some of the opportunities in nanoscience and nanotechnology.
- Apply acquired skills in a business project planning, show in his/her business plan he/she can operate spin-out companies by exploiting intellectual property.

SC.13.16.11 NANOSCIENCE (COURSEWORK) LEVEL 9 (MASTERS)

Qualification Code	M2058Q
Module NAN9X10	Instrumentation in Nanoscience
NQF Level	9
Credits	16
Presentation	Semester 2
Prerequisites	Fundamentals of Nanoscience
Purpose	The purpose of this module is to expose students to most of the major techniques and pieces of equipment available around the country at universities and science councils for characterizing nanomaterials. Many of these expensive pieces of equipment have been purchased through the National Nanotechnology Equipment Program (NNEP).

Outcomes: On completion of this learning event, the student should be able to:
- Demonstrate by carrying out laboratory experiments that that he/she can characterize nanomaterials using various NNEP instruments such as, SEM, TEM, HRSEM, XRD, AFM, among other instruments that are available in various institutions.
- Analyse data and write scientific reports on the data collected during laboratory activities.

SC.13.17 MASTER OF SCIENCE IN PHYSICS PHY

Awarding of a master's degree in Physics involves successful examination of a written dissertation, based on experimental and/or theoretical work, depending on the nature and topic of the project selected for the degree, subject to approval by the Head of the Department and the Faculty of Science.

The curriculum consists of:
A dissertation and such additional research work as may be prescribed by the Departmental Head.

SC.13.17.1 PHYSICS LEVEL 9 (MASTERS)

Qualification Code	M2012Q
Module PHY9X18	Physics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.17.2 PHYSICS LEVEL 9 (MASTERS)

Qualification Code	M2012Q
Module PHY9X28	Physics: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

MASTER'S DEGREE IN PSYCHOLOGY	PSY

Kindly refer to the Faculty of Humanities Rules and Regulation book for details.

SC.13.18 MASTER OF SCIENCE IN ZOOLOGY (Aquatic Health or Biodiversity Conservation or Zoology)

The Master's degree in Zoology consists of three programmes i.e. Aquatic Health, Biodiversity and Conservation and Zoology. The Masters examination in Zoology normally consists of a dissertation on an approved research topic, based on experimental work approved by the Head of the Department and the Faculty of Science, a manuscript ready for publication and two seminar presentations.

Alternatively, a Tutored Master's degree depending on the nature of the topic, consists of three examination papers (lectured component) that makes up 50% of the final mark and a research project in the form of a minor dissertation (making up the remaining 50% of the credits for the degree). To pass, a student must obtain at least 50% for each of the examination papers as well as the research project, based on a minor dissertation. The research-based minor dissertation makes up the remaining 50% of the final mark (i.e. a weight of 50% of the total course) and has to be passed (i.e. a mark of 50% or more) for the student to pass the degree. In the case of part-time students, the examination may be written in two parts: two papers in the first part and a paper and minor dissertation in the final part. The two parts must be passed within the course of one academic year. Candidates lacking adequate statistical awareness are required to complete a statistics awareness course.

SC.13.18.1 AQUATIC HEALTH RESEARCH DISSERTATION

SC.13.18.1.1 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2055Q
Module AQH9X18	Aquatic Health: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.18.1.2 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2055Q
Module AQH9X28	Aquatic Health: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.18.2 AQUATIC HEALTH (COURSEWORK)

SC.13.18.2.1 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2056Q
Module AQH9X01	Aquatic and estuarine ecology
NQF Level	9
Credits	40
Term of presentation	Semester 1
Prerequisites	A BSc Hons or equivalent 4-year degree in a biological science field, or Equivalent qualifications in environmental sciences for cross-disciplinary studies. Candidates lacking an adequate ecological foundation may be required to complete additional topics as co-requisites during a preliminary year (2-year programme).

Purpose	To develop intellectual competence and practical skills in the analysis, interpretation and evaluation of the structures, functions and assessment practices associated with different freshwater (riverine and wetland) and estuarine ecosystems in South Africa.

Outcomes: On completion of this learning event, the student should be able to:

- Assess the ecology of riverine and wetland ecosystems in South Africa.
- Assess the structure and function of estuarine ecosystems in South Africa.
- Appraise the different methodologies used to monitor health status of freshwater ecosystems in South Africa.

SC.13.18.2.2 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2056Q
Module AQH9X02	Aquatic Resource Management
NQF Level	9
Credits	40
Term of presentation	Semester 1
Prerequisites	A BSc Hons or equivalent 4-year degree in a biological science field, or equivalent qualifications in environmental sciences for cross-disciplinary studies. Candidates lacking an adequate ecological foundation may be required to complete additional topics as co-requisites during a preliminary year (2-year programme).
Purpose	To develop intellectual competence and practical skills in the analysis, interpretation and evaluation of the legal implications and management strategies involved in the integrated resources management of different freshwater (riverine and wetland) ecosystems in South Africa.

Outcomes: On completion of this learning event, the student should be able to:

- Appraise the different South African and international legislation influencing riverine and wetland management in South Africa.
- Assess the water resources management framework in South Africa.
- Evaluate the impact of management strategies in water resources management.

SC.13.18.2.3 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2056Q
Module AQH9X03	Aquatic Pollution and Remediation
NQF Level	9
Credits	40
Term of presentation	Semester 2
Prerequisites	A BSc Hons or equivalent 4-year degree in a biological science field, or equivalent qualifications in environmental sciences for cross-disciplinary studies. Candidates lacking an adequate ecological foundation may be required to complete additional topics as co-requisites during a preliminary year (2-year programme).
Purpose	To develop intellectual competence and practical skills in the analysis, interpretation and evaluation of the chemical and physical factors affecting aquatic ecosystem functioning in South Africa and the strategies employed to carry out remediation of these riverine and wetland ecosystems.

Outcomes: On completion of this learning event, the student should be able to:

- Assess the different factors affecting water quality in South Africa.
- Evaluate the different methods to remediate riverine and wetland ecosystems.

SC.13.18.2.4 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2056Q
Module AQH9X81	Aquatic Health: Minor Dissertation
NQF Level	9
Credits	90
Term of presentation	Semester 1
Prerequisites	A BSc Hons or equivalent 4-year degree in a biological science field, or equivalent qualifications in environmental sciences for cross-disciplinary studies. Candidates lacking an adequate ecological foundation may be required to complete additional topics as co-requisites during a preliminary year (2-year programme).
Purpose	Through a master's minor-dissertation a qualifying student would demonstrate his/her ability to carry out independent research by mastering the required experimental and technological skills and necessary fieldwork competencies. The minor-dissertation would also demonstrate the students' level of intellectual and theoretical knowledge and insight into aquatic health problems and reveal the candidate's ability in critical reasoning, formulation, analysis and evaluation of a specific aquatic health problem. It would finally demonstrate reflexive competencies such as innovation, decision making, strategic thinking and organisational abilities.

Outcomes: On completion of this learning event, the student should be able to:

- Define a problem in the relevant discipline.
- Assemble the relevant and appropriate literature.
- Formulate an appropriate programme to address the problem.
- Generate acceptable results through the use of appropriate methods and technologies.
- Produce the results in a style and terminology appropriate to the discipline.
- Discuss results and formulate conclusions and recommendations.

SC.13.18.2.5 AQUATIC HEALTH LEVEL 9 (MASTERS)

Qualification Code	M2056Q
Module AQH9X82	Aquatic Health: Minor Dissertation
NQF Level	9
Credits	90
Term of presentation	Semester 2
Prerequisites	A BSc Hons or equivalent 4-year degree in a biological science field, or equivalent qualifications in environmental sciences for cross-disciplinary studies. Candidates lacking an adequate ecological foundation may be required to complete additional topics as co-requisites during a preliminary year (2-year programme).
Purpose	Through a masters minor-dissertation a qualifying student would demonstrate his/her ability to carry out independent research by mastering the required experimental and technological skills and necessary fieldwork competencies. The minor-dissertation would also demonstrate the students' level of intellectual and theoretical knowledge and insight into aquatic health problems and reveal the candidate's ability in critical reasoning, formulation, analysis and evaluation of a specific aquatic health problem. It would finally demonstrate reflexive competencies such as innovation, decision making, strategic thinking and organisational abilities.

Outcomes: On completion of this learning event, the student should be able to:

- Define a problem in the relevant discipline.
- Assemble the relevant and appropriate literature.
- Formulate an appropriate programme to address the problem.
- Generate acceptable results through the use of appropriate methods and technologies.
- Produce the results in a style and terminology appropriate to the discipline.
- Discuss results and formulate conclusions and recommendations.

SC.13.18.3 BIODIVERSITY AND CONSERVATION RESEARCH DISSERTATION

SC.13.18.3.1 BIODIVERSITY AND CONSERVATION LEVEL 9 (MASTERS)

Qualification Code	M2053Q
Module BDB9X18	Biodiversity & Conservation: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.18.3.2 BIODIVERSITY AND CONSERVATION LEVEL 9 (MASTERS)

Qualification Code	M2053Q
Module BDB9X28	Biodiversity & Conservation: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

SC.13.18.4 ZOOLOGY RESEARCH DISSERTATION

SC.13.18.4.1 ZOOLOGY LEVEL 9 (MASTERS)

Qualification Code	M2009Q
Module ZOO9X18	Zoology: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 1

SC.13.18.4.2 ZOOLOGY LEVEL 9 (MASTERS)

Qualification Code	M2009Q
Module ZOO9X28	Zoology: Dissertation
NQF Level	9
Credits	180
Presentation	Semester 2

PART 14

SC.14 DOCTORATE IN SCIENCE – LEVEL 10

DOCTORES TECHNOLOGIAE (D TECH) – LEVEL 9

Purpose and characteristics of the programme
The purpose of the doctoral programme is to provide qualifying students with an in-depth understanding and integrated knowledge of advanced applicable theory in the field of specialisation. The D Tech degree in science is a pure science-based research study that requires candidates to demonstrate high-level research capability and make a significant and original academic contribution at the frontiers of the discipline of specialisation. The degree demands a very high level of intellectual, theoretical and practical specialized science knowledge and insight into problems related to the field of study and of the application of advanced experimental methods and techniques of the modern research, as well as of fundamental scientific and academic values in generating, processing, interpreting and presenting research data orally and in written form.

PHILOSOPHIAE DOCTOR (PhD) – LEVEL 10

Purpose and characteristics of the programme

The purpose of the doctoral programme is to provide qualifying students with an in-depth understanding and integrated knowledge of advanced applicable theory in the field of specialisation. A doctoral degree in science is a pure science-based research study that requires candidates to demonstrate high-level research capability and make a significant and original academic contribution at the frontiers of the discipline of specialisation. The degree demands a very high level of intellectual, theoretical and practical specialized science knowledge and insight into problems related to the field of study and of the application of advanced experimental methods and techniques of the modern research, as well as of fundamental scientific and academic values in generating, processing, interpreting and presenting research data orally and in written form.

Exit level outcomes

Students should be able to:
- Apply knowledge, theory and research methodologies and research methods/techniques creatively to complex practical, theoretical and epistemological problems
- Produce substantial, independent, in-depth and publishable work which is judged new and/or innovative by peers and makes a significant contribution to the area of specialisation.
- Operate independently and take full responsibility for their own work and its consequences and also assume significant accountability for the work of others
- Demonstrate intellectual independence, research leadership and management of advanced research and research development in the science area of specialisation
- Demonstrate advanced information retrieval and processing skills, using appropriate Information Communication Technology (ICT)
- Demonstrate a comprehensive, systematic and integrated grasp of the relevant specialist knowledge and expertise at the forefront of the science field and professional area of specialisation
- Demonstrate a critical understanding of the most advanced research methodologies, methods/ techniques and technologies in the discipline/field of specialisation and participate in scholarly debates at the forefront thereof
- Evaluate their own and others' work on the basis of independent criteria
- Present and communicate the results of research and opinion using the full resources of an academic/professional discourse

- Operate autonomously in science specialized, complex, unpredictable or new contexts and identify and address emerging ethical issues
- Use a wide range of complex skills in identifying, conceptualizing, designing and implementing research projects that address complex and challenging problems at the forefront of the discipline/field of specialisation
- Independently undertake a study and evaluate literature/scientific data and current research in the area of specialisation
- Produce a thesis which meets international standards of scholarly/professional writing.

PROGRAMME	DEGREE CODE	SC NR
D TECH BIOTECHNOLOGY *(pipeline only)*	BTN	14.1
D TECH FOOD TECHNOLOGY *(pipeline only)*	FTN	14.2
APPLIED MATHEMATICS	APM	14.3
AQUATIC HEALTH	AQH	14.4
BIOCHEMISTRY	BIC	14.5
BIODIVERSITY AND CONSERVATION	BDB	14.6
BOTANY	BOT	14.7
CHEMISTRY	CEM	14.8
COMPUTER SCIENCE	CSC	14.9
ENERGY STUDIES	ENS	14.10
ENVIRONMENTAL MANAGEMENT	ENM	14.11
GEOGRAPHY	GGR	14.12
GEOLOGY	GLG	14.13
INFORMATICS	IFM	14.14
MATHEMATICS	MAT	14.15
MATHEMATICAL STATISTICS	STA	14.16
PHYSICS	PHY	14.17
PSYCHOLOGY (*Refer to Faculty of Humanities Rules and Regulations book*)		
ZOOLOGY	ZOO	14.18

SC.14.1 DOCTORATE TECHNOLOGY IN BIOTECHNOLOGY BTN

No new intake – programme in process of phasing out

Doctoral studies consist of an original research project to be submitted in the form of a thesis at the end of the study period. The D Tech programme is offered at the Doornfontein Campus.

Please note:

* Admission to the Doctoral programme is subject to approval by the Department.

** This qualification will continue in the interim until the PhD in Biotechnology has been approved in future *(No new intake - Pipeline students only)*

SC.14.1.1 BIOTECHNOLOGY LEVEL 9 (DOCTORATE)

Qualification Code	516-1
Module BTN0119	Thesis: Biotechnology
NQF Level	9 (Not yet HEQF aligned)
Credits	180
Presentation	Semester 1

SC.14.1.2 BIOTECHNOLGY LEVEL 9 (DOCTORATE)

Qualification Code	516-1
Module BTN0129	Thesis: Biotechnology
NQF Level	9 (Not yet HEQF aligned)
Credits	180
Presentation	Semester 2

SC.14.2 DOCTORATE TECHNOLOGY IN FOOD TECHNOLOGY FTN

No new intake – programme in process of phasing out

Doctoral studies consist of an original research project to be submitted in the form of a thesis at the end of the study period. The D Tech programme is offered at the Doornfontein Campus.

Please note:

* Admission to the Doctoral programme is subject to approval by the Department.

** This qualification will continue in the interim until the PhD in Food Technology has been approved in future *(No new intake - Pipeline students only)*

SC.14.2.1 FOOD TECHNOLOGY LEVEL 9 (DOCTORATE)

Qualification Code	522-1
Module FTN0119	Thesis: Food Technology
NQF Level	9 (Not yet HEQF aligned)
Credits	180
Presentation	Semester 1

SC.14.2.2 FOOD TECHNOLGY LEVEL 9 (DOCTORATE)

Qualification Code	522-1
Module FTN0129	Thesis: Food Technology
NQF Level	9 (Not yet HEQF aligned)
Credits	180
Presentation	Semester 2

SC.14.3 DOCTORATE IN APPLIED MATHEMATICS APM

The doctoral study programme comprises a thesis which makes an original contribution to the research field approved for the study.

Please note: Admission to the Doctoral programme is subject to approval by the Department.

SC.14.3.1 APPLIED MATHEMATICS LEVEL 10 (DOCTORATE)

Qualification Code	P2013Q
Module APM10X1	Thesis: Applied Mathematics
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.3.2 APPLIED MATHEMATICS LEVEL 10 (DOCTORATE)

Qualification Code	P2013Q
Module APM10X1	Thesis: Applied Mathematics
NQF Level	9 (Not yet HEQF aligned)
Credits	180
Presentation	Semester 2

SC.14.4 DOCTORATE IN AQUATIC HEALTH AQH

The general regulations for Doctorates apply.

SC.14.4.1 AQUATIC HEALTH LEVEL 10 (DOCTORATE)

Qualification Code	P2019Q
Module AQH10X1	Thesis: Aquatic Health
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.4.2 AQUATIC HEALTH LEVEL 10 (DOCTORATE)

Qualification Code	P2019Q
Module AQH10X2	Thesis: Aquatic Health
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.5 DOCTORATE IN BIOCHEMISTRY BIC

Doctoral studies consist of an original research project to be submitted in the form of a thesis at the end of the study period.

Please note:
Standard entrance requirements for admission to Doctoral studies are subject to approval by the Department. A prospective candidate must have a minimum average mark of at least 65% for the Masters degree, while a motivation by a potential supervisor for a mark of 60-64% will need to be submitted to the Dean for approval. Where the major is not in Biochemistry but relevant to a research field, a motivation by a potential supervisor will need to be submitted to the Dean for approval.

SC.14.5.1 BIOCHEMISTRY LEVEL 10 (DOCTORATE)

Qualification Code	P2001Q
Module BIC10X1	Thesis: Biochemistry
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.5.2 BIOCHEMISTRY LEVEL 10 (DOCTORATE)

Qualification Code	P2001Q
Module BIC10X2	Thesis: Biochemistry
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.6 DOCTORATE IN BIODIVERSITY AND CONSERVATION BDB

The general regulations for Doctorates are applicable.

SC.14.6.1 BIODIVERSITY AND CONSERVATION LEVEL 10 (DOCTORATE)

Qualification Code	P2018Q
Module BDB10X1	Thesis: Biodiversity and Conservation
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.6.2 BIODIVERSITY AND CONSERVATION LEVEL 10 (DOCTORATE)

Qualification Code	P2018Q
Module BDB10X2	Thesis: Biodiversity and Conservation
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.7 DOCTORATE IN BOTANY BOT

A thesis based on original research. The general regulations for Doctoral Degrees are also applicable.

SC.14.7.1 BOTANY LEVEL 10 (DOCTORATE)

Qualification Code	P2009Q
Module BOT10X1	Thesis: Botany
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.7.2 BOTANY LEVEL 10 (DOCTORATE)

Qualification Code	PHD009
Module BOT10X2	Thesis: Botany
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.8 DOCTORATE IN CHEMISTRY CEM

The doctoral study programme comprises a thesis which makes an original contribution to the research field approved for the study.

SC.14.8.1 CHEMISTY LEVEL 10 (DOCTORATE)

Qualification Code	P2002Q
Module CEM10X1	Thesis: Chemistry
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.8.2 CHEMISTRY LEVEL 10 (DOCTORATE)

Qualification Code	P2002Q
Module CEM10X2	Thesis: Chemistry
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.9 DOCTORATE IN COMPUTER SCIENCE CSC

The General Rules for Doctorates are applicable. **In addition, a minimum result of 65% is required for the preceding master's degree.**

SC.14.9.1 COMPUTER SCIENCE LEVEL 10 (DOCTORATE)

Qualification Code	P2010Q
Module CSC10X1	Thesis: Computer Science
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.9.2 COMPUTER SCIENCE LEVEL 10 (DOCTORATE)

Qualification Code	P2010Q
Module CSC10X2	Thesis: Computer Science
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.10 DOCTORATE IN ENERGY STUDIES ENS

Admission to the Doctorate in Energy Studies preferably requires a Masters in Energy Studies, although a student with a master's degree in a related subject, and with appropriate experience in the energy industry, may be considered for admission. General rules of admission, as set out by the Faculty of Science and the University, apply.

A thesis on a suitable subject, chosen after consultation with the Programme Co-ordinator for Energy Studies, is required for the Doctor's Degree. The Degree conferred will be the PhD (Energy Studies).

SC.14.10.1 ENERGY STUDIES LEVEL 10 (DOCTORATE)

Qualification Code	P2022Q
Module ENS10X1	Thesis: Energy Studies
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.10.2 ENERGY STUDIES LEVEL 10 (DOCTORATE)

Qualification Code	P2022Q
Module ENS10X2	Thesis: Energy Studies
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.11 DOCTORATE IN ENVIRONMENTAL MANAGEMENT ENM

For admission to the PhD in Environmental Management a master's degree in Environmental Management is required, although as a result of the interfaculty nature of Environmental Management, another relevant and equivalent master's qualification will also be considered. General rules of admission, as set out by the Faculty of Science and the University, apply.

SC.14.11.1 ENVIRONMENTAL MANAGEMENT LEVEL 10 (DOCTORATE)

Qualification Code	P2020Q
Module ENM10X1	Thesis: Environmental Management
NQF Level	10
Credits	360
Presentation	Semester 1
Purpose	The student, under the supervision of a supervisor, will prepare a thesis based on an approved research topic in Environmental Management and must prove his/her ability to conduct original scientific research in Environmental Management.

Outcomes: On completion of this learning event, the student should be able to:

- Identify and formulate an original research problem related to the science of Environmental Management.
- Conduct original research in this problem independently.
- Prepare a research thesis according to the official requirements of the Department of Geography and Environmental Management.
- Publish his/her research results (or part thereof) in an accredited scientific journal.

SC.14.11.2 ENVIRONMENTAL MANAGEMENT LEVEL 10 (DOCTORATE)

Qualification Code	P2020Q
Module ENM10X2	Thesis: Environmental Management
NQF Level	10
Credits	360
Presentation	Semester 2
Purpose	The student, under the supervision of a supervisor, will prepare a thesis based on an approved research topic in Environmental Management and must prove his/her ability to conduct original scientific research in Environmental Management.

Outcomes: On completion of this learning event, the student should be able to:

- Identify and formulate an original research problem related to the science of Environmental Management.
- Conduct original research in this problem independently.
- Prepare a research thesis according to the official requirements of the Department of Geography and Environmental Management.
- Publish his/her research results (or part thereof) in an accredited scientific journal.

SC.14.12 DOCTORATE IN GEOGRAPHY GGR

For admission to the Doctorate in Geography a master's degree in Geography is required. General rules of admission, as set out by the Faculty of Science and the University, apply.

SC.14.12.1 GEOGRAPHY LEVEL 10 (DOCTORATE)

Qualification Code	P2005Q
Module GGR10X1	Thesis: Geography
NQF Level	10
Credits	360
Presentation	Semester 1
Purpose	In this module the student will prepare a research thesis on an approved research topic in Geography under the supervision of a supervisor, in which the student must prove that he/she can independently conduct original scientific research in Geography and publish the results in an accredited scientific journal. An original contribution to knowledge in Geography needs to be made.

Outcomes: On completion of this learning event, the student should be able to:

- Identify and formulate an original research problem related to the science of Geography.
- Conduct original research on this research problem independently.
- Prepare a research thesis according to the official requirements of the Department of Geography and Environmental Management.
- Publish his/her research results (or part thereof) in an accredited scientific journal.

SC.14.12.2 GEOGRAPHY LEVEL 10 (DOCTORATE)

Qualification Code	P2005Q
Module GGR10X2	Thesis: Geography
NQF Level	10
Credits	360
Presentation	Semester 2
Purpose	In this module the student will prepare a research thesis on an approved research topic in Geography under the supervision of a supervisor, in which the student must prove that he/she can independently conduct original scientific research in Geography, and publish the results in an accredited scientific journal. An original contribution to knowledge in Geography needs to be made.

Outcomes: On completion of this learning event, the student should be able to:

- Identify and formulate an original research problem related to the science of Geography.
- Conduct original research on this research problem independently.
- Prepare a research thesis according to the official requirements of the Department of Geography and Environmental Management.
- Publish his/her research results (or part thereof) in an accredited scientific journal.

SC.14.13 DOCTORATE IN GEOLOGY GLG

A thesis on a basic geological or earth science problem under a promoter of the student's choice; approved by the Departmental Head and the Faculty of Science.
General rules of admission, as set out by the Faculty of Science and the University, apply.

SC.14.13.1 GEOLOGY LEVEL 10 (DOCTORATE)

Qualification Code	P2006Q
Module GLG10X1	Thesis: Geology
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.13.2 GEOLOGY LEVEL 10 (DOCTORATE)

Qualification Code	P2006Q
Module GLG10X2	Thesis: Geology
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.14 DOCTORATE IN INFORMATICS IFM

The General Rules for Doctorates are applicable. **In addition, a minimum result of 65% is required for the preceding master's degree.**

SC.14.14.1 INFORMATICS LEVEL 10 (DOCTORATE)

Qualification Code	P2007Q
Module IFM10X1	Thesis: Informatics
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.14.2 INFORMATICS LEVEL 10 (DOCTORATE)

Qualification Code	P2007Q
Module IFM10X2	Thesis: Informatics
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.15 DOCTORATE IN MATHEMATICS MAT

The doctoral study programme comprises a thesis which makes an original contribution to the research field approved for the study.

Please note: Admission to the Doctoral programme is subject to approval by the Department, in addition to a minimum result of 65% for a relevant master's degree.

SC.14.15.1 MATHEMATICS LEVEL 10 (DOCTORATE)

Qualification Code	P2014Q
Module MAT10X1	Thesis: Mathematics
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.15.2 MATHEMATICS LEVEL 10 (DOCTORATE)

Qualification Code	P2014Q
Module MAT10X2	Thesis: Mathematics
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.16 DOCTORATE IN MATHEMATICAL STATISTICS STA

The general regulations for Doctorates are applicable.

SC.14.16.1 MATHEMATICAL STATISTICS LEVEL 10 (DOCTORATE)

Qualification Code	P2015Q
Module STA10X1	Thesis: Mathematical Statistics
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.16.2 MATHEMATICAL STATISTICS LEVEL 10 (DOCTORATE)

Qualification Code	P2015Q
Module STA10X2	Thesis: Mathematical Statistics
NQF Level	10
Credits	360
Presentation	Semester 2

SC.14.17 DOCTORATE IN PHYSICS PHY

The general regulations for Doctorate degrees are applicable.

SC.14.17.1 PHYSICS LEVEL 10 (DOCTORATE)

Qualification Code	P2004Q
Module PHY10X1	Thesis: Physics
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.17.2 PHYSICS LEVEL 10 (DOCTORATE)

Qualification Code	P2004Q
Module PHY10X2	Thesis: Physics
NQF Level	10
Credits	360
Presentation	Semester 2

DOCTORATE IN PSYCHOLOGY

Please refer to the Faculty of Humanities Rules and Regulations book for detail on this programme.

SC.14.18 DOCTORATE IN ZOOLOGY ZOO

The general regulations for Doctorates are applicable.

SC.14.18.1 ZOOLOGY LEVEL 10 (DOCTORATE)

Qualification Code	P2003Q
Module ZOO10X1	Thesis: Zoology
NQF Level	10
Credits	360
Presentation	Semester 1

SC.14.18.2 ZOOLOGY LEVEL 10 (DOCTORATE)

Qualification Code	P2003Q
Module ZOO10X2	Thesis: Zoology
NQF Level	10
Credits	360
Presentation	Semester 2

PART 15

SC.15 MODULES OFFERED TO OTHER FACULTIES BY THE FACULTY OF SCIENCE

SC.15.1 CHEMISTRY LEVEL 8 (HONOURS)

Qualification Code	H6CE0Q
Module CEM8X80	Advanced Chemistry
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	Bachelor's degree or equivalent at NQF level 7
Purpose	The purpose of this module is to provide students with common analytical and characterization skills to enable them to use these techniques in their experimental research.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Evaluate Spectroscopic techniques: IR, UV; XRD, XRF.
- Critically evaluate thermal analysis: TGA, DSC.
- Critically evaluate Microscopic analysis: TEM, SEM.
- Correctly compare Liquid and gas analysis techniques.

SC.15.2 CHEMISTRY LEVEL 8 (HONOURS)

Qualification Code	H6MT0Q
Module CEM8X81	Advanced Physical Chemistry
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	Bachelor's degree or equivalent at NQF level 7
Purpose	This module will provide insight into the fundamental behaviour of chemical systems and materials. This unit gives students an advanced understanding of the properties and characteristics of solids, liquids and gases. The course follows a natural progression from atomic and molecular properties at a single atom or bond level through key thermodynamics to the properties of chemical systems.

Module learning outcomes: On completion of this learning event, the student should be able to:

- Differentiate correctly the properties and characteristics of solids, liquids and gases.
- Utilise the computation of individual atoms and bonds.
- Understand colloids and surfactants relevant to minerals.
- Illustrate the viscosity, phase behaviour and the interactions between solids and liquids.
- Apply thermodynamics laws.
- Discuss and apply phase and chemical equilibrium and change of state of matter.

SC.15.3 PHYSICS LEVEL 8 (HONOURS)

Qualification Code	H6MS0Q, H6EL0Q, H6IN0Q, H6ME0Q
Module PHE8X80	Energy Physics
NQF Level	8
Credits	14
Presentation	Semester 1
Prerequisites	Bachelor's degree or equivalent at NQF level 7
Purpose	This module will provide students with conceptual and practical understanding of the production, conversion, storage, and transmission of energy in various forms.

Module learning outcomes: On completion of this learning event, students should be able to:

- Understand and analyse various forms of energy generation transmission and conversion from nuclear, hydroelectric, geothermal, solar, fossil fuel, bio-fuel and fuel cell's perspective.
- Calculate and explain energy loss and efficiency in various contexts.
- Critically analyse various energy generation, storage and distribution of electricity and other forms of energy.

SC.15.4 ENVIRONMENTAL MANAGEMENT - LEVEL 9 (MASTERS)

Qualification Code	M6MUPQ – Master in Sustainable Urban Planning & Development
Module UEPG029	Urban Environmental Planning & GIS Applications
NQF Level	9
Credits	15
Presentation	Semester 2
Prerequisites	-
Purpose	The purpose of this module is to introduce and enable the master's students to comprehend the concept of environmental policy and theory and how GIS and ICT can be used in environmental planning.

Outcomes: On completion of this learning event, the student should be able to:

- Comprehend the basic concepts of environment and environmental planning
- research and its methodologies,
- Apply and comprehend SDGs in urban planning
- Apply GIS and other techniques in environmental planning
- Define climate change and devise a climate change mitigation and adaptation plan
- appropriate research topics,
- Prepare an environmental plan or strategy
- Utilize public participation techniques in environmental planning
- Collect environmental data
- Carry out basic to advanced GIS techniques in environmental planning

PART 16

SC.16 ACADEMIC AWARDS AND PRIZES FOR OUTSTANDING ACHIEVEMENTS IN THE FACULTY OF SCIENCE

Awarded by	Award	Awarded to
Faculty of Science	Faculty of Science Honours Award	Top Honours Graduate in the Faculty of Science
Faculty of Science	S_2A_3 (Southern Africa Association for the Advancement of Science)	Awarded every second year to a master's student who has made exceptional contributions to the advancement of science
Faculty of Science	Chancellor's Medal	Master student for the most meritorious study
Applied Mathematics	Applied Mathematics Merit Award	Best Applied Mathematics Honours Student
Biochemistry	Shimadzu	Top Honours student
	Inqaba Biotec	Top Masters student
Botany	Robb Wood Floating Trophy	Top Post Graduate student
	Lennon Gold Medal for Honours	For best presentation
	Lennon Gold Medal for MSc	For best presentation
	Lennon Gold Medal for PhD	For best presentation
Academy of Computer Science and Software Engineering	Award	Top 3 Honours projects
	Award	Top Masters Dissertation
Geography, Environmental Management and Energy Studies	Absa Award	Top Honours student in Geography
	Terence Payne Memorial Trophy and Medal	Top Masters student in Environmental Management
Geology	Geology Merit Awards	Best achievement in Geology Honours
Mathematics	Mathematics Merit Award	Best Pure Mathematics Honours Student
Physics	Departmental Award	Best Overall Academic Achievement over 75% for students continuing their studies towards BSc Honours in Physics at UJ
Zoology	Merit Award Zoological Society of Southern Africa	Top 3rd year and Honours student in Zoology (criteria set by the Zoological Society of Southern Africa)
	HOD Award	Best project presentation by Honours student
	Juan Heyns Certificate	Best proposal and results presentation by MSc and PhD students of that year
	Schoonbee medal	Best Masters or Doctoral thesis in Zoology in the previous year

PART 17

BACHELOR OF SCIENCE HONOURS (BSC HONS)

QUALIFICATION CODE	DESCRIPTION
H2001Q	APPLIED MATHEMATICS *(phasing out)*
H2023Q	APPLIED MATHEMATICS
H2002Q	BIOCHEMISTRY
H2003Q	BOTANY
H2004Q	CHEMISTRY
H2005Q	COMPUTER SCIENCE
H2018Q	COMPUTER SCIENCE specializing in ARTIFICIAL INTELLIGENCE
H2019Q	COMPUTER SCIENCE specializing in CYBER SECURITY
H2006Q	ENERGY STUDIES
H2007Q	GEOGRAPHY
H2008Q	GEOLOGY
H2009Q	INFORMATICS
H2010Q	INFORMATION TECHNOLOGY
H2016Q	MATHEMATICS *(phasing out)*
H2020Q	MATHEMATICS
H2012Q	MATHEMATICAL STATISTICS
H2013Q	PHYSICS
H2021Q	PHYSIOLOGY
H2022Q	ZOOLOGY

BACHELOR OF ARTS HONOURS (BA HONS)

QUALIFICATION CODE	DESCRIPTION
H2H15Q	GEOGRAPHY

BACHELOR OF COMMERCE HONOURS (BCOM HONS)

QUALIFICATION CODE	DESCRIPTION
H2C07Q	INFORMATICS

MASTER OF PHILOSOPHY

QUALIFICATION CODE	DESCRIPTION
M2201Q	CHEMISTRY (DISSERTATION)
M2203Q	MATHEMATICS (DISSERTATION)
M2205Q	ENERGY STUDIES (DISSERTATION)
M2211Q	ENVIRONMENTAL MANAGEMENT (LECTURED)

MASTER OF SCIENCE

QUALIFICATION CODE	DESCRIPTION
M2005Q	APPLIED CHEMISTRY (DISSERTATION) (*phasing out*)
M2040Q	APPLIED MATHEMATICS (LECTURED)
M2041Q	APPLIED MATHEMATICS (DISSERTATION)
M2055Q	AQUATIC HEALTH (DISSERTATION)
M2056Q	AQUATIC HEALTH (LECTURED)
M2003Q	BIOCHEMISTRY (DISSERTATION)
M2053Q	BIODIVERSITY AND CONSERVATION (DISSERTATION)
M2004Q	BIOTECHNOLOGY (DISSERTATION)

QUALIFICATION CODE	DESCRIPTION
M2029Q	BOTANY (DISSERTATION)
M2006Q	CHEMISTRY (DISSERTATION)
M2032Q	COMPUTER SCIENCE (DISSERTATION)
M2016Q	ENVIRONMENTAL MANAGEMENT (LECTURED)
M2007Q	FOOD TECHNOLOGY (DISSERTATION)
M2015Q	GEOGRAPHY (DISSERTATION)
M2018Q	GEOLOGY (DISSERTATION)
M2013Q	INFORMATION TECHNOLOGY (DISSERTATION)
M2021Q	INFORMATICS (DISSERTATION)
M2044Q	MATHEMATICS (DISSERTATION)
M2058Q	NANOSCIENCE (LECTURED)
M2012Q	PHYSICS (DISSERTATION)
M2009Q	ZOOLOGY (DISSERTATION)
02MPRP	PRE/POST REGIS: M THESIS/DISS: SCIENCE

MASTER OF ARTS (MA)

QUALIFICATION CODE	DESCRIPTION
M2H45Q	GEOGRAPHY (DISSERTATION)
M2H68Q	ENVIRONMENTAL MANAGEMENT (LECTURED)

MASTER OF COMMERCE (M COM)

QUALIFICATION CODE	DESCRIPTION
M2C21Q	INFORMATICS (DISSERTATION)

MASTER'S DEGREE

QUALIFICATION CODE	DESCRIPTION
M6MUPQ	SUSTAINABLE URBAN PLANNING & DEVELOPMENT (LECTURED) *(Refer to Faculty of Engineering and the Built Environment)*

DOCTORES TECHNOLOGIAE (D TECH)

QUALIFICATION CODE	DESCRIPTION
516-1	D Tech Biotechnology *(phasing out)*
522-1	D Tech Food Technology *(phasing out)*

PHILOSOPHIAE DOCTOR (PHD)

QUALIFICATION CODE	DESCRIPTION
P2001Q	BIOCHEMISTRY
P2002Q	CHEMISTRY
P2003Q	ZOOLOGY
P2004Q	PHYSICS
P2005Q	GEOGRAPHY
P2006Q	GEOLOGY
P2007Q	INFORMATICS
P2009Q	BOTANY
P2010Q	COMPUTER SCIENCE
P2013Q	APPLIED MATHEMATICS
P2014Q	MATHEMATICS
P2015Q	MATHEMATICAL STATISTICS
P2018Q	BIODIVERSITY AND CONSERVATION
P2019Q	AQUATIC HEALTH
P2020Q	ENVIRONMENTAL MANAGEMENT
P2022Q	ENERGY STUDIES
02PRER/02PREG	PRE/POST REGIS: D THESIS/DISS: SCIENCE
NNG002	NON-DEGREE PURPOSES (POSTGRADUATE)

PART 18

SC.18 IMPORTANT REGULATIONS REGARDING SUBMISSION OF MINOR DISSERTATIONS/ DISSERTATIONS/ THESES

ACADEMIC REGULATIONS APPLICABLE TO MASTER'S DEGREES (refer to A-Regulation 15)

ACADEMIC REGULATIONS APPLICABLE TO DOCTORAL DEGREES (refer to A-Regulation 16)

SUBMISSION OF FINAL COPIES FOR FINAL ASSESSMENT
Examination copies may be submitted at any time during the year, with the reservation that, students who submit later than 31 October (in view of the autumn graduation ceremony) and 31 May (in view of the spring graduation ceremony), cannot be guaranteed that the assessment will be finalized before the following graduation ceremony.

NUMBER OP COPIES
Final Assessment
Submitted copies must be ring-bound. One copy is required for each assessor together with a CD in PDF format for the Faculty Officer: Post Graduate Studies.
For a minor dissertation or dissertation two copies will be required and for a thesis, three copies.

Submission of final copies
Final copies to be submitted to the Faculty on a CD.
If bound, the final copies must be bound in mock leather with the title page as per examples that follow below. The affidavit must be bound into the final copy after the title page. The title of the minor dissertation/ dissertation/ thesis and the candidate's initials and surname are printed in either gold or silver lettering on the cover and spine of the relevant copy.

ABSTRACT
A summary of not more than 500 words, in which the problems, the most important methods followed, and the most important results obtained, must be included in the bound copy after the affidavit of every minor dissertation/ dissertation/ thesis.

DECLARATION
The final declaration form should include the following sentence:
"***I hereby declare that the minor dissertation/ dissertation/ thesis submitted for the degree to the University of Johannesburg apart from the help recognised, is my own work and has not been formerly submitted to another university for a degree"***.

The final declaration form should be signed by the student, supervisor and co-supervisors at the stage when the student completed his/her final corrections and is ready to submit for graduation.

PRINTING
- The copies of the minor dissertation/ dissertation/ thesis must be of a high print quality.
- Any typing or printing is acceptable as long as it is clearly legible and can be reproduced.
- Arial font 10 in double spacing is advisable.
- A paper size of A4 is acceptable.
- Printing may be done on both sides as long as the printing does not show through.

TITLE PAGE
The following are examples of the prescribed title pages for a minor dissertation/ dissertation/ thesis.

INDUCED SYSTEMATIC RESISTANCE IN WHEAT AFTER POTASSIUM PHOSPHATE TREATMENT

By

CARLA MAGNOLIA PILLAY

MINOR DISSERTATION

Submitted in partial fulfilment of the requirements for the degree

MASTER IN BOTANY

at the

UNIVERSITY OF JOHANNESBURG

OCTOBER 2020

SUPERVISOR: DR E VENTER

CO-SUPERVISOR: PROF M OBERHOLSER

INDUCED SYSTEMATIC RESISTANCE IN WHEAT AFTER POTASSIUM PHOSPHATE TREATMENT

By

CHANE VIRGINIA ANSOOR

DISSERTATION

Submitted in fulfilment of the requirements for the degree

MASTER IN CHEMISTRY

at the

UNIVERSITY OF JOHANNESBURG

OCTOBER 2018

SUPERVISOR: DR E ROODT

CO-SUPERVISOR: PROF AM OBERHOLZER

CONSERVATION OF SOUTH AFRICAN TORTOISES WITH EMPHASIS ON THEIR APICOMPLEXAN HAEMATOZOANS, AS WELL AS BIOLOGICAL AND METAL-FINGERPRINTING OF CAPTIVE INDIVIDUALS

By

WHITNEY ANE BROOKE

THESIS

Submitted in fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR

in

ZOOLOGY

at the

UNIVERSITY OF JOHANNESBURG

OCTOBER 2018

SUPERVISOR: PROF NP SMIT

CO-SUPERVISOR: PROF A WILKIN

CO-SUPERVISOR: PROF AJ DAVIES