POTCHEFSTROOM CAMPUS

NATURAL SCIENCES

POSTGRADUATE PROGRAMMES

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PLEASE MENTION YOUR UNIVERSITY NUMBER IN ALL CORRESPONDENCE.

The **General Academic Rules** of the University, to which all students have to subject themselves and which apply to all the qualifications offered by the University, appear in a separate publication and are available on the web page at:

http://www.nwu.ac.za/sites/www.nwu.ac.za/files/files/i-governance-management/policy/7P-Arules2015_e.pdf

Yearbook available on the web page at: http://www.nwu.ac.za/e-yearbook-index

Please note: Although the information in this Calendar has been compiled with the utmost care and accuracy, the Council and the Senate of the University accept no responsibility whatsoever for errors that may occur. Before students finally decide on the selection of modules, they must consult the class timetable. If a clash occurs in the planned selection of a student, the relevant module combination is not permitted.

Warning against plagiarism: Assignments are individual tasks and not group activities (unless explicitly indicated as group activities).

http://www.nwu.ac.za/content/policy_rules

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Compiled by Mrs H Swart
Administrative Manager, Faculty of Natural Sciences
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FACULTY OF NATURAL SCIENCES

OFFICIALS

DEAN
Prof JJ Pienaar, HED, DSc (PU for CHE)

SCHOOL DIRECTORS

School of Biological Sciences
Prof V Wepener, PhD (RAU)

School of Geo- and Spatial Sciences
Prof S J Piketh, PhD (University of the Witwatersrand, Johannesburg)

School of Physical and Chemical Sciences
Prof CA Strydom, Pr Sci Nat, PhD (UP)

School of Computer, Statistical and Mathematical Sciences
Prof GJ Groenewald, Hons BSc (UWK), MSc (Univ of Illinois at Urbana-Champaign), MSc (UK), PhD (Vrije Univ at Amsterdam)

RESEARCH DIRECTORS and CENTRE DIRECTORS

Centre for Business Mathematics and Informatics
Prof PJ de Jongh, BCom (US), MSc (UNISA), PhD (UCT)

Centre for Environmental Management
Prof JG Nel, BA (Ed), Hons BA (UPE), MA (UPE)

Centre for Human Metabolomics
Prof BC Vorster, MMed (Chem Paths), (UP)

Centre for Space Research (Centre of Excellence)
Prof SES Ferreira, PhD (PU for CHE)

Centre for Water Science and Management
Prof I Dennis, PhD (UFS)

Focus Area for Chemical Resource Beneficiation
Prof HCM Vosloo, Hons BSc (UOFS), PhD (PU for CHE), HED (UOFS)

Focus Area for Human Metabolomics
Prof DT Loots, PhD (NWU)

Unit for Business Mathematics and Informatics
Prof HM Huisman, BSc (PU for CHE), Hons BSc (PU for CHE), MSc (PU for CHE), PhD (PU for CHE)

Unit for Environmental Sciences and Management
Prof N Smit , PhD (UOFS)

ADMINISTRATIVE MANAGER
Mrs H Swart, BBibl (UNISA)

SUBJECT CHAIRPERSONS

Biochemistry
Dr R Louw, PhD Biochemistry (NWU)

Botany
Prof SJ Siebert, PhD (UP)

Centre for Business Mathematics and Informatics: Professional Programs
Ms J Larney, BSc Actuarial Science (US), Post Graduate Diploma Actuarial Science (UCT), FASSA, FIA, CERA

Chemistry
Prof JP Beukes MSc (PU for CHE), PhD Chemistry (PU for CHE)

Computer Sciences and Information Systems
Dr E Taylor, PhD (NWU), HED(N) (PU for CHE)

Geography and Environmental Management
Dr J-A Wessels, BSc (PU for CHE), PhD (NWU)

Geology
Prof MS Coetzee, Pr Sci Nat, PhD (UFS)

Mathematics and Applied Mathematics
Dr EHA Venter, MSc (UP), PhD (PU for CHE)

Microbiology
Dr S Claassens, PhD (NWU)

Physics
Prof C Venter BSc (PU vir CHO), MSc (NWU), PhD (NWU)

Statistics and Operational Research
Dr L Santana, PhD (NWU)

Urban and Regional Planning
Dr JE Drewes, Pr Pln (A/817/1995), PhD (Urban and Regional Planning) [PU for CHE]

Zoology
Prof MS Maboeta, PhD (US)

FACULTY BOARD

The Faculty board is composed of the following members:

- The Dean
- School/Centre/Research directors
- Full Professors
- Subject group chairpersons
- A student representative from each School
- Two representatives from the designated groups from each School
- A representative from the Faculty of Economic and Management Sciences, Health Sciences, Engineering and Education Sciences
- Administrative Manager

N.1 RULES: FACULTY OF NATURAL SCIENCES

N.1.1 INTRODUCTION

N.1.1.1 Authority of the General Academic Rules (A-Rules)

The faculty rules that apply to the different programmes of the Faculty of Natural Sciences and are included in this calendar of the Faculty are subject to the General Academic Rules of North West University, as determined by the Council of North West University from time to time, and therefore the faculty rules have to be read together with the General Academic Rules (hence referred to as General Rule(s)).

http://www.nwu.ac.za/sites/www.nwu.ac.za/files/files/i-governance-management/policy/7P-Arules2015_e.pdf

N.1.2 SCHOOLS, CENTRES AND RESEARCH ENTITIES IN THE FACULTY

The Faculty of Natural Sciences consists of four schools and one centre, of which each one is made up of one or more subject groups. At the head of each school is a director and he/she is assisted by the subject chairpersons, one of each from the various subject groups. The schools are responsible for teaching graduate, honours and lectured master's programmes. These schools, centre as well as the subjects groups that make up each school are represented in the following table:

SCHOOL/CENTRE	SUBJECT GROUP
Biological Sciences	Botany Microbiology Zoology
Physical and Chemical Sciences	Biochemistry Chemistry Physics
Geo- and Spatial Sciences	Geography and Environmental Management Geology Urban and Regional Planning
Computer, Statistical and Mathematical Sciences	Computer Science and Information Systems Statistics and Operational Research Mathematics and Applied Mathematics
Centre for Business Mathematics and Informatics	Actuarial Science Data Mining (Hons BSc); Business Analytics (MSc) Financial Mathematics Quantitative Risk Management Risk Analysis

Research in the Faculty is managed in research entities The research entities are further responsible for the master's (MSc) and doctorate (PhD) training programmes, i.e. programmes that contain a significant research component.

The Faculty consists of the following Research Entities and Centres:

a) Centre for Business Mathematics and Informatics
b) Centre of Excellence in Space Research
c) Centre for Environmental Management (CEM)
d) Centre for Human Metabolomics
e) Centre for Water Science and Management
f) Research Focus Area for Chemical Resource Beneficiation
g) Focus Area for Human Metabolomics
h) Unit for Business Mathematics and Informatics
i) Unit for Environmental Sciences and Management

N.1.3 QUALIFICATIONS, PROGRAMMES AND CURRICULA

Different qualifications (degrees) may be taken in the Faculty of Natural Sciences. A specific qualification may be taken in one or more different programmes (the term *programme* indicates a specific direction of study), and in each programme one or more curricula are available.

NB: Lectures for lectured honours and master's modules are with one exception presented full-time only. The only exception is the lectured modules of N824P for the Master's in Environmental Sciences degree. Lectures for these modules are presented after hours only.

N.1.3.1 Re-curriculation of qualifications and programmes to adhere to HEQSF requirements

Please note that the Faculty is in the process of re-curriculating its qualifications and linked programmes over a 2 year time frame as managed by the institutional HEQSF-alignment project team. While a number of qualifictions and programmes have been HEQSF-aligned during 2016 and are included in the 2017 yearbook, many of the qualifications and programmes in need of more extensive re-curriculation will only be attended to during 2017, with a view to include them in the 2018 yearbook. A table indicating the old qualification-programme vs new qualification-programme codes is therefore included for purposes of elucidation. Only **first year students** will be registered on the new qualification-programme codes and names in 2017, while senior students will be registered on the old codes and names as was also indicated in the 2016 yearbook.

QUALIFICATION NAME	WITH specialisation	NEW Qualification and Curriculum code as from 2017	OLD Qualification and Curriculum code
HONOURS DEGREES			
Bachelor of Science Honours in Environmental Sciences	**Ecological Interactions and Ecosystem Resillience**	**2DM L01**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Biodiversity and Conservation Ecology**	**2DM L02**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Aquatic Ecosystem Health**	**2DM L03**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Integrated Pest Management**	**2DM L04**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Environmental Geology**	**2DM L05**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Hydrology**	**2DM L06**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Geography and Environmental Management**	**2DM L07**	**202 124**
Bachelor of Science Honours in Environmental Sciences	**Waste Management**	**2DM L08**	**202 124**
Bachelor of Science Honours in Quantitative Risk Management		**2DP L01**	**202 127**
Bachelor of Science Honours in Financial Mathematics		**2DQ L01**	**202 128**

Bachelor of Science Honours in Biochemistry		**2DW L01**	**202 156**
MASTERS DEGREES			
Master of Science in Urban and Regional Planning		**2DH N01**	**119102**
Master of Science in Environmental Sciences	**Disaster Risk Science**	**2CT N07**	**195100**
Master of Science in Chemistry		**2CN P01**	**203123**
Master of Science in Astrophysical Sciences		**2CQ P01**	**203128**
Master of Science in Astrophysics and Space Science		**2CR P01**	**203128**
Master of Science in Environmental Sciences	**Atmospheric Chemistry**	**2CT N03**	**203133**
Master of Science in Natural Science Teaching		**2CU N01**	**203134**
Master of Science in Mathematical Statistics		**2CY P01**	**203156**
Master of Science in Zoology		**2DD N01**	**203190**
Master of Science in Microbiology		**2DE N01**	**203191**
Master of Science in Botany		**2DF N01**	**203192**
Master of Science in Geography and Environmental Management		**2DG N01**	**203193**

Master of Science in Environmental Sciences	**Hydrology and Geohydrology**	**2CT N04**	**203194**
Master of Science in Environmental Sciences		**2CT N02**	**203194**
Master of Science in Environmental Sciences	**Mining Hydrology**	**2CT N06**	**203194**
Master of Science in Environmental Sciences	**Integrated Pest Management**	**2CT N05**	**203194**
Master of Environmental Management		**2CD P01**	**218106**
Master of Science in Agricultural Economics		**2CG N01**	**277103**
DOCTORS DEGREES			
Doctor of Philosophy in Science	**Disaster Risk Science**	**2CC R14**	**104119**
Doctor of Philosophy in Science	**Urban and Regional Planning**	**2CC R07**	**204105**
Doctor of Philosophy in Science	**Business Mathematics**	**2CC R01**	**204111**
Doctor of Philosophy in Science	**Environmental Sciences**	**2CC R04**	**204114**
Doctor of Philosophy in Science	**Atmospheric Chemistry**	**2CC R05**	**204114**
Doctor of Philosophy in Science	**Hydrology and Geohydrology**	**2CC R06**	**204114**
Doctor of Philosophy in Science	**Biochemistry**	**2CC R08**	**204116**
Doctor of Philosophy in Science	**Natural Sciences Education**	**2CC R09**	**204118**

Doctor of Philosophy in Science	**Chemistry**	**2CC R11**	**204120**
Doctor of Philosophy in Agriculture	**Agricultural Economics**	**2EA R03**	**204128**
Doctor of Philosophy in Computer and Information Sciences	**Information Technology**	**2CB R01**	**204130/132 506 114**
Doctor of Philosophy in Science	**Risk Analysis**	**2CC R15**	**204133**
Doctor of Philosophy in Science	**Botany**	**2CC R16**	**204134**
Doctor of Philosophy in Science	**Microbiology**	**2CC R17**	**204135**
Doctor of Philosophy in Science	**Zoology**	**2CC R18**	**204136**
Doctor of Philosophy in Science	**Geography and Environmental Management**	**2CC R19**	**204137**
Doctor of Philosophy in Science	**Statistics**	**2CC R20**	**204138/506115**

N.1.3.2 Degrees qualifications

North West University is authorised to award a number of postgraduate degrees in the Faculty of Natural Sciences. These degrees are not necessarily presented in all subjects and also not necessarily full-time and/or part-time in all subjects. They are:

Qualification; Abbreviation	Programme WITH	Qualification/ Curriculum Codes
Hons BSc **Bachelor of Science Honours in Biochemistry**		**2DW L01** **N601P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Chemistry**	**202117**
	Chemistry	**N651P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Physics**	**202121**
	Physics	**N652P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Computer Science and Information Systems**	**202134**
	Computer Science and Information Systems	**N653P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Statistics**	**202135**
	Statistics	**N654P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Applied Mathematics**	**202136**
	Applied Mathematics	**N601P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Mathematics**	**202137**
	Mathematics	**N601P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Actuarial Science**	**202126**
	Actuarial Science (following on BSc N137P)	**N609P**
Hons BSc **Bachelor of Science Honours in Quantitative Risk Management**		**2DP L01** **N601P**
Hons BSc **Bachelor of Science Honours in Financial Mathematics**		**2DQ L01** **N601P**
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Data Mining**	**202129**
	Data Mining (following on BSc N134P, N136P)	**N612P**

Qualification; Abbreviation	Programme WITH	Qualification/ Curriculum Codes
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Ecological Interactions and Ecosystem Resillience**	**2DM L01** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Biodiversity and Conservation Ecology**	**2DM L02** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Aquatic Ecosystem Health**	**2DM L03** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Integrated Pest Management**	**2DM L04** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Environmental Geology**	**2DM L05** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Hydrology**	**2DM L06** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Geography and Environmental Management**	**2DM L07** **N601P**
Hons BSc **Bachelor of Science Honours in Environmental Sciences**	**Waste Management**	**2DM L08** **N601P**
Honours Baccalaureus Commercii; Hons BCom	**Programme: Computer Science and Information Systems**	**504143**
	Computer Science-Information Systems	**N658P**
Qualification name IN; Abbreviation	**Programme name WITH**	**Qualification/ Curriculum Codes**
Magister Scientiae; MSc (following Hons BSc)	**Programme: Computer Science**	**203155**
	Computer Science	**N861P**
MSc **Master of Science in Mathematical Statistics**		**2CY P01** **N801P**

Qualification; Abbreviation	Programme WITH	Qualification/ Curriculum Codes
Magister Scientiae; MSc (following Hons BSc)	Programme: Applied Mathematics	203157
	Applied Mathematics	N863P
Magister Scientiae; MSc (following Hons BSc)	Programme: Mathematics	203158
	Mathematics	N864P
Magister Scientiae; MSc (following Hons BSc)	Programme: Business Mathematics and Informatics (Quantitative Risk Management)	203181
	Quantitative Risk Management (following Hons BSc N609P or N610P)	N809P
Magister Scientiae; MSc (following Hons BSc)	Programme: Business Mathematics and Informatics (Financial Mathematics)	203182
	Financial Mathematics (following Hons BSc N611P)	N810P
Magister Scientiae; MSc (following Hons BSc)	Programme: Business Mathematics and Informatics (Business Analytics)	203183
	Business Analytics (following Hons BSc N612P)	N811P
Magister Scientiae; MSc (following Hons BSc)	Programme: Risk Analytics	203127
	Risk Analytics	N865P
MSc Master of Science in Astrophysical Sciences		2CQ P01 N801P
MSc Master of Science in Astrophysics and Space Science		2CR P01 N801P
MSc in Chemistry Master of Science in Chemistry		2CN P01 N801P
Magister Scientiae; MSc (following Hons BSc)	Programme: Biochemistry	203132
	Biochemistry	N869P
MSc Master of Science in Environmental Sciences		2CT N02 N801P
MSc Master of Science in Environmental Sciences	Atmospheric Chemistry	2CT N03 N801P

Qualification; Abbreviation	Programme WITH	Qualification/ Curriculum Codes
MSc **Master of Science in Environmental Sciences**	**Hydrology and Geohydrology**	**2CT N04** **N801P**
MSc **Master of Science in Environmental Sciences**	**Integrated Pest Management**	**2CT N05** **N801P**
MSc **Master of Science in Environmental Sciences**	**Mining Hydrolgy**	**2CT N06** **N801P**
MSc **Master of Science in Environmental Sciences**	**Disaster Risk Sciences**	**2CT N07** **N801P**
MSc **Master of Science in Zoology**		**2DD N01** **N801P**
MSc **Master of Science in Microbiology**		**2DE N01** **N801P**
MSc **Master of Science in Botany**		**2DF N01** **N801P**
MSc **Master of Science in Geography and Environmental Management**		**2DG N01** **N801P**
MSc **Master of Science in Natural Science Teaching**		**2CU N01** **N801P**
MSc **Master of Environmental Management**		**2CD P01** **N801P**
Magister Commercii; MCom (following on BCom Hons))	**Programme: Computer Science and Information Systems**	**505138**
	Computer Science and Information Systems	**N870P**
Mart et Scien **Master of Science in Urban and Regional Planning**		**2DH N01** **N801P**
MSc **Master of Science in Agricultural Economics**		**2CG N01** **N801P**

Qualification name IN; Abbreviation	Programme name WITH	Qualification/ Curriculum Codes
PhD Doctor of Philosophy in Computer and Information Sciences	Information Technology	2CB R01 N901P
PhD Doctor of Philosophy in Science	Statistics	2CC R20 N901P
Philosophiae Doctor; PhD	Programme: Applied Mathematics	204139
	Applied Mathematics	N903P
Philosophiae Doctor; PhD	Programme: Mathematics	204140
	Mathematics	N904P
PhD Doctor of Philosophy in Science	Business Mathematics	2CC R01 N901P
PhD Doctor of Philosophy in Science	Risk Analysis	2CC R15 N901P
Philosophiae Doctor; PhD	Programme: Space Physics	204112
	Physics	N906P
PhD Doctor of Philosophy in Science	Chemistry	2CT R11 N901P
PhD Doctor of Philosophy in Science	Environmental Sciences	2CC R04 N901P
PhD Doctor of Philosophy in Science	Atmospheric Chemistry	2CC R05 N901P
PhD Doctor of Philosophy in Science	Hydrology and Geohydrology	2CC R06 N901P
PhD Doctor of Philosophy in Science	Disaster Risk Sciences	2CC R14 N901P
PhD Doctor of Philosophy in Science	Zoology	2CC R18 N901P
PhD Doctor of Philosophy in Science	Geography and Environmental Management	2CC R19 N901P
PhD Doctor of Philosophy in Science	Microbiology	2CC R17 N901P

PhD **Doctor of Philosophy in Science)**	**Botany**	**2CC R16** **N901P**
PhD **Doctor of Philosophy in Science)**	**Urban and Regional Planning**	**2CC R07** **N901P**
PhD **Doctor of Philosophy in Science)**	**Agricultural Economics**	**2EA R03** **N901P**
PhD **Doctor of Philosophy in Science**	**Biochemistry**	**2CC R08** **N901P**
PhD **Doctor of Philosophy in Science**	**Natural Sciences Education**	**2CC R09** **N901P**

N.1.4 MODULES AND CREDITS

Subjects are presented in modules, of which everyone is awarded a specific credit value**. Each module must be passed individually** (See General Rules).Each module has a code and a descriptive name, for example FSKN111. The meaning of the digital codes of these names is explained in General Rules.

In the description of each qualification and programme a number of possible curricula, from which the student must select one, are set out. An explanation is also given in what way the modules of each curriculum have to be divided into the different semesters of each study year. The curricula are compiled for a minimum period of one or two years, as applicable to the relevant qualification. A student may apply to distribute the modules of a curriculum over a longer period. Exceeding the maximum study period of a curriculum as a result of the student not progressing satisfactorily will only be granted in exceptional cases.

The order in which modules are taken in a curriculum is not voluntary, but has been designed to ensure that ensuing learning will always be built on prior learning.

N.1.4.1 Relationship between credits and examination papers

The duration for an examination paper of an 8 and 12 credit module is usually two hours and the duration of examination papers that count for 16, 24 or 32 credit points is usually three hours.

N.1.5 RECOGNITION OF PRIOR LEARNING

a) North West University accepts the principle underlying outcomes-based, source-based and lifelong learning, in which considerations of articulation and mobility play a significant role, and subscribes to the view that recognition of prior learning, whether acquired by formal education programmes at this or other institutions, or informally (by experience), is an indispensable element in deciding on admission to and awarding credits in an explicitly chosen teaching-learning programme of the University.

b) Recognition of prior learning concerns the provable knowledge and learning that an applicant has acquired, whether by having completed formal education programmes, or by experience. At all times the question will concentrate on the level of skills, and skills will be judged in the context of the exit level skills required for the intended teaching-learning programme or modules in the programme, or the status for which the applicant applies, and not merely by virtue of the experience recorded by the applicant. Recognition of prior learning will therefore take place in terms of applied competencies demonstrated by the applicant in his/her application, taking into consideration the exit level outcomes that have to be obtained by means of the selected teaching-learning programme.

c) North West University accepts that recognition of prior learning must take place in a valid, trustworthy and fair way, within the normal existing policy on awarding credits to potential and existing students, whether they are from this or another institution.

d) With the view of processing an application for recognition of prior learning a non-refundable administrative levy determined from time to time by the University has to be paid by the prospective student.

N.1.6 ADMISSION AND REGISTRATION

On taking an appropriate baccalaureus degree students are not automatically admitted to the postgraduate programmes of the Faculty. Admission and registration for postgraduate programmes take place in accordance with the General Rules.

Prospective postgraduate students are advised to consult the University's *Manual for Postgraduate Studies* carefully beforehand.

N.1.7 LANGUAGE MEDIUM

A functional language policy is followed in all postgraduate modules. The language of instruction is determined by the class in cooperation with the lecturer. All tests and papers are available in Afrikaans and English and students are free to use Afrikaans or English as language of communication.

N.1.8 APPROVAL OF STUDY PROGRAMMES

Approval of study programmes for master's (MSc) and doctorate (PhD) degrees is given in accordance with General Rule 4.2 and 5.2. **Prospective postgraduate students are advised to study these rules carefully beforehand.**

N.1.9 EXAMINATIONS AND PASS REQUIREMENTS

Admission to examinations, the number of examination opportunities, pass requirements of modules and curricula, repetition of endorsed modules and the requirements that mini-dissertations, dissertations and theses must conform to are extensively discussed in the General Rules. **Prospective postgraduate students are advised to study these rules carefully beforehand.** The University's *Manual for Postgraduate Studies* also contains very useful information in this regard.

The Faculty of Natural Sciences stipulates that in all honours curricula and in master's and PhD curricula that contain endorsed modules each endorsed module must be passed individually before the degree will be conferred on the student.

N.1.9.1 Deadlines

Students must beforehand make sure of the official deadlines for submitting examination documents, i.e. mini-dissertations, dissertations and theses. These dates are determined annually. A student who submits his examination documents after the prescribed deadline will most probably not receive his degree at the next graduate ceremony and he/she will have to wait to the next graduation ceremony. The implication of this negligence will be that the student will have to register and pay class fees for another year.

N.1.10 ASSUMED LEARNING-BASED PROGRESS IN A CURRICULUM

In compiling each curriculum care has been taken that assumed learning, i.e. prior knowledge and the general level of insight and experience necessary to comfortably take the modules prescribed in a specific semester of a curriculum, has been acquired in preceding semesters. A student having failed one or more modules in preceding semesters will probably not be adequately

equipped to take the modules of the following semester. Such students are URGENTLY advised to consult the director of the relevant school BEFOREHAND to find out which modules of the semester concerned they can take with a reasonable expectancy of being successful.

N.1.11 TERMINATION OF STUDIES

The studies of students who fail to keep scheduled appointments for their studies or do not progress satisfactorily may be terminated in terms of the General Rules.

N.1.12 PROFESSIONAL STATUS

Persons who obtained the following qualifications at a university in the Republic of South Africa and have acquired the experience as indicated below may register as a Professional Natural Scientists (Pr Sc Nat) at the South African Council for Natural Scientific Professions:

a) 4-year BSc or Hons BSc (that preferentially includes a research module), plus three years of experience in a natural science profession
b) MSc plus two years of experience in a natural science profession;
c) DSc or PhD plus one year of experience in a natural science profession.
d) In order to become a professional medical scientist in the registration category Independent Practice in South Africa the Health Professions council of South Africa requires a minimum of an appropriate BSc (honours) degree as well as an internship at an approved institution and Board approved assessment of competence. The duration of the internship is 24 months and may only commence after completion of the degree. A scientist who has completed an MSc or PhD degree may apply for a shortened internship. In such a case a minimum of 6 months internship as well as an assessment of competence is required.
e) Students who took the BArt et Scien degree may apply for membership of the South African Council for Town and Regional Planners.

N.2 RULES FOR THE DEGREE BACHELOR OF SCIENCE HONOURS

The honours degree follows on an appropriate baccalaureus degree (see N.2.3). The studies may be taken full-time or part-time.

Prospective students must, before the date set by the director involved, apply to the director involved for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other proven prior learning, are judged to have a realistic chance of success would be admitted to the programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

NB: Lectures for honours modules in the Faculty of Natural Science are only offered full-time.

N.2.1 DURATION OF STUDIES

The minimum duration of the studies is one year full-time and two years part-time. The maximum duration is two years full-time and three years part-time.

N.2.2 ADMISSION AND REGISTRATION

The studies may be undertaken in a study programme approved by the Faculty Board of the Faculty of Natural Sciences. These study programmes are set out in N.2.5. Apart from the provisions in General Rule 3.2, the additional requirements set out in the relevant curricula in N.2.7 have to be complied with.

If the applications for a programme received are more than what the specific group in a school can handle, the group of students who, in the judgment of the school director has the greatest chance of success for the programme, are selected. The background of study and potential of students in this selection process, will also be taken into account.

N.2.3 ASSUMED PRIOR LEARNING

a) The student has already obtained an appropriate baccalaureus degree of which he has taken at least 60 module credits at NQR level 7 in the core subject of the relevant honours programme for which he intends to register.

b) If the student does not comply with provision a) the school director may, if necessary in consultation with the Dean and with notice to the Faculty Board, decide whether the candidate may be admitted to the Hons BSc studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

c) For admission to curricula N610P-N612P in the programme Business Mathematics and Informatics a further learning requirement above and beyond the assumed learning as mentioned in a) and b) will be that a student must have taken the BSc qualification in Business Mathematics and Informatics or the BCom qualification in Quantitative Risk Management, subject to the following prerequisites:

Honours curriculum	Graduate curriculum
N610P	N134P or N135P or N137P
N611P	N135P
N612P	N134P or N135P or N136P or N137P

d) A minimum prerequisite for registration for the postgraduate BMI qualifications N610P, N611P and N612P is that students must have obtained an average mark of at least 60% in the core modules of the third year of the relevant undergraduate curriculum. Exceptions to this rule will be considered according to individual merits and must be approved by the director of the Centre for Business Mathematics and Informatics. Note that the BMI Selection Committee will have the final authority in allowing students into all BMI and actuarial honours programmes.

e) Students in Actuarial Science who passed the curriculum N137P and obtained five or more exemption recommendations for levels A1 and A2 subjects from the Actuarial Society of South Africa (or equivalent CT subjects from the Institute and Faculty of Actuaries) may be admitted to the curriculum N609P.

f) Prospective students in Actuarial Science must make certain of the provisions that apply to studies in Actuarial Science and are obtainable from the director of the Centre for Business Mathematics and Informatics.

N.2.4 ATTAINMENT OF THE DEGREE

N.2.4.1 Qualification with distinction

Referring to General Rule 3.5.2 the honours degree is conferred with distinction where the student completes the degree in the minimum period and obtained a weighted average of at least 75% in all the modules achieved.

N.2.5 STUDY PROGRAMMES

Save for exceptions that the Dean might approve the honours degree may be taken in the following possible study programmes: Chemistry and Biochemistry, Physics (School of Physical and Chemical Sciences), Computer, Statistical and Mathematical Sciences (School of Computer, Statistical and Mathematical Sciences), Business Mathematics and Informatics (Centre for Business Mathematics and Informatics), Environmental Sciences and Development (School of Biological Sciences and School of Geo- and Spatial Sciences).

N.2.6 EXIT LEVEL OUTCOMES

The outcomes described regarding the first Baccalaureus Scientiae degree are still striven after in this Honours Bachelor of Science, with special reference to a specific discipline or a few disciplines from natural sciences. At the end of these honours studies the knowledge, skills, values and attitudes that the student has acquired will be further rounded off, with more emphasis on accompanying research skills.

N.2.6.1 Natural science (including mathematical and computer) and technology problem solving

At the end of the studies the student will be able to identify, evaluate and solve certain convergent and divergent problems in relevant disciplines from the health sciences and technology in a creative and innovative way.

N.2.6.2 Applying fundamental and expert knowledge

At the end of the studies the student will have abilities to integrate a basic knowledge and techniques from natural science and information technology in such a way that he/she will be able to investigate human and natural phenomena and to solve accompanying problems. These abilities will include the following:

Application of natural science knowledge and methods (with emphasis on those of the specific discipline) to problems by the appropriate use of -

- formal analysis and modelling of human activities and natural phenomena, systems and problems;
- communication of theories, concepts and ideas;
- discussions and conceptualisation of human activities and natural phenomena, systems and problems;
- management of uncertainties and risks by utilising statistical principles and methods;
- computer skills and information technology;

Implementation of principles, laws and techniques of natural sciences and health sciences (with emphasis on those of the specific discipline) at the fundamental level to –

- identify and solve open business and community problems;
- identify and utilise applications;
- make use of common fundamental expertise across the boundaries of disciplines.

N.2.6.3 Investigations, experimenting and data analysis

At the end of the studies the student will be able to -

a) plan and perform investigations and experiments by utilising scientific modelling techniques;
b) analyse, interpret and derive information from data.

The student will have a limited knowledge of the fundamental research methodology of the specific discipline.

N.2.6.4 Scientific methods, skills and information technology

At the end of the studies the student will be able to -

a) apply appropriate scientific methods and to evaluate the results obtained;

use computer software for calculations, modelling, simulation and handling of information, including -

- the evaluation of the appropriateness and limitations of software;
- the correct application and functioning of software;
- the critical evaluation of the end product delivered by software;

manage computers, networks and information infrastructures in evaluating, processing, managing and storing information to improve personal productivity and team work;

implement basic techniques and knowledge of business management and health, safety and environmental conservation in business practice.

N.2.6.5 Professional and general communication

At the end of the studies the student will be able to -

a) communicate effectively both orally and in writing with scientists (with emphasis on the specific discipline) and the community by using the appropriate structure, style and graphic and electronic aids;

apply methods of information communication for use by others, especially in the world of natural sciences and economic sciences (with emphasis on those methods of the specific discipline).

N.2.6.6 Impact of natural science activities on the community and environment

The student will be critically aware of -

a) the impact of natural science activities (especially those of the specific discipline) on the community and the environment;

b) the necessity to take into account in natural science activities

- the impact of technology on the community and
- the personal, social and cultural values and expectancies of those people on whom scientific activities have an influence.

N.2.6.7 Team and multidisciplinary work

At the end of the studies the student will be able to work effectively as an individual, in teams and in multidisciplinary environments and to exercise leadership and other critical functions.

N.2.6.8 Lifelong learning

The student understands the necessity to ensure continuing competency and to remain at the forefront of the latest technology and techniques, and he/she will have the ability to stay involved in lifelong learning by means of well-developed learning skills.

N.2.6.9 Professional ethics and practice

The student is critically aware of the necessity to act in a professional and ethical way and to assume responsibility within his/her own limitations and skills, while he/she is able to make judgements according to his/her knowledge and experience. Articulation possibilities

a) On successfully completing the Hons BSc programme the student may be admitted to further learning for the MSc degree in an appropriate and approved programme. Programme specific articulation possibilities, if any will be stated in the description of the relevant curricula.

b) Credits will be awarded for modules from other faculties and institutions, on condition that the outcomes and total credit requirements for this programme are totally met with.

c) The basic and applied skills acquired by the student with this qualification in one of the disciplines in which it may be taken will equip him/her to continue with further learning in several specialist areas at other universities.

N.3 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN BIOCHEMISTRY

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

N.3.1.1 Qualification code: 2DW L01: Curriculum N601P

This curriculum is designed in view of training biochemists as natural scientists. This curriculum is compiled of the following modules:

Module code	Descriptive name	Credits
First Semester		
BCHN611	Analytical Biochemistry	24
BCHN612	Advanced Metabolism	24
Second Semester		
BCHN621	Advanced Molecular Biology	24
BCHN622	Bioenergetics	24
BCHN671	Biochemistry Research Project	32
	Total number of credits	**128**

N.3.2 PROGRAMME: CHEMISTRY

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202117

N.3.2.1 Curriculum N651P: Chemistry

This curriculum is compiled of the following modules:

Module code	Descriptive name	Credits
First Semester		
CHEN611	Advanced organic chemistry	16
CHEN612	Advanced physical chemistry	16
CHEN613	Advanced inorganic chemistry	16
CHEN614	Molecular modelling	8
CHEN671	Project	48
Second Semester		
Select THREE of the following optional modules in consultation with the subject chairperson:		
CHEN621	Homogeneous catalysis	8
CHEN622	Coal chemistry	8
CHEN623	Membrane science and technology	8
CHEM621	Polymer chemistry	8
CHEM622	Advanced structural elucidation	8
CHEM623	Environmental chemistry	8
CHEM624	Techniques for organic synthesis	8
CHEM626	Electrochemistry	8
	Total number of credits	**128**

N.3.3 PROGRAMME: PHYSICS

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202121

Lectures for the taught modules for this degree in the Faculty of Natural Sciences are presented mainly in **English.**

The research director may recommend that students that have studied the BSc curricula N151P en N153P, or lack sufficient mathematical background, take extra undergraduate courses, e.g., ITRW115, TGWN223, WISN212, WISN226, TGWN311, en / of TGWN312.

N.3.3.1 Curriculum N652P: Physics

This curriculum is compiled of the following modules:

Module code	Descriptive name	Credits
First Semester		
FSKH611	Classical Mechanics	16
FSKH612	Quantum Mechanics I	16
FSKH613	Electrodynamics	16
FSKH614	Plasma Physics	16
FSKH671	Project I	8
Second Semester		
FSKH621	Quantum Mechanics II	16
FSKH622	Statistical Mechanics	16
FSKH623	Computer Physics (Research)	16
FSKH672	Project II	8
	Total number of credits	**128**

N.3.4 PROGRAMME: COMPUTER SCIENCE AND INFORMATION SYSTEMS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202134

N.3.4.1 Curriculum N653P: Computer Science and Information Systems

This curriculum is compiled, as indicated, from the following modules:

Module code	Descriptive name	Credits
First Semester		
ITRI671	Project I	32
And FOUR of the following modules in consultation with the school director:		
ITRI611	Data Warehouses I	12
ITRI612	Linear Programming I	12
ITRI613	Databases I	12
ITRI614	Information Systems Engineering I	12
ITRI615	Computer Security I	12
ITRI616	Artificial Intelligence I	12
ITRI617	Image Processing I	12
ITRI618	Decision Support Systems I	12
Second Semester		
And FOUR of the following modules in consultation with the school director:		
ITRI621	Data Warehouses II	12
ITRI622	Linear Programming II	12
ITRI623	Databases II	12
ITRI624	Information Systems Engineering II	12
ITRI625	Computer Security II	12
ITRI626	Artificial Intelligence II	12
ITRI627	Image Processing II	12
ITRI628	Decision Support Systems II	12
	Elective module*	12
Total number of credits of this curriculum		128

This curriculum N653P grants admission to MSc studies in Computer Science and Information Systems

N.3.5 PROGRAMME: STATISTICS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202135

N.3.5.1 Curriculum N654P: Statistics

This curriculum is compiled, as indicated, from the following modules:

Module code	Descriptive name	Credits
First Semester		
STTN611	Research project I (practice directed)	16
STTN612	Statistical Data-analysis I: Models	12
STTN613	Resampling	12
And TWO modules, in consultation with the School director and the head of subject group Statistics, from the following list:		
STTN614	Statistical Inference	12
STTN615	Stochastic Processes I	12
STTN616	Nonparametric estimation methods	12
STTN617*	Mathematical and Computer-intensive methods I	12
STTN618**	Financial-driven Statistics I	12
Second Semester		
STTN621	Research project (Research journal directed)	16
STTN622	Statistical Data-analysis II: Time Series	12
STTN623	Multivariate Statistics	12
And TWO modules, in consultation with the School director and the head of subject group Statistics, from the following list:		
STTN624	Discrete Data-analysis	12
STTN625	Stochastic Processes II	12
STTN626	Probability Theory	12
STTN627*	Mathematical and Computer-intensive methods II	12
STTN628**	Financial-driven Statistics II	12
Total number of credits of this curriculum		**128**

* **Choose subject in consultation with the school director and subject chairperson on honours level, one of the following modules for the first or second semester from N653P or N601P**

** **Choose subject in consultation with the school director and subject chairperson on honours level, one of the following modules for the first or second semester from N609P, N610P or N611P or N612P.**

This curriculum N654P grants admission to MSc studies in Statistics.

N.3.6 PROGRAMME: APPLIED MATHEMATICS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202136

N.3.6.1 Curriculum N601P: Applied Mathematics

A student who has completed BSc in N152P, N155P, N159P, N176P (or a similar degree), may enrol for this curriculum. This curriculum is composed of modules in the table. The curriculum is developed for training of Applied Mathematicians and consists of several Mathematics and Applied Mathematics modules, as well as a practical research project. The curriculum focuses on mathematical modelling and students may choose between financial mathematical modelling and mechanical mathematical modelling. This curriculum gives admission to MSc study in Applied Mathematics. This curriculum gives access to careers in education (secondary, tertiary), the financial sector, mining, weather and environmental modelling, engineering firms, programming, business analytics and data analytics.

Module code	Descriptive name	Credits
TGWN671	Project	32
First Semester		
TGWN612	Numerical Analysis I	12
TGWN613	Partial Differential Equations I	12
and TWO modules, in consultation with the school director and the head of the subject group Mathematics and Applied Mathematics, from the following list:		
TGWN614	Financial Mathematics Modelling I	12
TGWN615	Modelling I	12
TGWN616	Control Theory I	12
TGWN617	Fluid Dynamics I	12
WISN613	Complex Function Theory	12
WISN614	Measure and Integration theory I	12
WISN615	Functional Analysis I	12
Second Semester		
TGWN622	Numerical Analysis II	12
TGWN623	Partial Differential Equations II	12
and TWO modules, in consultation with the school director and the head of the subject group Mathematics and Applied Mathematics, from the following list:		
TGWN624	Financial Mathematics Modelling II	12
TGWN625	Modelling II	12
TGWN626	Control Theory II	12
TGWN627	Fluid Dynamics II	12
WISN623	Fourier/Harmonic Analysis	12
WISN624	Measure and Integration theory II	12
WISN625	Functional Analysis II	12
Total number of credits of this curriculum		**128**

N.3.7 PROGRAMME: MATHEMATICS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202137

N.3.7.1 Curriculum N601P: Mathematics

A student who has completed BSc in N152P, N154P, N157P, N158P, N159P, N176P, N135P (or a similar degree), may enrol for this curriculum. This curriculum is composed of modules in the table. The curriculum is developed for training of Mathematicians and consists of several Mathematics modules, as well as a practical research project. This curriculum gives admission to MSc study in Mathematics and (in combination with a post graduate education certificate and the choice of modules WISN616/626 in the programme) admission to MSc study in Natural Science Education. This curriculum gives access to careers in education (secondary, tertiary) and the financial, industrial and research sectors.

Module code	Descriptive name	Credits
WISN671	Project	32
First Semester		
WISN612	Abstract Algebra I	12
WISN614	Measure and Integration theory I	12
WISN615	Functional Analysis I	12
and ONE module, in consultation with the school director and the head of the subject group Mathematics and Applied Mathematics, from the following list:		
WISN613	Complex Function Theory	12
WISN616	Fundamentals of Mathematics	12
TGWN614	Financial Mathematics Modelling I	12
TGWN615	Modelling I	12
Second Semester		
WISN624	Measure and Integration theory II	12
WISN625	Functional Analysis II	12
WISN627	Matrix Analysis	12
and ONE module, in consultation with the school director and the head of the subject group Mathematics and Applied Mathematics, from the following list:		
WISN622	Abstract Algebra II	12
WISN623	Fourier/Harmonic Analysis	12
WISN626	Evolution of Mathematical Ideas	12
WISN628	Topology	12
TGWN624	Financial Mathematics Modelling II	12
TGWN625	Modelling II	12
	Total number of credits of this curriculum	**128**

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N.3.8 PROGRAMME: ACTUARIAL SCIENCES

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 202126

N.3.8.1 Curriculum N609P: Actuarial Science (following on BSc N137P)

Please note that all BMI post graduate programmes are presented in **English**.

This curriculum is compiled from the following modules:

Module code	Descriptive name	Credits
First Semester		
BWIN611	Quantitative Risk Analysis I	16
BWIN613	Financial Engineering I	16
BWIN614	Investment Theory I	16
Year Module		
BWIA671	Actuarial Risk Management (A301/CA1)	80
BWIR671	Research Module: Financial Engineering and Financial Modelling	32
	Total number of credits of this curriculum	**160**

The integrated assessment of this curriculum takes place during the assessment of the module BWIR671.

N.3.9 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN QUANTITATIVE RISK MANAGEMENT

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

N.3.9.1 Qualification code: 2DP L01: Curriculum N601P (following on BSc N134P or N137P)

Please note that all BMI post graduate programmes are presented in **English**.

This programme consists of the following modules divided into two semesters:

Module code	Descriptive name	Credits
First Semester		
BWIN611	Quantitative Risk Analysis I	16
BWIN613	Financial Engineering I	16
BWIN614	Investment Theory I	16
STTN612	Statistical Data-analysis I: Models	12
Second Semester		
BWIN621	Quantitative Risk Analysis	16
ECON623	Risk Management	16
STTN622	Statistical Data-analysis II: Time Series	12
STTN623	Multivariate Statistics	12
Year Module		
BWIR671	Research Module: Financial Engineering and Financial Modelling	32
Total number of credits of this programme		**148**

The integrated assessment of this programme takes place during the assessment of the module BWIR671.

N.3.10 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN FINANCIAL MATHEMATICS

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

N.3.10.1 Qualification code: 2DQ L01: Curriculum N601P (following on BSc N135P)

Please note that all BMI post graduate programmes are presented in **English**.

This programme consists of the following modules divided into two semesters:

Module code	Descriptive name	Credits
First Semester		
BWIN613	Financial Engineering I	16
STTN612	Statistical Data-analysis I: Models	12
STTN615	Stochastic Processes I	12
WISK613	Topology of Metric and Normed Spaces	8
WISN614	Measure and Integration Theory I	12
WISK615	Differential Equations	16
Second Semester		
BWIR622	Research Module: Financial Engineering and Pricing of Derivatives	32
STTN622	Statistical Data-analysis II: Time Series	12
STTN625	Stochastic Processes II	12
WISN624	Measure and Integration Theory II	12
Total number of credits of this programme		**144**

The integrated assessment of this programme takes place during the assessment of the module BWIR622.

N.3.11 PROGRAMME: DATA-MINING

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 202129:

N.3.11.1 Curriculum N612P: Data Mining (following on BSc N134P or N136P or N135P or N137P)

Please note that all BMI post graduate programmes are presented in **English.**
This curriculum consists of the following modules divided into two semesters:

Module code	Descriptive name	Credits
First Semester		
STTN612	Statistical Data-analysis I: Models	12
	Elective Module#	12
	Elective Module#	12/16
	Elective Module#	12/16
Second Semester		
STTN623	Multivariate Statistics	12
	Elective Module#	12
	Elective Module#	12/16
	Elective Module#	12/16
Year Module		
BWIR672	Research Module: Financial Modelling	32
Total number of credits of this curriculum		**128 (min)** **144 (max)**

#The elective modules in the first semester are chosen from the modules in the following table.

Module code	Descriptive name	Credits
BWIB611	Statistical Learning I	16
BWIB612	Introduction to Business Intelligence	12
BWIB613	Problem Solving using Simulation	12
BWIN614	Investment Theory I	16
STTN613	Resampling	12
ITRI611	Data Warehouses I	12
ITRI613	Databases I	12
ITRI616	Artificial Intelligence I	12
ITRI618	Decision Support Systems I	12

#The elective modules in the second semester are chosen from the modules in the following table.

Module code	Descriptive name	Credits
BWIB621	Statistical Learning II	16
BWIB622	Forecasting for Business	16
STTN622	Statistical Data-analysis II: Time Series	12
STTN624	Discrete Data-analysis	12
ITRI621	Data Warehouses II	12
ITRI623	Databases II	12
ITRI626	Artificial Intelligence II	12
ITRI628	Decision Support Systems II	12

The integrated assessment of this curriculum takes place during the assessment of the module BWIR672.

N.3.12 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

SCHOOLS: BIOLOGICALSCIENCES AND GEO- AND SPATIAL SCIENCES

N.3.12.1 Qualification code: 2DM L07: Curriculum N601P

This programme consists of the following modules divided into two semesters:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMBE673	Research project	Year	40
	Total compulsory modules		**56**
Elective modules			
Student selects FOUR of the following modules			
Module code		**Semester**	**Cr**
OMBO613	Introduction to GIS	1	16
OMBO614	GIS Applications (full-time only)	1	16
OMBE625	Introduction to Hydrology and Integrated Water Resources ManagementHydrology	2	16
OMBO678	Environmental Management I	Year	20
OMBO681	Environmental assessment	Year	20
GGFS671	Introduction to Earth Observation	Year	20
GGFS672	Air pollution	Year	20
OMSB613	Biodiversity planning	1	16
	Total elective modules		**72**
Total number of credits of this programme			**128**

Students have to take four elective modules to a value of 72 credits. These must be made up of two 20-credit modules and two 16-credit modules.
Combinations of modules will advised by the post graduate lecturers, subject to approval of the School director.

TOTAL	**Credits**
Semester 1	92
Semester 2	36
Total year level	**128**

Note: There are certain year modules that are assigned to semester ONE (1) but the credit load will be distributed over the whole year.

N.3.13 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH ECOLOGICAL INTERACTIONS AND ECOSYSTEM RESILLIENCE

SCHOOL: BIOLOGICAL SCIENCES

N.3.13.1 Qualification code: 2DM L01: Curriculum N601P

a) Faculty specific rules for this programme

Students are not allowed to register for more than four (4) modules in the first semester (except for the research project, which is a year module). Elective modules are selected according to required knowledge and skills for the research project. Selection of elective modules must therefore be approved by the research project mentor, as well as the School Director.

b) This programme is compiled from the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMSE674	Research Project	Year	32
		Total compulsory modules	**32**
Elective modules			
Student selects SIX of the following modules in consultation with programme manager, research mentor and School Director			
Module code		**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMWE611	Rehabilitation of disturbed areas (full-time only, GDKN 121, GDKN 211 and GDKN 221 are pre-requisites for this module)	1	16
OMSE611	Environmental Soil Science (full-time only, GDKN 121, GDKN 211 and GDKN 221 are pre-requisites for this module)	1	16
OMBO613	Introduction to GIS	1	16
OMBO614	GIS Applications (full-time only)	1	16
OMSB611	Conservation Ecology	1	16
OMSE612	Introduction to Landscape Ecology	1	16
OMSE621	Restoration of degraded ecosystems	2	16
OMSE622	Urban Ecology	2	16
OMSE623	Plant ecophysiology and stress physiology	2	16
OMSE625	Advanced Ecotoxicology	2	16
OMSE626	Microbial Ecology	2	16
		Total elective modules	**96**
Total number of credits of this programme			**128**

N.3.14 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH BIODIVERSITY AND CONSERVATION ECOLOGY

SCHOOL: BIOLOGICAL SCIENCES

N.3.14.1 Qualification code: 2DM L02: Curriculum N601P

a) Faculty specific rules for this programme

Students are not allowed to register for more than four (4) modules in the first semester (except for the research project, which is a year module). Elective modules are selected according to required knowledge and skills for the research project. Selection of elective modules must therefore be approved by the research project mentor, as well as the School Director.

b) This programme is compiled from the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMSB611	Conservation Ecology	1	16
OMSB624* OMSB613 **	Biodiversity Planning	1	16
OMSB625* OMSB614 **	Biomonitoring and risk assessment	1	16
OMSE674	Research project	Year	32
	Total compulsory modules		**80**
Elective modules			
Student selectsTHREE of the following modules in consultation with programme manager, research mentor and School Director			
Module code		**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMBO613	Introduction to GIS	1	16
OMSB621* OMSB629 **	Genome Analysis and Bio-informatics	2	16
OMSB627	Herpetology in Practise	2	16
OMSB628	Coral Reef Ecology	2	16
OMSE621	Restoration of degraded ecosystems	2	16
OMSE622	Urban Ecology	2	16
OMSE625	Advanced Ecotoxicology	2	16
OMSP624	Arthropoda / Plant Interactions	2	16
	Total elective modules		**48**
Total number of credits of this programme			**128**

*** OMSB624 and OMSB625 and OMSB621**: Only for pipe line students. Phasing out at the end of 2017.

****OMSB613 and OMSB614 and OMSB629** : Only new students to use for registration as from 2017

OMSB614/OMSB625 - Includes a week long practical session in Potchefstroom. Part time students can only register for this module if they are willing to travel to Potchefstroom for this practical session.

N.3.15 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH AQUATIC ECOSYSTEM HEALTH

SCHOOL: BIOLOGICAL SCIENCES

N.3.15.1 Qualification code: 2DM L03: Curriculum N601P

a) Faculty specific rules for this programme

Students are not allowed to register for more than four (4) modules in the first semester (except for the research project, which is a year module). Elective modules are selected according to required knowledge and skills for the research project. Selection of elective modules must therefore be approved by the research project mentor, as well as the School Director.

b) This programme consists of the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMWW611	Physical, chemical and biological properties of inland water	1	16
OMSW611	Aquatic Ecosystems: Pollution and Ecotoxicology	1	16
OMSE674	Research project	Year	32
		Total compulsory modules	**64**
Elective modules			
Student selects FOUR of the following modules in consultation with programme manager, research mentor and School Director			
Module code		**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMWW614 (Pipe line) OMWW617* (2017 new students)	Zoonoses*	1	16
OMWW616	Estuarine and near shore marine ecology	1	16
OMWW629 (Pipe line) OMWF621 (2017 new students)	Advanced waste water treatment	2	16
OMSW622**	Phycology**	2	16
OMBE625	Introduction to hydrology and integrated water resources management	2	16
OMSW624	Environmental Hydrology (full-time only)	2	16
OMSB621(Pipe line) OMSB629 (2017 new students)	Genome analysis and bio-informatics	2	16
OMSE625	Advanced ecotoxicology	2	16
OMSE626	Microbial ecology	2	16
OMSW625**	Limnology**	2	16
OMSW626**	Animal Ecology**	2	16
		Total elective modules	**64**
Total number of credits of this programme			**128**

* Includes a week long practical session in Potchefstroom. Part time students can only register for this module if they are willing to travel to Potchefstroom for this practical session.

** Full-time – only students involved in Arkansas State University exchange programme may register for this module.

N.3.16 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH INTEGRATED PEST MANAGEMENT

SCHOOL: BIOLOGICAL SCIENCES

N.3.16.1 Qualification code: 2DM L04: Curriculum N601P

a) Faculty specific rules for this programme

Students are not allowed to register for more than four (4) modules in the first semester (except for the research project, which is a year module). Elective modules are selected according to required knowledge and skills for the research project. Selection of elective modules must therefore be approved by the research project mentor, as well as the School Director.

b) This programme consists of the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMSP611	Principles of integrated pest management	1	16
OMWP611	Pest phenology and damage symptoms	1	16
OMSE674	Research project	Year	32
		Total compulsory modules	**64**
Elective modules			
Student selects FOUR of the following modules in consultation with programme manager, research mentor and School Director			
Module code		**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMWW614 will become OMWW617*	Zoonoses*	1	16
OMWP613	Economic damage and threshold values	1	16
OMSP622	GM crops and integrated pest management	2	16
OMSP623	Nematodes and crops	2	16
OMSP624	Arthropoda/plant interactions	2	16
OMSB621 will become OMSB629	Genome analysis and Bio-informatics	2	16
OMSA622	Weeds: interactions and control	2	16
OMSA623	Plant pathology	2	16
		Total elective modules	**64**
Total number of credits of this programme			**128**

* This module includes a week long practical session in Potchefstroom. Part time students can only register for this programme if they are willing to travel to Potchefstroom for this practical session.

N.3.17 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH ENVIRONMENTAL GEOLOGY

SCHOOL: GEO- AND SPATIAL SCIENCES

N.3.17.1 Qualification code: 2DM L05: Curriculum N601P

a) Faculty specific rules for this programme

Students are not allowed to register for more than four (4) modules in the first semester (except for the research project, which is a year module). Elective modules are selected according to required knowledge and skills for the research project. Selection of elective modules must therefore be approved by the research project mentor, as well as the School Director.

b) This programme consists of the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMSG611	Environmental geochemistry (full-time only, GLGN 112 and GLGN311 are pre-requisites for this module)	1	16
OMWE611	Rehabilitation of disturbed areas (full-time only, GDKN 121, GDKN 211 and GDKN 221 are pre-requisites for this module)	1	16
OMSE674	Research project	Year	32
	Total compulsory modules		**64**
Elective modules			
Student selects FOUR of the following modules in consultation with programme manager, research mentor and School Director			
Module code	**Module name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMSE611	Environmental Soil Science (full-time only, GDKN 121, GDKN 211 and GDKN 221 are pre-requisites for this module)	1	16
OMWW611	Physical, chemical and biological properties of inland water	1	16
OMBO613	Introduction to GIS	1	16
OMBO614	GIS Applications	1	16
OMSG621	Environmental Mineralogy (GLGN 112 and GLGN 211 are pre-requisites for this module)	2	16
OMSG622	Applied environmental geology (GLGN 112 and GLGN211 are pre-requisites for this module)	2	16
OMSE621	Restoration of degraded ecosystems	2	16
	Total compulsory modules		**64**
Total number of credits of this programme			**128**

N.3.18 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH HYDROLOGY

CENTRE: WATER SCIENCE AND MANAGEMENT

N.3.18.1 Qualification code: 2DM L06: Curriculum N601P

a) Faculty specific rules for the programme

Elective modules are selected according to required knowledge and skills for the research project. Selection of elective modules must therefore be approved by the research project mentor, as well as the School Director.

b) This programme is compiled from the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
Year module			
OMSE674	Research Project	Year	32
		Total credits	**32**
First Semester			
OMBO611	Introduction to Environmental Management	1	16
OMSG611	Environmental geochemistry (full-time only, GLGN 112 and GLGN311 are pre-requisite for this module)	1	16
	Total compulsory modules in the first semester		**32**
Second Semester			
OMBE625	Introduction to Hydrology and Integrated Water Resources Management	2	16
OMBE623	Groundwater Geology	2	16
OMBE624	Geohydrology	2	16
	Total compulsory modules in the second semester		**48**
Elective module*			
Student selects ONE of the following modules, either in the first or second semester, in consultation with programme manager, research mentor and School Director			
OMBO614*	GIS Applications*	1	16
OMWW611*	Physical, chemical and biological properties of inland water*	1	16
OMBE622*	Applied Hydrology*	2	16
		Total Elective module	**16**
Total number of credits of this programme			**128**

* A student must take **one** elective either in the first or second semester.

N.3.19 PROGRAMME: BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCES WITH WASTE MANAGEMENT

SCHOOL: GEO- AND SPATIAL SCIENCES

N.3.19.1 Qualification code 2DM L08: Curriculum N601P

This programme consists of the following modules divided into two semesters:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
Year module			
OMBE673	Research project	Year	40
		Total credits	**40**
First Semester			
OMBO611	Introduction to Environmental Management	1	16
OMBW611	Fundamentals of Waste Management	1	20
OMBW612	Waste Management Law and Governance	1	16
		Total compulsory modules	**52**
Second Semester			
OMBO679	Environmental Analysis I	Year	20
OMBW621	New Waste Management Solutions	2	16
		Total compulsory modules	**36**
Elective modules			
	None		
		Total elective modules	**0**
Total number of credits of this programme			**128**

TOTAL	**Credits**
Yearmodule	40
Semester 1	52
Semester 2	36
Total year level	**128**

Note: There are certain year modules that are assigned to semester 1 but the credit load will be distributed over the whole year.

N.4 EXAMINATION

The examination opportunities and relevant related rules apply in congruence with General Rule 3.4.

N.4.1 COMPOSITION OF THE PARTICIPATION MARK

A participation mark for a module (General Rule 2.4.2) can be compiled from tests, worksheets and other forms of evaluation.

N.4.2 ADMISSION TO THE EXAM

a) Admission to the exam in any module takes place after achieving a participation proof (General Rule 2.4.2)
b) A participation proof, where admission to the exam is permitted, will only be issued after the student meets the approval of the school director, and meets the requirements thereof stipulated in the study guide for the appropriate module (General Rule 2.4.2).

N.4.3 MODULE MARK

The module mark (General Rule 2.4.2) is calculated in the ratio that is applied where the evaluation method is applicable on a specific module combined, as is in the study guide of that module.

N.4.4 PASS REQUIREMENTS

a) The stipulations of General Rule 3.4.3 applies.
b) The subminimum of the exam, for all modules wherein exam is written, is 40%.
c) The pass requirement for a module is a module mark of 50%.
d) A programme is passed by passing every module that the programme consists of respectively.
e) A module is passed with distinction if a pass mark of at least 75% is acquired. The degree is passed with distinction if the average module mark, weighed according to credit marks of every module in the curriculum, is at least 75%.

N.4.5 NUMBER OF EXAM OPPORTUNITIES FOR REPEATING OF MODULES

A once off repeating of modules that are not passed, as well as further examination opportunities, only occurs according to the stipulations of General Rule 3.4.4.

N.4.6 UNSATISFACTORY ACADEMIC PERFORMANCE

General Rule 2.4.7 and 2.4.8 is applicable here.

N.5 RULES FOR THE DEGREE HONOURS BACHELOR OF COMMERCE

The honours degree follows on a baccalaureus degree or on the approval of the school director that the candidate's knowledge and skills acquired by prior learning and experience are adequate to be admitted to the Hons BCom studies. The studies may take place full-time or part-time.

Involved for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other proven prior learning, are judged to have a realistic chance of success would be admitted to the programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

NB: Lectures for honours modules in the Faculty of Natural Science is only offered full-time.

N.5.1 DURATION OF THE STUDIES

The minimum duration of the studies is one year full-time and two years part-time. The maximum duration is two years full-time and three years part-time.

N.5.2 ADMISSION AND REGISTRATION

Honours studies may be undertaken in a study programme that has been approved by the Faculty Board and is set out in N.3.4. Apart from the provisions in General Rule 3.2, the specific requirements stated in the description of the relevant curricula in N.3.6 must additionally be complied with.

If the applications for a programme received is more than what the specific group in a school can handle, the group of students who, in the judgment of the school director has the greatest chance of success for the programme, are selected. The background and potential of students in this selection process, will also be taken into account.

N.5.3 ASSUMED PRIOR LEARNING

The student has already obtained an appropriate baccalaureus degree of which he has taken at least 60 module credits at NQF level 7 in the core subject of the relevant honours programme for which he intends to register.

If a prospective student does not conform to N.2.3 he may be admitted to the Hons BCom studies by the school director on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

N.5.4 STUDY PROGRAMMES

This honours degree may be taken in Computer Science-Information Systems.

N.5.5 GENERAL EXIT LEVEL OUTCOMES

The outcomes described in N.2.6 are still striven after in this Honours Bachelor of Commerce, with emphasis on a specific discipline or a few disciplines from the natural sciences. At the end of the honours studies the knowledge, skills, values and attitudes that the student already has attained will be further rounded off with greater emphasis on the accompanying research skills.

N.5.6 PROGRAMME: COMPUTER SCIENCE-INFORMATION SYSTEMS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 504143

N.5.6.1 Curriculum N658P: Computer Science-Information Systems

The curriculum is compiled as follows:

Module code	Descriptive name	Credits
First Semester		
ITRI671	Project	32
And another FOUR of the following modules in consultation with the school director:		
ITRI611	Data Warehouses I	12
ITRI613	Databases I	12
ITRI614	Information Engineering Systems I	12
ITRI615	Computer Security I	12
ITRI616	Artificial Intelligence I	12
ITRI618	Decision Support Systems I	12
Second Semester		
And FOUR of the following modules in consultation with the school director:		
ITRI621	Data Warehouses II	12
ITRI623	Databases II	12
ITRI624	Information Systems Engineering II	12
ITRI625	Computer Security II	12
ITRI626	Artificial Intelligence II	12
ITRI628	Decision Support Systems II	12
Total number of credits of this curriculum		**128**

N.5.7 EXAMINATION

The examination opportunities and relevant related rules apply in congruence with General Rule 3.4. **(See N4)**

N.6 RULES FOR THE DEGREE MAGISTER SCIENTIAE (MASTER OF SCIENCE)

The MSc degree is a qualification that may follow on a four year baccalaureus degree or another recognised degree approved by the Dean.

Studies may be taken full-time or part-time.

Prospective students must, before the date as set by the relevant research director in consultation with the relevant school director, apply to the relevant research director for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other proven prior learning, are judged to have a realistic chance of success would be admitted to the programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

NB: Lectures for the lectured modules for this degree in the Faculty of Natural Sciences are with a single exception presented full-time only.

N.6.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research entities. The research entities deal with the master's and PhD training curricula, i.e. curricula that contain a considerable research component.

At the moment, there is one centre of excellence in Space Research, two research units, viz. Business Mathematics and Informatics, Environmental Sciences and Management, and the research focus area, Chemical Resource Beneficiation and focus area Human Metabolomics, as well as three centres, viz. 1) Human Metabolomics, 2) Business Mathematics and Informatics and 3) Water Science and Management.

Except for very rare exceptions, which must be approved by the Dean, research that is required for a master's dissertation or mini dissertation must be conducted within a research entity. In the following table the most important connections between schools, centres, subject groups and the corresponding research entities are represented.

SCHOOL/CENTRE	SUBJECT GROUP	RESEARCH ENTITY
School of Physical and Chemical Sciences	Biochemistry	Human Metabolomics
	Chemistry	Chemical Resource Beneficiation Environmental Sciences and Management
	Physics	Space Research
School of Biological Sciences	Botany Microbiology Zoology	Environmental Sciences and Management

SCHOOL/CENTRE	SUBJECT GROUP	RESEARCH ENTITY
School of Geo- and Spatial Sciences	Geography and Environmental Management Geology Urban and Regional Planning	Environmental Sciences and Management
School of Computer, Statistical and Mathematical Sciences	Computer Science and Information Systems Statistics Applied Mathematics Mathematics	Business Mathematics and Informatics
Centre for Business Mathematics and Informatics	Actuarial Science Business Analytics Financial Mathematics Quantitative Risk Management Risk Analysis	Business Mathematics and Informatics
Centre for Water Science and Management	Hydrology	Water Science and Management

The Master's curricula that are presented in the Faculty of Natural Sciences are in this calendar classified in the research entity under which the research component of the programme falls.

N.6.2 DURATION OF THE STUDIES

The minimum duration of the studies is one year full-time and two years part-time and the maximum duration is two years full-time and three years part-time, taken from the date of first registration for the specific programme. In terms of the procedure explained in the General Rule 4.4.10, a student may apply for an extension of the study period.

N.6.3 ASSUMED PRIOR LEARNING

The student has already obtained an appropriate four year baccalaureus degree.

If the student does not conform to the provision the research director determines in consultation with the school director, and if necessary after consulting the Dean and with notice to the Faculty Board, whether the candidate may be admitted to the MSc studies on the strength of knowledge and skills acquired by prior learning and work experience.

Programme-specific assumed prior learning is, where applicable, indicated in each of the programme descriptions.

N.6.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in the General Rule 4.2.

The relevant research director in consultation with the school director, may

refuse admission to a programme if the standard of competence previously attained by the prospective student in the subject(s) in which he/she wishes to continue his/her studies, does not conform to the relevant programme requirements.

If the applications received for a programme are more than the relevant research entity can handle in that programme, the group of students who, in the opinion of the research director in consultation with the school director, has the greatest chance of success will be selected for the relevant programme. The background and potential of students will also be taken into account in this selection process.

N.6.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place in terms of the provisions in the General Rules and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective students must consult this manual carefully**.

N.6.6 ARTICULATION POSSIBILITIES

On successful completion of most of the MSc curricula the student may be admitted to further learning for the doctorate at NQF level 10 in the core subject in which the qualification has been obtained.

Credits will be awarded for modules of other faculties and institutions on condition that the outcomes and total credit requirements of this qualification are totally complied with.

With the basic applied and expert skills, as well as the research skills that the student has acquired by this qualification in one of the mathematical, computer and natural science disciplines, he/she will be equipped to continue with further learning and research in related specialist areas at other institutions.

Programme-specialised articulation possibilities will be indicated, where applicable, in the programme descriptions.

N.6.7 CHANGING FROM MASTER'S STUDIES TO DOCTORATE STUDIES

The General Rules makes provision for a student who has registered for a master's degree and has attained, according to the unanimous judgement of the study leader and the research and school directors involved, outcomes of a quality and scope acceptable for a doctoral degree, to apply to the Faculty Board to change his/her registration for master's studies to registration for doctorate studies.

N.6.8 EXIT LEVEL OUTCOMES

The outcomes as described for the Honours Bachelor of Science are further refined and rounded off by this Magister Scientiae. Furthermore the qualifiers in these curricula will be familiar with the general scientific methods of research, with emphasis on the special research methodologies of one of the natural science core disciplines. These include:

a) identification and formulation of a problem statement;

b) thorough investigation of existing knowledge as reflected in appropriate scientific literature;

c) appropriate research to solve the problem;

d) scientific evaluation of the results in the context of the problem statement;

e) scientific communication of the results in the form of a mini dissertation, research report or dissertation.

N.6.8.1 Natural science (including mathematical and computer) and technological problem solving

At the end of the studies the student will be able to identify, evaluate and creatively and innovatively solve certain convergent and divergent problems in the relevant discipline from the natural science, health and technology fields.

N.6.8.2 Applying fundamental and expert knowledge

At the end of the studies the student will be able to integrate a basic knowledge and techniques from natural science and information technology in order to investigate human and natural phenomena and to solve accompanying problems. These abilities include the following:

a) Application of natural science knowledge and methods (with emphasis on those of the specific discipline) to problems by means of the appropriate use of:

- formal analysis and modelling of human activities and natural phenomena, systems and problems;
- communication of theories, concepts and ideas;
- discussions and conceptualisation of human activities and natural phenomena, systems and problems;
- management of uncertainties and risks by utilising statistical principles and methods;
- computer skills and information technology.

b) Use of principles, laws and techniques of natural sciences and health sciences (with emphasis on those of the specific discipline) at the fundamental level to -

- identify and solve open business and community problems;
- identify and utilise applications;
- work with common fundamental expertise across the boundaries of disciplines.

N.6.8.3 Investigations, experiments and data-analysis

At the end of the studies the student will be able to -

a) plan and perform investigations and experiments by utilising scientific modelling techniques;

b) analyse, interpret and derive information from data.

The student will have a limited knowledge of the fundamental research methodology of the specific discipline.

N.6.8.4 Scientific methods, skills and information technology

At the end of the studies the student will be able to

a) apply appropriate scientific methods and to evaluate the results delivered;

b) use computer software for calculations, modelling, simulation and handling

of information, including

- evaluation of the appropriateness and limitations of software;
- correct application and functioning of software;
- critical evaluation of the end product delivered by software;
- manage computers, networks and information infrastructures in evaluating, processing, managing and storing information to improve personal productivity and team work;
- implement basic techniques and knowledge of business management and health, safety and environmental conservation in business practice.

N.6.8.5 Professional and general communication

At the end of the studies the student will be able to -

a) communicate effectively both orally and in writing with scientists (with emphasis on the specific discipline) and the community by using the appropriate structure, style and graphic and electronic support;

b) apply methods of information communication for use by others, especially in the world of natural sciences and health sciences (with emphasis on those of the specific discipline).

N.6.8.6 Impact of natural science activities on the community and environment

The student is critically aware of

a) the impact of natural science and health science activities (especially those of the specificdiscipline) on the community and the environment;

b) the necessity to take into account in natural and health science activities

- the impact of technology on the community and
- the personal, social and cultural values and expectancies of those people influenced by the scientific activities.

N.6.8.7 Team and multidisciplinary work

At the end of the studies the student will be able to work effectively as an individual, in teams and in multidisciplinary environments and to exercise leadership and other critical functions.

N.6.8.8 Lifelong learning

The student will understand the necessity to ensure continuing competency and to remain at the forefront of the latest technology and techniques and he/she will have the ability to stay involved in lifelong learning by means of well-developed learning skills.

N.6.8.9 Professional ethics and practice

The student is critically aware of the necessity to act in a professional and ethical way and to assume responsibility within his/her own limitations and skills, while he/she is able to make judgements according to knowledge and experience.

N.7 PROGRAMMES IN THE UNIT FOR BUSINESS MATHEMATICS AND INFORMATICS

N.7.1 SPECIFIC ASSUMED PRIOR LEARNING

The student has already obtained an appropriate honours baccalaureus degree. If not, the school director and/or centre director determines in consultation with the research director, and if necessary after consulting the Dean and with notice to the Faculty Board, whether the candidate may be admitted to the MSc studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

For an MSc in a specific subject (Computer Science, Statistics, Applied Mathematics or Mathematics) the honours baccalaureus degree in the same subject is normally required, with the following additions:

- An honours baccalaureus degree in Mathematics in which Statistics has been taken at level 7 grants admission to Statistics.
- A four-year Baccalaureus degree in Engineering with Applied Mathematics at level 7 grants admission to Applied Mathematics.

For admission to the curricula N809P-N811P in Business Mathematics and Informatics (BMI) above and beyond the assumed prior learning as stated in the general programme description of the MSc programme a student is also required to have taken the Hons BSc qualification in Business Mathematics and Informatics, subject to the following specific prerequisites:

Magister curriculum	Honours curriculum
N809P	N610P or N609P
N810P	N611P
N811P	N612P or equivalent 4-year degree

Switching between the curricula may take place in consultation with Director of the Centre for BMI.

Apart from the prerequisites specified for admission in N.4.9.1 (d) students may be refused to be admitted to the postgraduate BMI qualifications N809P, N810P and N811P if the Centre should have insufficient capacity to handle the accompanying projects (BWIR826). This limitation will naturally be applied very cautiously and will vary from year to year. The selection process of the master's degree in BMI takes place during September of the previous year and only the best candidates will be selected.

For the MSc in Risk Analytics (N865P) the candidate must already have obtained an honours degree in mathematical sciences with theoretical or practical experience in risk analysis.

N.7.1.1 Programme-specific articulation possibilities

N.7.1.1.1 MSc curricula N861P-808P in Computer Science, Statistics, Applied Mathematics and Mathematics

- On successful completion of the MSc programme the student will have direct access to further learning for the doctoral degree at NQF level 10.
- Credits will be awarded for modules of other faculties and institutions on condition that the outcomes and total credit requirements of this qualification are totally complied with.
- With the basic applicable and expert skills, as well as the research skills that the student has acquired by this qualification in one of the mathematical, computer and natural science disciplines or health science disciplines, he/she will be equipped to continue with further learning and research in related specialist areas at other institutions.

N.7.1.1.2 MSc curricula N809P-N811P in Business Mathematics and N865P in Risk Analysis

The above-mentioned MSc curriculum's grants admission to a PhD in Risk Analytics and a PhD in Business Mathematics and Informatics. Please note that due to the nature of the BMI industry directed research projects, all projects have to be completed before the end of the academic year. Failure to do so will result in failing the degree.

N.7.2 PROGRAMME: COMPUTER SCIENCE

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203155

N.7.2.1 Curriculum N861P: Computer Science

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
First Semester		
ITRN872	Dissertation	100
RSWW811	Research Methodology	8
Selects in consultation with the research director and the school director TWO other modules from the following list:		
ITRW876	Databases	32
ITRW877	Decision Support Systems	32
ITRW878	Artificial Intelligence	32
ITRW883	Image Processing	32
ITRW884	Information Systems Engineering	32
ITRW885	Computer Security	32
ITRW886	Data Warehouses	32
Second Semester		
ITRN872	Dissertation (continue)	
RSWW821	Research Communication	8
	Total number of credits	**180**

N.7.3 PROGRAMME: MASTER OF SCIENCE IN MATHEMATICAL STATISTICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

N.7.3.1 Qualification code: 2CY P01: Curriculum N801P

This programme is compiled as follows:

Module code	Descriptive name	Credits
First Semester		
STTN872	Dissertation	100
RSWW811	Research Methodology	8
Select in consultation with the research director and the school director TWO other modules from the following list:		
STTK874	Advanced Resampling Methods	32
STTK875	Advanced Statistical Models	32
STTK876	Advanced Multivariate Statistics	32
STTK877	Advanced Probability Theory	32
STTK878	Advanced Time Series Models	32
STTK879	Advanced Stochastic Processes	32
STTN874	Advanced Survival Models	32
Second Semester		
STTN872	Dissertation (continue)	
RSWW821	Research Communication	8
Total number of credits of this programme		**180**

N.7.4 PROGRAMME: APPLIED MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203157

N.7.4.1 Curriculum N863P: Applied Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
First Semester		
TGWN872	Dissertation	100
RSWW811	Research Methodology	8
Select in consultation with the research director and the school director TWO modules from the following list:		
TGWN881	Applicable Analysis I	32
TGWN882	Applicable Analysis II	32
TGWN883	Modelling I	32
TGWN884	Modelling 2	32
TGWN887	Principles and Paradigms:Applied Mathematics	32
WISN885	Discrete Structures I	32
WISN886	Discrete Structures 2	32
Second Semester		
TGWN872	Dissertation (continue)	
RSWW821	Research Communication	8
	Total number of credits	**180**

N.7.5 PROGRAMME: MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203158

N.7.5.1 Curriculum N864P: Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
First Semester		
WISK872	Dissertation	100
RSWW811	Research methodology	8
Select in consultation with the research director and the school director TWO modules from the following list:		
WISN881	Abstract Analysis I	32
WISN882	Abstract Analysis II	32
WISN883	Algebra I	32
WISN884	Algebra II	32
WISN885	Discrete Structures 1	32
WISN886	Discrete Structures 2	32
WISN887	Principles and Paradigms: Pure Mathematics	32
Second Semester		
WISK872	Dissertation (continue)	
RSWW821	Research communication	8
	Total number of credits	**180**

N.7.6 PROGRAMME: MASTER OF SCIENCE IN NATURAL SCIENCE TEACHING

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

N.7.6.1 Qualification code: 2CU N01: Curriculum N801P

Prospective students must hold an applicable honours degree and a Post-Graduate Certificate in Education (PGCE).

Module Code	Descriptive name	Credits
NWON871	Dissertation	180
	Total number of credits	**180**

N.7.7 PROGRAMME: BUSINESS MATHEMATICS AND INFORMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

N.7.7.1 Qualification code: 203127: Curriculum N865P in Risk Analysis

The curriculum consists of a dissertation and an examination paper on topics that are supportive of the research done for the dissertation. The study leader decides together with the research director and the school/centre director on appropriate topics.

Module code	Descriptive Name	Credits
First Semester		
BWIN872	Dissertation	132
RSWW811	Research Methodology	8
Select in consultation with the research director and director of the Centre for BMI ONE of the following modules:		
BWIN611	Quantitative Risk Analysis I	16
BWIN613	Financial Engineering I	16
BWIN615	Financial Modelling I	16
BWIN811	Practical Risk Management SAS RD	16
BWIN812	Pricing of Derivatives B	24
BWIN813	Practical Data Mining	16
BWIN816	Modern Portfolio Theory	16
BWIN817	Retail Credit Risk	16
BWIN818	Topical Research issues in Risk Analysis	16
BWIA811	Enterprise-wide Risk Management	16
Second Semester		
BWIN872	Dissertation (continue)	
RSWW821	Research Communication	8
Select in consultation with the research director and director of the Centre for BMI ONE of the following modules:		
BWIN621	Quantitative Risk Analysis II	16
BWIN622	Pricing of Derivatives A	16
BWIN623	Financial Engineering II	16
BWIN625	Financial Modelling II	16
BWIA821	Enterprise wide Risk Management II	12
	Total number of credits	**180**

N.8 PROGRAMMES IN CENTRE FOR BUSINESS MATHEMATICS AND INFORMATICS

N.8.1 PROGRAMME: QUANTITATIVE RISK MANAGEMENT

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203181

N.8.1.1 Curriculum N809P: BMI (Quantitative Risk Management - following Hons BSc N609P or N610P)

Please note that all BMI post graduate programmes are presented in **English**.

This curriculum consists of the following modules that are divided into two semesters:

Module code	Descriptive name	Credits
First Semester		
BWIA812	Enterprise-Wide Risk Management I	24
BWIN815	Industry Integration Project	32
	Elective Module[#]	16
	Elective Module[#]	16
Second Semester		
BWIR826	Industry Directed Research Project	80
	Elective Module [#]	12
Total number of credits for this curriculum		**180**

[#]The elective module in the first semester is chosen from the modules in the following table.

Module code	Descriptive name	Credits
BWIN811	Practical Risk Management SAS RD	16
BWIN816	Modern Portfolio Theory	16
BWIN817	Retail Credit Risk	16

[#]The elective module in the second semester is chosen from the modules in the following table.

Module code	Descriptive name	Credits
BWIA821	Enterprise-wide Risk Management II	12
BWIB821	Data Mining Techniques	12

The integrated assessment of this curriculum takes place during the assessment of the module BWIR826.

Please note that due to the nature of the BMI industry directed research projects (BWIR826) all projects have to be completed before the end of the academic year. A student who fails to do so will fail the degree.

N.8.2 PROGRAMME: FINANCIAL MATHEMATICS

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203182

N.8.2.1 Curriculum N810P: BMI (Financial Mathematics - following Hons BSc N611P)

Please note that all BMI post graduate programmes are presented in **English**.

This curriculum consists of the following modules divided into two semesters:

Module code	Descriptive name	Credits
First Semester		
BWIN812	Pricing of Derivatives B	24
BWIN815	Industry Integration Project	32
	Elective Module#	16
	Elective Module#	16
Second Semester		
BWIB821	Data Mining Techniques	12
BWIR826	Industry Directed Research Project	80
	Total number of credits in curriculum	**180**

#The elective module in the first semester is chosen from the modules in the following table.

Module code	Descriptive name	Credits
BWIN811	Practical Risk Management SAS RD	16
BWIN816	Modern Portfolio Theory	16
BWIN817	Retail Credit Risk	16

The integrated assessment of this curriculum takes place during the assessment of the module BWIR826.

Please note that due to the nature of the BMI industry directed research projects (BWIR826) all projects have to be completed before the end of the academic year. A student who fails to do so will fail the degree.

N.8.3 PROGRAMME: BUSINESS MATHEMATICS AND INFORMATICS

(With Specialisation in Business Analytics)

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203183

N.8.3.1 Curriculum N811P: BMI Business Analytics (following Hons BSc N612P)

Please note that all BMI post graduate programmes are presented in **English**.

This curriculum consists of the following modules that are divided into two semesters:

Module code	Descriptive name	Credits
First Semester		
BWIB818	Business Intelligence	16
BWIN817	Retail Credit Risk	16
BWIN815	Industry Integration Project	32
Second Semester		
BWIB821	Data Mining Techniques	12
BWIB822	Contemporary Issues in Business Analytics	12
BWIB823	Multiple Criteria Decision Making	12
BWIR826	Industry Directed Research Project	80
	Total number of credits in curriculum	**180**

The integrated assessment of this curriculum takes place during the assessment of the module BWIR826.

Please note that due to the nature of the BMI industry directed research projects (BWIR826) all projects have to be completed before the end of the academic year. A student who fails to do so will fail the degree.

N.9 PROGRAMMES IN CENTRE FOR SPACE RESEARCH

N.9.1 PROGRAMME: MASTER OF SCIENCE IN ASTROPHYSICAL SCIENCES

CENTRE: SPACE RESEARCH

N.9.1.1 Qualification code: 2CQ P01: Curriculum N801P

All of the modules described in the curricula below are not necessarily presented every year. The school director decides in consultation with the research director which modules may be taken in each semester.

The Capita Selecta module may replace one of the other modules and the contents to be chosen in consultation with the school director and the research director.

Lectures for the taught modules for this degree in the Faculty of Natural Sciences are presented mainly in **English** only.

Module code	Descriptive name	Credits
First Semester		
FSKS872	Dissertation	132
A student choose TWO of the following in consultation with the research director:		
FSKM811	Astrophysics I	16
FSKM812	Transport Theory	16
FSKM813	Astrophysics II	16
FSKM814	Heliospheric Physics	16
FSKM815	Capita Selecta I*	16
Second Semester		
FSKS872	Dissertation (continue)	
FSKM821	General Relativity	16
	Total number of credits	**180**

*Select in consultation with the research director one of the following: Space Physics or Nuclear Physics or Solid State Physics.

N.9.2 PROGRAMME: MASTER OF SCIENCE IN ASTROPHYSICS AND SPACE SCIENCE

CENTRE: SPACE RESEARCH

N.9.2.1 Qualification code: 2CR P01: Curriculum N801P

This curriculum is taken by students in the National Astrophysics and Space Science Programme (NASSP). It is compiled from FSKS872 and lectured modules. The lectured modules, which represent 60 credits, are presented and examined by the NASSP consortium and are selected from modules in the list following below. **Students are permitted to start on the dissertation only after they have passed all of the lectured modules**.

Lectures for the taught modules for this degree in the Faculty of Natural Sciences are presented in **English** only.

Module code	Descriptive name	Credits
A student choose 60 credits of the following in consultation with the research director:		
FSKB874	Plasma Physics	12
FSKB875	Magnetohydrodynamics	12
FSKB891	Theoretical Cosmology	12
FSKB877	Cataclysmic Variables	12
FSKB878	Extragalactic Astronomy	12
FSKB879	Advanced General Relativity	12
FSKB880	High Energy Astrophysics and Pulsars	12
FSKB882	Stellar Structure and -Evolution	12
FSKB885	Geomagnetism and Aeronomy	12
FSKB886	Computational Astrophysics	12
FSKB887	Radio Interferometry	12
FSKB888	Time Series and Data Analysis	12
FSKB889	Space Weather	12
FSKB890	Observational Cosmology	12
Elective modules		**60**
Compulsory module		
FSKS872	Dissertation	132
	Total number of credits	**192**

N.10 PROGRAMME IN FOCUS AREA FOR CHEMICAL RESOURCE BENEFICATION

N.10.1 PROGRAMME: MASTER OF SCIENCE IN CHEMISTRY

FOCUS AREA: CHEMICAL RESOURCE BENEFICIATION

N.10.1.1 Qualification code: 2CN P01: Curriculum N801P

There are five research areas in this research entity and a research topic for a MSc dissertation must therefore be selected from one of these research areas. The research areas are:

a) Chromium Technology

b) Catalysis and Synthesis

c) Membrane Technology

d) Electrochemistry for Energy and Environment

e) Coal Chemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
CHEN872	Dissertation	132
CHEN874*	Advanced Chemistry*	48
	Total of credits of the curriculum	**180**

*Select in consultation with the research director a topic at the M-level from the subject Chemistry.

N.11 PROGRAMME IN THE FOCUS AREA FOR HUMAN METABOLOMICS

N.11.1 PROGRAMME: BIOCHEMISTRY

CENTRE: HUMAN METABOLOMICS

Qualification code: 203132

N.11.1.1 Curriculum N869P: Biochemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BCHN872	Dissertation	135
BCHN877*	Advanced Biochemistry*	45
	Total of credits of the curriculum	**180**

* Presentation and oral examination of the dissertation and relevant field of HDMG871

N.12 PROGRAMME IN THE UNIT FOR ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.1 PROGRAMME: MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.1.1 Qualification code: 2CT N02: Curriculum N801P (Full-time and Part-time)

This programme can only be followed if a student already has an appropriate honours degree.

The topic of a MSc dissertation must be selected in conjunction with the directors of the School and Research Unit, from one of the followed research fields:

a) Climate change, Air Quality and Impacts

b) Aquatic Ecosystem Health

c) Biodiversity and Conservation Ecology

d) Ecological Interactions and Ecosystem Resilience

e) Spatial Planning, Development and Implementation

f) Environmental Geology and Soil Sciences

This programme is composed of the following:

Module code	Descriptive name	Credits
OMWN871	Dissertation	180
	Total credits for this programme	**180**

NB: For further programmes in the Research Unit Environmental Sciences and Management readers are referred to N.1.3

N.12.2 PROGRAMME: MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES WITH ATMOSPHERIC CHEMISTRY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.2.1 Qualification code: 2CT N03: Curriculum N801P (Full-time and Part-time)

This programme is composed of the following:

Module code	Descriptive name	Credits
CHEM871	Dissertation	180
	Total credits for this programme	**180**

N.12.3 PROGRAMME: MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES WITH DISASTER RISK SCIENCE

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.3.1 Qualification code: 2CT N07: Curriculum N801P (Full-time and Part-time)

This programme is composed of the following:

Module code	Descriptive name	Credits
DRRS871	Dissertation	180
	Total credits for this programme	**180**

N.12.4 PROGRAMME: MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES WITH INTEGRATED PEST MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.4.1 Qualification code: 2CT N05: Curriculum N801P (Full-time and Part-time)

This programme is composed of the following:

Module code	Descriptive name	Credits
IPMM871	Dissertation	180
	Total credits for this programme	**180**

N.12.5 PROGRAMME: MASTER OF SCIENCE IN ZOOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.5.1 Qualification code: 2DD N01: Curriculum N801P Zoology (Full-time and Part-time)

In this programme research can be conducted on any area in Zoology, although the Unit retains the right not to accept a candidate in instances where there does not exist sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
DRKN871	Dissertation	180
	Total credits for this programme	**180**

N.12.6 PROGRAMME: MASTER OF SCIENCE IN GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.6.1 Qualification code: 2DG N01: Curriculum N801P

In this programme research can be conducted on any aspect of Geography and environmental management, although the Unit retains the right not to accept a student if there is not sufficient particular expertise among staff on the specific research topic. Specialisation fields include (but are not limited to):

- Spatial studies
- Environmental impact analysis and all aspects thereof
- Environmental management and all aspects thereof
- Physical and human Geography

This programme is composed of the following:

Module code	Descriptive name	Credits
GGFN871	Dissertation	180
	Total credits for this programme	**180**

N.12.7 PROGRAMME: MASTER OF SCIENCE IN MICROBIOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.7.1 Qualification code: 2DE N01: Curriculum N801P (Full-time and Part-time)

In this programme research can be conducted on any subject in Microbiology, although the Unit retains the right not to accept a candidate in instances where there is not sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
MKBN871	Dissertation	180
	Total credits for this programme	**180**

N.12.8 PROGRAMME: MASTER OF SCIENCE IN BOTANY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.12.8.1 Qualification code: 2DF N01: Curriculum N801P (Full-time and Part-time)

In this programme research can be conducted on any subject in the field of Botany, although the Unit retains the right not to accept a candidate in cases where there is not sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
PLKN871	Dissertation	180
	Total credits for this programme	**180**

N.13 PROGRAM IN THE CENTRE FOR WATER SCIENCE AND MANAGEMENT

N.13.1 PROGRAMME: MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES WITH MINING HYDROLOGY

CENTRE: WATER SCIENCE AND MANAGEMENT

N.13.1.1 Qualification code: 2CT N06: Curriculum N801P(Full-time and Part-time)

In this programme research can be conducted on any area in Mining Hydrolgy, although the Unit retains the right not to accept a candidate in instances where there does not exist sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
HDMG871	Dissertation	180
Total credits for this programme		180

N.13.2 PROGRAMME: MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES WITH HYDROLOGY AND GEOHYDROLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.13.2.1 Qualification code: 2CT N04: Curriculum N801P.(Full-time and Part-time)

In this programme research can be conducted on any area in Hydrology and Geohydrology, although the Unit retains the right not to accept a candidate in instances where there does not exist sufficient capacity:

Module code	Descriptive name	Credits
HDGH871	Dissertation	180
	Total credits for this programme	**180**

N.14 EXAMINATION

N.14.1 EXAMS

The examination opportunities and relevant related rules apply in congruence with General Rule 4.4.

N.14.2 COMPOSITION OF THE PARTICIPATION MARK

A participation mark for a module (General Rule 2.4.2) can be compiled from tests, worksheets and other forms of evaluation.

N.14.3 ADMISSION TO THE EXAMINATION FOR MODULES WHEREIN EXAM WILL BE WRITTEN

a) Admission to the exam in any module takes place after achieving a participation proof.
b) A participation proof, where admission to the exam is permitted, will only be issued after the student meets the approval of the school director, and met the requirements thereof stipulated in the study guide for the appropriate module.

N.14.4 MODULE MARK

The module mark (General Rule 2.4.2) is calculated in the ratio that is applied where the evaluation method is applicable on a specific module combined, as is in the study guide of that module.

N.14.5 PASS REQUIREMENTS

a) The stipulations of General Rule 4.4. Applies.
b) The subminimum of the exam, for all modules on NQR-level 9 wherein exam is written, is 50%.
c) The pass requirements for a module wherein exam is written, is 50%.
d) A programme is passed by passing all the modules that the programme consists of respectively.
e) If the examiners are not unanimous that the student passed the module, then the final decision rests with the dean, after the dean has sought advice as the dean deems necessary.

f) A module is passed with distinction if a pass mark of at least 75% is acquired. The degree is passed with distinction if the average module mark, weighed against credit marks of every module in the curriculum, is at least 75%.

N.14.6 REPEATING OF MODULES

A once off repeating of modules that are not passed only occurs according to the stipulations of the General Rule A4.4.6.2.

N.15 RULES FOR THE DEGREE MASTER OF ENVIRONMENTAL MANAGEMENT

Prospective students must, before the date set by the relevant research director in consultation with the relevant school director involved, apply to the relevant research director for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other proven prior learning, are judged to have a realistic chance of success would be admitted to a programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

NB: Lectures for the taught modules for this degree in the Faculty of Natural Sciences are presented mainly on a part time basis in <u>English</u> only.

N.15.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research entities. The research entities are furthermore responsible for the master's (MSc) and doctorate (PhD) training curricula, i.e. curricula that contain a considerable research component.

Apart from very rare exceptions that must be approved by the Dean, the research required for this master's degree must be conducted in the RESEARCH UNIT of Environmental Sciences and Management.

N.15.2 DURATION OF THE STUDIES

The minimum duration of the studies is one year full-time and two years part-time and the maximum duration is two years full-time and three years part-time, taken from the date of first registration for the specific programme. In terms of the procedure explained in the General Rules, a student may apply for an extension of the study period.

N.15.3 ASSUMED PRIOR LEARNING

The student has already obtained an honours baccalaureus degree in Geography and Environmental Management or Studies.

If the student does not conform to the provision of N.4.3 the school director determines in consultation with the research director and, if necessary, after consulting the Dean and with notice to the Faculty Board, whether the candidate may be admitted to studies for the master's degree in environmental

management (Master of Environmental Management) on the strength of knowledge and skills acquired by prior learning and work experience.

On the ground of the assessment of individual merits by the school director, in consultation with the research director, a prospective student may be required to pass certain fundamental and core modules before he/she will be admitted to the Master of Environmental Management studies.

Programme specific assumptions are, where applicable, indicated in the programme descriptions**.**

N.15.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in the General Rules.

The relevant research director in consultation with the school director, may refuse admission to a programme if the standard of competence previously attained by the prospective student in the subject(s) in which he/she wishes to continue his/her studies does not conform to the relevant programme requirements.

If the applications received for a programme are more than the relevant research entity can handle in that programme, the group of students who, in the opinion of the research director in consultation with the school director, has the greatest chance of success will be selected for the relevant programme. The background and potential of students will also be taken into account in this selection process.

N.15.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place in terms of the provisions in the General Rules and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective students must consult this manual carefully.**

Full information on the programme in which research for this degree may be undertaken is available from the director of the research area.

N.15.6 ARTICULATION POSSIBILITIES

A student having completed this degree may be admitted to the PhD studies in a core subject in which adequate credits have been obtained.

N.15.7 EXIT LEVEL OUTCOMES

N.15.7.1 GENERAL EXIT LEVEL OUTCOMES

On successful completion of this qualification the student ought to be able to provide proof that he has command of the following skills and competencies:

a) The ability to apply corporate environmental management and demonstrate a good understanding and a knowledge of concepts such as sustainability, environmental legislation and the role of local authorities in environmental management;

b) The ability to implement environmental management systems and apply environmental standards;

c) The ability to demonstrate expertise in carrying out and applying environmental auditing, environmental impact assessments, landscape

assessment and all relevant environmental assessments and analyses;

d) The ability to independently plan research, collect, process, analyse and make a résumé of data in a mini dissertation;

e) The ability to retrieve current knowledge and remain at the forefront of the latest technology and experimental methods in environmental sciences;

f) The ability to apply knowledge and skills acquired in these studies meaningfully as an entrepreneur or for the benefit of the national economy and the people in a specific work situation;

g) The ability to act as a leader in the local or general community;

h) The ability to communicate professionally or in general with scientists and the community, whether orally or in writing, while making use of the appropriate structure, style and graphic and electronic support.

N.15.7.2 SPECIFIC EXIT LEVEL OUTCOMES

N.15.7.2.1 Knowledge

On completion of the qualification the student will have a knowledge and skills to:

a) Understand the concept of environmental reporting and be able to initiate the "State of the environmental" report project;
b) Understand and critically evaluate "command and control" and "joint management" strategies in legislation;
c) Understand the different environmental management systems, be familiar with the requirements of ISO 14001 and be able to implement a environmental management system based on ISO 14001;
d) Understand the requirements of an integrated management system based on ISO 14001, ISO 9000:2000 and OHSAS 18001;
e) Understand and plan environmental monitoring and performance evaluation;
f) Know the requirements of ISO 19011 and be able to take part in an environmental audit and to manage the auditing process;
g) Understand the concept of sustainable development and be able to apply the principles of Agenda 21;
h) Understand in what way government structures are functioning at a local, provincial and national level;
i) Understand the legal requirements of an environmental impact study;
j) Be able to carry out a base line study and to carry out a screening process successfully;
k) Be able to understand the process to determine significant impacts and to identify and debate different possible processes;
l) Manage the public participation process successfully;
m) Compile a full environmental impact report and evaluate such a report;
n) Understand and manage the process of reporting on social impact;
o) Understand and be able to manage the process of reporting on strategic and life cycles impact;
p) Understand and manage the process of environmental risk analysis.

N.15.7.2.2 Skills

On successful completion this course the student will be able to use the relevant implements (instruments) to effectively implement the full P-D-C-A-R environmental management loop. (The P-D-C-A-R environmental management loop refers to the Denning management model as applied to environmental management and the meaning of the symbols is the following: "Plan-Do-Check-Act-Report".)

The student will further be able to:

a) independently plan, collect, analyse and interpret data and report the findings in a mini dissertation that conforms to scientific standards;

b) communicate in every mode, whether orally, in writing or visually;

c) function in multidisciplinary groups and apply responsible and effective self-management;

d) develop an own frame of thought in writing reports.

N.15.7.2.3 Values

On completion of the degree the student will be able to provide proof that he/she is familiar with the following values:

a) environmental, research and conservation ethics from a grounded perspective;

b) a holistic view of the nature, structure and functioning of the environment;

c) an appreciation of the nationally and internationally shared responsibility and stewardship with regard to the management and conservation of the environment and biodiversity.

N.15.8 PROGRAMME: MASTER OF ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.15.8.1 Qualification code: 2CD P01: Curriculum N801P

Programme rules

a) This programme is presented part-time and in **English** only and extends over two years.

b) Students who have an appropriate honours degree (or equivalent) may after they have been selected be admitted to this curriculum in consultation with the school and/or research director.

c) The closing date for applications to be admitted to this programme is the last day of October of the previous year.

The programme consists of the following specialization choices**:**

A. Master of Environmental Management (Part time):
Qualification code: 2CD P01: Curriculum N801P

Module code	Descriptive name	Credits
OMBO878	Environmental Management	40
OMBO879	Environmental Assessment	40
Mini dissertation		
OMBO873	Mini dissertation	100
Total of credits of this programme		**180**

B. Master Of Environmental Management with Specialization in Ecological Water Requirements (EWR) (Part time):
Qualification code: 2CD P02: Curriculum N801P

Module code	Descriptive name	Credits
*OMBO880	Management of Ecological Drivers in Aquatic Systems Completion of OMBO880 is a prerequisite for admission to OMBO881	40
OMBO881	Management of Ecological Responders in Aquatic Systems	40
Mini dissertation		
OMBO873	Mini dissertation	100
Total of credits of this programme		**180**
***Completion of OMBO880 is a prerequisite for admission to OMBO881		

C. Master Of Environmental Management with Specialization in Waste Management (Part time):
Qualification code: 2CD P03: Curriculum N801P

Module code	Descriptive name	Credits
OMBO882	Integrated Waste Management	40
OMBO883	Waste Management Law And Governance	40
Mini dissertation		
OMBO873	Mini dissertation	100
Total of credits of this programme		**180**

N.15.9 EXAMINATIONS

N.15.9.1 Exams

The examination opportunities and relevant related rules apply in congruence with General Rule 4.4.

N.15.9.2 Composition of the participation mark

A participation mark for a module (General Rule 2.4.2) can be compiled from tests, worksheets and other forms of evaluation.

N.15.9.3 Admission to the examination for modules wherein exam will be written

a) Admission to the exam in any module takes place after achieving a participation proof.
b) A participation proof, where admission to the exam is permitted, will only be issued after the student meets the approval of the school director, and met the requirements thereof stipulated in the study guide for the appropriate module.

N.15.9.4 Module mark

The module mark (General Rule 2.4.2) is calculated in the ratio that is applied where the evaluation method is applicable on a specific module combined, as is in the study guide of that module.

N.15.9.5 Pass requirements

a) The stipulations of General Rule 4.4. Applies.
b) The subminimum of the exam, for all modules on NQR-level 9 wherein exam is written, is 50%.
c) The pass requirements for a module wherein exam is written, is 50%.
d) A programme is passed by passing all the modules that the programme consists of respectively.
e) If the examiners are not unanimous that the student passed the module, then the final decision rests with the dean, after the dean has sought advice as the dean deems necessary.
f) A module is passed with distinction if a pass mark of at least 75% is acquired. The degree is passed with distinction if the average module mark, weighed against credit marks of every module in the curriculum, is at least 75%.

N.15.9.6 Repeating of modules

A once off repeating of modules that are not passed only occurs according to the stipulations of the General Rule 4.4.6.2.

N.16 RULES FOR THE DEGREE MAGISTER COMMERCII

Prospective students must, before the date set by the relevant research director in consultation with the relevant school director involved, apply to the relevant research director for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other proven prior learning, are judged to have a realistic chance of success would be admitted to a programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

NB: Lectures for the lectured modules for this degree in the Faculty of Natural Sciences are with a single exception presented full-time only.

N.16.1 INTRODUCTION

The MCom degree is a qualification in the Faculty of Natural Sciences following on a BCom, Hons BCom degree or an appropriate BSc or Hons BSc degree.

The research component of the curricula for this degree is conducted in the Research Unit for Business Mathematics and Informatics.

The studies may be undertaken full-time or part-time.

N.16.2 DURATION OF THE STUDIES

The minimum duration of the studies is one year full-time and two years part-time and the maximum duration is two years full-time and three years part-time, taken from the date of first registration for the specific programme. In terms of the procedure explained in the General Rules, a student may apply for an extension of the study period.

N.16.3 ASSUMED PRIOR LEARNING

The student has already obtained an appropriate baccalaureus degree and/or appropriate honours baccalaureus degree. For an MCom degree in a specific subject the honours baccalaureus degree in the same subject is required with the following additional requirement: an honours baccalaureus degree in Mathematics in which Statistics up to level 6 has been taken grants admission to master's studies in Statistics.

If a student does not conform to the provision of N.5.3 the school director determines, in consultation with the research director and if necessary after consulting the Dean and with notice to the Faculty Board, whether the candidate may be admitted to the MCom studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

Programme-specific assumed learning is, where applicable, indicated in each of the programme descriptions.

N.16.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in the General Rules.

The relevant research director in consultation with the school director, may refuse admission to a programme if the standard of competence previously attained by the prospective student in the subject(s) in which he/she wishes to continue his/her studies does not conform to the relevant programme requirements.

If the applications received for a programme are more than the relevant research entity can handle in that programme, the group of students who, in the opinion of the research director in consultation with the school director, has the greatest chance of success will be selected for the relevant programme. The background and potential of students will also be taken into account in this selection process.

N.16.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place on the basis of the provisions in the General Rules and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective students must consult this manual carefully.**

N.16.6 ARTICULATION POSSIBILITIES

On successful completion of one of these MCom curricula the student may be admitted to further learning for the doctorate at NQF level 8 in the core subject in which the qualification has been taken.

Credits will be awarded for modules of other faculties and institutions on condition that the outcomes and total credit requirements of this qualification are totally complied with.

With the basic, applied and expert skills, as well as the research skills that the student has acquired with this qualification in one of the mathematical, computer and natural science disciplines, he/she will be equipped to continue in related specialist areas at other institutions.

Programme specific articulation possibilities are, where applicable, indicated in the programme descriptions.

N.16.7 CHANGING FROM MASTER'S STUDIES TO DOCTOR'S STUDIES

The General Rules make provision for a student who is registered for a master's degree and has attained, according to the unanimous judgement of the study leader and the research and school directors concerned, outcomes of a quality and scope acceptable for a doctorate, to apply to the Faculty Board to change his/her registration for master's studies to that for a doctorate.

N.16.8 EXIT LEVEL OUTCOMES

Above and beyond the exit level outcomes and the critical outcomes as described in the general MSc programme description (see N.4.8) the student will also have mastered the following specific knowledge and skills:

N.16.8.1 Knowledge

a) Knowledge of the research methodology and techniques in one of the subjects that will be demonstrated by writing a mini dissertation or dissertation on an advanced topic.

b) Knowledge of two or more advanced topics from one or more of the subjects as indicated below:

- *Computer Science:* linear programming, databases, data warehouses, pseudo-intelligence, decision support systems, information systems engineering and computer security;
- *Statistics:* advanced resampling methods, statistical models, multivariate statistics, probability theory, stochastic processes and survival theory;
- *Mathematics:* functional analysis, operator theory, algebra, Riesz spaces and Banach latices.

N.16.8.2 Skills

On successful completion of the programme the student will be able to demonstrate that he/she has the following skills:

a) The ability to identify problems from reality with computer/mathematical/ stochastic content, formulate these in forms lending themselves to computer/mathematical/statistical handling, handle them with the most appropriate methods and communicate the solutions.

b) The ability to learn new techniques and theories necessary in solving a problem stated and to consult and use literature by so doing.

c) The ability to see problems of a computer/mathematical/stochastic nature in a broad context and to work on them in a team.

d) The ability to understand, utilise and generalise abstract theories.

e) The ability to structure arguments logically and use them coherently in effective subject communication for the benefit of the broad community when teaching computer science and information systems, statistics or mathematics up to a tertiary level.

f) The ability to act as an independent practitioner in anyone of the topics and to take the lead in standard research projects in the work context.

g) The ability to communicate with non-subject specialists in view of applying results of abstract theories in the community.

h) The ability to use appropriate computer technology and software.

i) The ability to communicate internationally with collegial peers.

N.16.9 PROGRAMME: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 505138

N.16.9.1 Curriculum N870P: Computer Science and Information Systems

Module code	Descriptive name	Credits
First Semester		
ITRN872	Dissertation	100
RSWW811	Research Methodology	8
Select in consultation with the research and school directors TWO of the following modules:		
ITRW876	Databases	32
ITRW877	Decision Support Systems	32
ITRW878	Artificial Intelligence	32
ITRW886	Data Warehouses	32
ITRW884	Information Systems Engineering	32
ITRW885	Computer Security	32
ITRW883	Image Processing	32
Second Semester		
ITRN872	Dissertation (continue)	
RSWW821	Research Communication	8
Total number of credits of the curriculum		**180**

N.16.10 EXAMINATION

N.16.10.1 Exams

The examination opportunities and relevant related rules apply in congruence with General Rule 4.4.

N.16.10.2 Composition of the participation mark

A participation mark for a module (General Rule 2.4.2) can be compiled from tests, worksheets and other forms of evaluation.

N.16.10.3 Admission to the examination for modules wherein exam will be written

a) Admission to the exam in any module takes place after achieving a participation proof.
b) A participation proof, where admission to the exam is permitted, will only be issued after the student meets the approval of the school director, and met the requirements thereof stipulated in the study guide for the appropriate module.

N.16.10.4 Module mark

The module mark (General Rule 2.4.2) is calculated in the ratio that is applied where the evaluation method is applicable on a specific module combined, as is in the study guide of that module.

N.16.10.5 Pass requirements

a) The stipulations of General Rule 4.4. Applies.
b) The subminimum of the exam, for all modules on NQR-level 9 wherein exam is written, is 50%.
c) The pass requirements for a module wherein exam is written, is 50%.
d) A programme is passed by passing all the modules that the programme consists of respectively.
e) If the examiners are not unanimous that the student passed the module, then the final decision rests with the dean, after the dean has sought advice as the dean deems necessary.
f) A module is passed with distinction if a pass mark of at least 75% is acquired. The degree is passed with distinction if the average module mark, weighed against credit marks of every module in the curriculum, is at least 75%.

N.16.10.6 Repeating of modules

A once off repeating of modules that are not passed only occurs according to the stipulations of the General Rule 4.4.6.2.

N.17 RULES FOR THE DEGREE MAGISTER ARTIUM ET SCIENTIAE (PLANNING)

Prospective students must, before the date set by the relevant research director in consultation with the relevant school director involved, apply to the relevant research director for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and proven prior learning, are judged to have a realistic chance of success would be admitted to a programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

N.17.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research entities. The research entities areas are furthermore responsible for the master's and doctorate (PhD) training curricula, i.e. curricula that contain a considerable research component.

Apart from very rare exceptions that must be approved by the Dean the research required for this master's degree must be conducted in the Research Unit of Environmental Sciences and Management.

N.17.2 DURATION OF THE STUDIES

The minimum duration of the studies is one year full-time and two years part-time and the maximum duration is two years full-time and three years part-time, taken from the date of first registration for the specific programme. In terms of the procedure explained in the General Rules 4.4.10, a student may apply for an extension of the study period.

N.17.3 ASSUMED PRIOR LEARNING

The student has a four year baccalaureus degree and/or an appropriate honours baccalaureus degree.

If the student does not conform to the provision of N.6.3 the school director determines in consultation with the research director, and if necessary, after consulting the Dean and with notice to the Faculty Board, whether the candidate may be admitted to the MArt et Scien-studies on the strength of knowledge and skills acquired by prior learning and work experience.

A student must have command of Afrikaans or English.

Programme-specific assumed learning is, where applicable, indicated in each of the programme descriptions.

N.17.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in the General Rules.

The relevant research director in consultation with the school director, may refuse admission to a programme if the standard of competence previously attained by the prospective student in the subject(s) in which he/she wishes to continue his/her studies does not conform to the relevant programme requirements.

If the applications received for a programme are more than the relevant research entity can handle in that programme, the group of students who, in the opinion of the research director in consultation with the school director, has the greatest chance of success will be selected for the relevant programme. The background and potential of students will also be taken into account in this selection process.

N.17.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place in terms of the provisions of the General Rules and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective students must consult this manual carefully.**

N.17.6 ARTICULATION POSSIBILITIES

On taking this degree the student may be admitted to further learning for the PhD degree in Urban and Regional Planning.

N.17.7 CHANGING FROM MASTER'S TO DOCTOR'S STUDIES

The General Rules make provision for a student who is registered for a master's degree and has attained, according to the unanimous judgement of the study leader and the research and school directors concerned, outcomes of a quality and scope acceptable for a doctorate, to apply to the Faculty Board to change his/her registration for master's studies to that for a doctorate.

N.17.8 EXIT LEVEL OUTCOMES

On completion of this qualification the student ought to be able to provide proof that he/she has the following skills and competencies:

a) The ability to apply subject-specific and general planning knowledge and skills in addressing planning issues and in identifying, analysing and solving problems.
b) The ability to independently plan research, collect, process, analyse and interpret data and to write down these findings meaningfully in a dissertation.
c) the ability to retrieve new knowledge and to remain at the forefront of the latest technology and experimental methods in planning;
d) The ability to apply the knowledge and skills acquired in these studies meaningfully as an entrepreneur or for the benefit of the national economy and the people in a specific work situation.
e) The ability to act as a leader in the local or general community.
f) The ability to communicate professionally or in general with scientists and the community, whether orally or in writing, while making use of the appropriate structure, style and graphic and electronic support.

N.17.9 OBJECTIVE

The objective of this programme is to provide students with specialist and advanced skills in research methodology in order to afford such student the opportunity to continue with further research in the field of planning through further learning on NQF 10 level.

A complete dissertation based on research related to the core focuses within Urban and Regional Planning will have to be undertaken. Study leadership will internally be provided by a Professional Urban and Regional Planner registered with SACPLAN. An article option will only be considered on merit and in extraordinary circumstances.

N.17.10 PROGRAMME: MASTER OF SCIENCE IN URBAN AND REGIONAL PLANNING

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANGEMENT

N.17.10.1 Qualification code: 2DH N01: Curriculum N801P (Full-time or Part-time)

Module code	Descriptive name	Credits
SBEL871	Dissertation	180
	Total of credits for curriculum	**180**

N.17.11 EXAMINATION

N.17.11.1 Exams

The examination opportunities and relevant related rules apply in congruence with General Rule 4.4.

N.17.11.2 Composition of the participation mark

A participation mark for a module (General Rule 2.4.2) can be compiled from tests, worksheets and other forms of evaluation.

N.17.11.3 Admission to the examination for modules wherein exam will be written

a) Admission to the exam in any module takes place after achieving a participation proof.
b) A participation proof, where admission to the exam is permitted, will only be issued after the student meets the approval of the school director, and met the requirements thereof stipulated in the study guide for the appropriate module.

N.17.11.4 Module mark

The module mark (General Rule 2.4.2) is calculated in the ratio that is applied where the evaluation method is applicable on a specific module combined, as is in the study guide of that module.

N.17.11.5 Pass requirements

a) The stipulations of General Rule 4.4. Applies.
b) The subminimum of the exam, for all modules on NQR-level 9 wherein exam is written, is 50%.
c) The pass requirements for a module wherein exam is written, is 50%.
d) A programme is passed by passing all the modules that the programme consists of respectively.
e) If the examiners are not unanimous that the student passed the module, then the final decision rests with the dean, after the dean has sought advice as the dean deems necessary.
f) A module is passed with distinction if a pass mark of at least 75% is acquired. The degree is passed with distinction if the average module mark, weighed against credit marks of every module in the curriculum, is at least 75%.

N.17.11.6 Repeating of modules

A once off repeating of modules that are not passed only occurs according to the stipulations of the General Rule 4.4.6.2.

N.18 RULES FOR THE DEGREE MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS

Prospective students must, before the date set by the relevant research director in consultation with the relevant school director involved, apply to the relevant research director for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other proven prior learning, are judged to have a realistic chance of success would be admitted to a programme. The background and potential of students are also taken into account in this selection process. Late applications will only be considered if an additional student can be accommodated in the relevant subject group.

N.18.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research entities. The research entities areas are furthermore responsible for the master's (MSc) and doctorate (PhD) training curricula, i.e. curricula that contain a considerable research component.

Apart from very rare exceptions that must be approved by the Dean the research required for this master's degree must be conducted in the Research Unit for Environmental Sciences and Management.

N.18.2 DURATION OF STUDIES

The minimum duration of the studies is one year full-time and two years part-time and the maximum duration is two years full-time and three years part-time, taken from the date of first registration for the specific programme. In terms of the procedure explained in the General Rules, a student may apply for an extension of the study period.

N.18.3 ASSUMED PRIOR LEARNING

To be admitted to this qualification the candidate should be in possession of the BSc Agric Honours degree (including subjects relevant to agricultural economics, animal health, animal science, crop science and agricultural extension) or an equivalent qualification as approved by Senate. Admission to the study is also subject to the approval of the School Director (MC) or Research Unit Director (PC) and a post graduate selection committee, which will be based on a satisfactory study record and appropriate qualification already obtained. The School Director (MC) or Research Unit Director (PC) may require additional subjects/modules to be completed before the admission to the MSc (Agric).

N.18.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in the General Rules.
The relevant research director in consultation with the school director, may refuse admission to a programme if the standard of competence previously attained by the prospective student in the subject(s) in which he/she wishes to continue his/her studies does not conform to the relevant programme requirements.
If the applications received for a programme are more than the relevant research entity can handle in that programme, the group of students who, in the opinion of the research director in consultation with the school director, has the greatest chance of success will be selected for the relevant programme. The background and potential of students will also be taken into account in this selection process.

N.18.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place in terms of the provisions of the General Rules and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective students must consult this manual carefully.**

N.18.6 ARTICULATION POSSIBILITIES

A student having completed this degree may be admitted to the PhD studies in a core subject in which adequate credits have been obtained.

N.18.7 CHANGING FROM MASTER'S TO DOCTOR'S STUDIES

The General Rules make provision for a student who is registered for a master's degree and has attained, according to the unanimous judgement of the study leader and the research and school directors concerned, outcomes of a quality and scope acceptable for a doctorate, to apply to the Faculty Board to change his/her registration for master's studies to that for a doctorate.

N.18.8 EXIT LEVEL OUTCOMES

By completion of this qualification, the student should be able to:

a) Demonstrate a comprehensive and systematic knowledge base in the specific field of animal health / animal sciences / agronomy and crop science / agriculture economics.
b) Demonstrate a critical understanding of the theory, research methodologies and techniques relevant to agriculture and be able to collect and critical evaluate current research and take part in scholarly debates in this particular field of specialization.
c) Identify, analyse and deal with complex real world problems and issues regarding agriculture, to apply relevant research methods, techniques and technologies, collect, interpret and evaluate data under supervision and communicate results of the research to specialist and non-specialist audiences in a dissertation which meets the standards of the faculties and NWU.

N.18.9 OBJECTIVE

The purpose of this programme is to provide students of specialist knowledge and advanced skills in research methodology, which should enable the student to continue as a specialist in the field of Agricultural Sciences on NKR-level 9. The qualifier should belong to a prestigious group of masters in the field of Agricultural Sciences in the country. Students will have access to further studies in Agricultural Sciences nationally, as well as internationally.

N.18.10 PROGRAMME: MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.18.10.1 Qualification code: 2CG N01: Curriculum N801P (Full-time or Part-time)

Module code	Descriptive name	Credits
AECM871	Dissertation	240
	Total of credits for curriculum	**240**

N.18.11 EXAMINATION

N.18.11.1 Exams

The examination opportunities and relevant related rules apply in congruence with General Rule 4.4.

N.18.11.2 Composition of the participation mark

A participation mark for a module (General Rule 2.4.2) can be compiled from tests, worksheets and other forms of evaluation.

N.18.11.3 Admission to the examination for modules wherein exam will be written

a) Admission to the exam in any module takes place after achieving a participation proof.
b) A participation proof, where admission to the exam is permitted, will only be issued after the student meets the approval of the school director, and met the requirements thereof stipulated in the study guide for the appropriate module.

N.18.11.4 Module mark

The module mark (General Rule 2.4.2) is calculated in the ratio that is applied where the evaluation method is applicable on a specific module combined, as is in the study guide of that module.

N.18.11.5 Pass requirements

a) The stipulations of General Rule 4.4. Applies.
b) The subminimum of the exam, for all modules on NQR-level 9 wherein exam is written, is 50%.
c) The pass requirements for a module wherein exam is written, is 50%.
d) A programme is passed by passing all the modules that the programme consists of respectively.
e) If the examiners are not unanimous that the student passed the module, then the final decision rests with the dean, after the dean has sought advice as the dean deems necessary.
f) A module is passed with distinction if a pass mark of at least 75% is acquired. The degree is passed with distinction if the average module mark, weighed against credit marks of every module in the curriculum, is at least 75%.

N.18.11.6 Repeating of modules

A once off repeating of modules that are not passed only occurs according to the stipulations of the General Rule 4.4.6.2.

N.19 RULES FOR THE DEGREE PHILOSOPHIAE DOCTOR

The PhD degree is the doctor's degree in the Faculty of Natural Sciences following on a master's degree.
The studies may be undertaken full-time or part-time.
Prospective students must apply to the relevant research director for selection and formal admission to the intended programme in the following year (see General Rules). Only students who, on the basis of their academic record and other relevant proven prior learning, are judged to have a realistic chance of success would be admitted to a programme. The background and potential of students are also taken into account in this selection process.
New PhD students must register before 30 March of the year in which they wish to commence their studies.

N.19.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research entities. The research entities are responsible for the master's (MSc) and doctorate (PhD) training curricula, i.e. curricula that contain a considerable research component.

At the moment, there is one centre of excellence in Space Research, two research units, viz. Business Mathematics and Informatics, Environmental Sciences and Management, and the research focus area, Chemical Resource Beneficiation, as well as two centres, viz. 1) Human Metabolomics and 2) Business Mathematics and Informatics.

Apart from very rare exceptions that must be approved by the Dean, research required for a doctoral thesis must therefore be conducted in the context of a research entity. In the following table the most important connections between schools, centres, subject groups and the corresponding research entity are represented.

SCHOOL/CENTRE	SUBJECT GROUP	RESEARCH ENTITY
School of Physical and Chemical Sciences	Biochemistry	Human Metabolomics
	Chemistry	Chemical Resource Beneficiation Environmental Sciences and Management
	Physics	Space Research
School of Biological Sciences	Botany Microbiology Zoology	Environmental Sciences and Management
School of Geo- and Spatial Sciences	Geography and Environmental Management Geology Urban and Regional Planning	Environmental Sciences and Management

SCHOOL/CENTRE	SUBJECT GROUP	RESEARCH ENTITY
School of Computer, Statistical and Mathematical Sciences	Computer Science and Information Systems Statistics Applied Mathematics Mathematics	Business Mathematics and Informatics
Centre for Business Mathematics and Informatics	Actuarial Science Data Mining (Hons BSc) ; Business Analytics (MSc) Financial Mathematics Quantitative Risk Management Risk Analysis	Business Mathematics and Informatics
Centre for Water Science and Management	Hydrology	Water Science and Management

The PhD curricula that are presented in the Faculty of Natural Sciences are in this calendar classified in the research entity in which the research component of the programme falls.

N.19.2 DURATION OF THE STUDIES

The minimum duration of the studies is two years and the maximum duration four years, taken from the date of first registration for the specific programme. In terms of the procedure explained in the General Rule 5.4.10, a student may apply for an extension of the study period.

N.19.3 ASSUMED PRIOR LEARNING

The student has already obtained an appropriate master's degree.
If the student does not conform to this the Dean determines in consultation with the Faculty Management Committee and with notice to the Faculty Board and Senate whether the candidate may be admitted to the PhD studies on the strength of prior learning and work experience that led to learning.
Programme-specific assumed learning is, where applicable, indicated in each of the programme descriptions.

N.19.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in the General Rules 5.2.
The relevant research director in consultation with the school director, may refuse admission to a programme if the standard of competence previously attained by the prospective student in the subject(s) in which he/she wishes to continue his/her studies does not conform to the relevant programme requirements.
If the applications received for a programme are more than the relevant research entity can handle in that programme, the group of students who, in the opinion of the research director in consultation with the school director, has the greatest chance of success will be selected for the relevant programme. The background and potential of students will also be taken into account in this selection process.

N.19.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place in terms of the provisions in the General Rules and the relevant provisions in the ***Manual for Postgraduate Studies*. Prospective students must consult this manual carefully.**

N.19.6 ARTICULATION POSSIBILITIES

a) Credits will be awarded in view of learning at other faculties and institutions, on condition that the outcomes and total credit requirements for the curriculum of this qualification is totally complied with.
b) With the basic applied and expert skills, as well as the research skills that the student has acquired by this qualification in one of the mathematical, computer and natural science disciplines, he/she will be equipped to continue with further learning and research in related specialist areas at other national or international institutions.

N.19.7 EXIT LEVEL OUTCOMES

The student in this programme will attain the following specific outcomes:

- He will write *a thesis of high technical quality* (with reference to language usage, illustrations, tables, graphic representations, etc.) that will demonstrate: his command of an applied competency in an applicable quantitative and qualitative research methodology and in scientific penmanship; his ability to identify a relevant research problem in a natural science or health science discipline by integrating the above-mentioned skills and by thoroughly investigating existent knowledge as reflected in appropriate scientific literature;

- his ability to carry out the desired research in view of solving the problem;

- his ability to evaluate the results scientifically in the context of the problem statement;

- his ability to communicate the results scientifically.

The student will demonstrate by means of a *literature investigation* that he has a thorough and in-depth knowledge of related scientific literature; has the ability to interpret and debate different viewpoints and theories on a scientific basis; has looked up a large enough quantity of recent *and* appropriate historic primary and secondary sources in the speciality area.

The student will provide proof by means of *problem identification* that he has a sound insight into the nature and aim of the research; has the ability to circumscribe the research topic properly at the level of a doctorate.
Apart from the literature investigation the student will demonstrate that the research method is appropriate to the speciality area in view of handling the problem identified and that the research method has been selected in a reflexive and responsible manner.

By scientific *evaluation and communication of the results* the student will demonstrate the following:

- scientific processing of the thesis, with reference to the handling of appropriate quantitative or qualitative research methods and/or techniques, such as modelling, mathematical techniques of proof, experiments, observations, systematisation, founding of scientific statements, etc., as may be relevant to the problem investigated;
- the ability to formulate clearly; the ability to present a logical structure; a critical attitude and personal insight;
- the ability to formulate scientifically justified recommendations.

Summarised:
Students will have to demonstrate their ability to make a specific contribution to the development of new knowledge and skills in the field of specialisation by providing proof they have mastered knowledge of the theory and principles in the field; they are capable of integrating theory and practice in the field; of critical analysis of existing methodologies in the field; of analysis and interpretation of research data and results; of reporting research results in a scientifically acceptable format.
The outcomes as described for the master's degrees are further refined and finally rounded off in this programme.

N.20 PROGRAMMES IN THE RESEARCH UNIT FOR BUSINESS MATHEMATICS AND INFORMATICS

N.20.1 PROGRAMME: DOCTOR OF PHILOSOPHY IN COMPUTER AND INFORMATION SCIENCES WITH COMPUTER SCIENCE AND INFORMATION SYSTEMS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

N.20.1.1 Qualification code: 2CB R02: Curriculum N901P

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
ITRW971	Thesis	360

N.20.2 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH STATISTICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

N.20.2.1 Qualification code: 2CC R20: Curriculum N901P

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
STTK971	Thesis	360

N.20.3 PROGRAMME: APPLIED MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204139

N.20.3.1 Curriculum N903P: Applied Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
TGWS971	Thesis	360

N.20.4 PROGRAMME: MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204140

N.20.4.1 Curriculum N904P: Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
WISK971	Thesis	360

N.20.5 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH NATURAL SCIENCES EDUCATION

N.20.5.1 Qualification Code 2CC R09: Curriculum N901P

Prospective students must hold an applicable masters degree and a Post-Graduate Certificate in Education (PGCE).

Module Code	Descriptive Name	Credits
NWON971	Thesis	360

N.21 PROGRAMMES IN THE CENTRE OF BUSINESS MATHEMATICS AND INFORMATICS

N.21.1 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH BUSSINESS MATHEMATICS

N.21.1.1 Qualification code: 2CC R01: Curriculum N901P

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

This programme is compiled as follows:

Module code	Descriptive name	Credits
BWIN971	Thesis	360

N.21.2 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH RISK ANALYSIS

N.21.2.1 Qualification code: 2CC R15: Curriculum N901P

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

This programme is compiled as follows:

Module code	Descriptive name	Credits
BWIR971	Thesis	360

N.22 PROGRAMMES IN THE CENTRE FOR SPACE RESEARCH

N.22.1 PROGRAMME: SPACE PHYSICS

RESEARCH UNIT: CENTRE FOR SPACE RESEARCH

Qualification code: 204112

There is only one curriculum in this research unit. A topic for a thesis may be selected from one of the following research directions:

a) Gamma-ray astronomy
b) Optical astronomy
c) Cosmic-ray Physics
d) Heliospheric Physics
e) Experimental/technical work on neutron monitors as cosmic-ray recorders, and their data analysis.
f) Technological innovation studies based on astro-technologies.

N.22.1.1 Curriculum N906P: Physics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
FSKN971	Thesis	360

N.23 PROGRAMMES IN THE FOCUS AREA FOR CHEMICAL RESOURCE BENEFICIATION

N.23.1 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH CHEMISTRY

RESEARCH UNIT: CHEMICAL RESOURCE BENEFICIATION

N.23.1.1 Qualification code: 2CC R11: Curriculum N901P

There are five research areas in this research entity and a research topic for a PhD thesis must therefore be selected from one of these research areas. The research areas are:

a) Chromium Technology
b) Catalysis and Synthesis
c) Membrane Technology
d) Electrochemistry for Energy and Environment
e) Coal Chemistry

This programme is compiled as follows:

Module code	Descriptive name	Credits
CHEN971	Thesis	360

N.24 PROGRAMMES IN THE UNIT FOR ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.1 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH ENVIROMENTAL SCIENCES

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.1.1 Qualification code: 2CC R04: Curriculum N901P

The topic for a PhD thesis must be selected from one of the following research fields in consultation with the directors of the School and Research Unit:

a) Climate change, Air Quality and Impacts
b) Aquatic Ecosystem Health
c) Biodiversity and Conservation Ecology
d) Ecological Interactions and Ecosystem Resilience
e) Spatial Planning, Development and Implementation
f) Environmental Geology and Soil Sciences

Module code	Descriptive name	Credits
OMWN971	Thesis	360

N.24.2 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH ATMOSPHERIC CHEMISTRY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.2.1 Qualification code: 2CC R05: Curriculum N901P

This programme is composed of the following:

Module code	Descriptive name	Credits
CHEM971	Thesis	360

N.24.3 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH DISASTER RISK SCIENCE

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.3.1 Qualification code: 2CC R14: Curriculum N901P

This programme is composed of the following:

Module code	Descriptive name	Credits
DRRS971	Thesis	360

N.24.4 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH ZOOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.4.1 Qualification code: 2CC R18: Curriculum N901P

This programme can only be followed of the student already has an appropriate MSc degree.

In this programme research can be conducted on any subject in Zoology, although the Unit retains the right not to accept a candidate in instances where there is not sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
DRKN971	Thesis	360

N.24.5 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.5.1 Qualification Code: 2CC R19: Curriculum N901P

This programme can only be followed of the student already has an appropriate MSc degree.

In this programme research can be conducted on any subject in Geography, although the Unit retains the right not to accept a candidate in instances where there is not sufficient particular expertise among staff on the specific research topic. Specialist fields include (but are not limited to):

a) Spatial studies

b) Environmental impact analysis and all aspects thereof

c) Environmental management and all aspects thereof

d) Physical and human Geography

This programme is composed of the following:

Module code	Descriptive name	Credits
GGFN971	Thesis	360

N.24.6 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH MICROBIOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.6.1 Qualification Code: 2CC R17: Curriculum N901P

This programme can only be followed of the student already has an appropriate MSc degree.

In this programme research can be conducted on any subject in Microbiology, although the Unit retains the right not to accept a candidate in instances where there is not sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
MKBN971	Thesis	360

N.24.7 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH BOTANY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.7.1 Qualification Code: 2CC R16: Curriculum N901P

This programme can only be followed of the student already has an appropriate MSc degree.

In this programme research can be conducted on any subject in Botany, although the Unit retains the right not to accept a candidate in instances where there is not sufficient capacity.

This programme is composed of the following:

Module code	Descriptive name	Credits
PLKN971	Thesis	360

N.24.8 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH URBAN AND REGIONAL PLANNING

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

N.24.8.1 Qualification Code: 2CC R07: Curriculum N901P

This programme is compiled as follows:

Module code	Descriptive name	Credits
SBEL971	Thesis	360

Objective

The objective of the programme is to enable a student who has completed a recognized Magister degree in Urban and Regional Planning the opportunity to prove through a doctoral thesis that he/she made a contribution to the development of new knowledge and/or applicable skills directly related to the subject field.
A further objective of the programme is to provide South Africa with scientific researchers that have a broad theoretical knowledge and practical skills in planning in order to contribute to the leadership basis for innovative and knowledge based environmental scientists for the country.

The option of writing the thesis in article format, will be considered on merit, in which case the rules of the Faculty of Natural Sciences will apply. A complete thesis based on original research related to the core focuses within Urban and Regional Planning will have to be undertaken. Unlocking of specific new knowledge within the subject area of Urban and Regional Planning forms a basic requirement. Study leadership will internally be provided by a Professional Urban and Regional Planner registered with SACPLAN.

N.24.9 PROGRAMME: DOCTOR OF PHILOSOPHY IN AGRICULTURE WITH AGRICULTURAL ECONOMICS

N.24.9.1 Qualification Code: 2EA R03: Curriculum N901P

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

A student in order to qualify for admission to PhD studies, must have a MAgric or Msc Agric or MSA degree.
At the PC candidates must apply at the Research Unit Director on the prescribed form for admission to PhD studies at the PC and convince the Research Unit Director concerned beforehand that he/she has sufficient knowledge of the subject to warrant admission.

Agricultural Economics

This programme is compiled as follows:

Module Code	Descriptive Name	Credits
AECM971	Thesis	360

N.25 PROGRAMME IN THE FOCUS AREA HUMAN METABOLOMICS

N.25.1 PROGRAMME: DOCTOR OF PHILOSOPHY IN SCIENCE WITH BIOCHEMISTRY

N.25.1.1 Qualification Code 2CC R08: Curriculum N901P

CENTRE: HUMAN METABOLOMICS

This programme is compiled as follows:

Module code	Descriptive name	Credits
BCHN971	Thesis	360

N.26 PROGRAMME IN CENTRE FOR WATER SCIENCE AND MANAGEMENT

N.26.1 PROGRAMME DOCTOR OF PHILOSOPHY IN SCIENCE WITH HYDROLOGY AND GEOHYDROLOGY

N.26.1.1 Qualification code: 2CC R06: Curriculum N901P

CENTRE: WATER SCIENCE AND MANAGEMENT

This programme is composed of the following:

Module code	Descriptive name	Credits
HDGH971	Thesis	360

N.27 EXAMINATIONS

N.27.1 EXAMS

a) Examinations for the doctorate are taken in terms of the provisions of the General Rule 5.4.

b) Submitting the thesis takes place in terms of the General Rule 5.4.2.

c) The number of times that a student may present him-/herself for examinations and the repetition of modules are determined by the provisions of the General Rule 5.4.6.

N.27.2 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with General Rule 5.4.4 and 5.4.9.

N.28 MODULE LIST

HONOURS			
Module code Honours	**Descriptive name**	**Credits**	**NQF-level**
BCHN611	Analytical Biochemistry	24	8
BCHN612	Advanced Metabolism	24	8
BCHN621	Advanced Molecular Biology	24	8
BCHN622	Bioenergetics	24	8
BCHN671	Biochemistry research project	32	8
BWIA671	Actuarial Risk Management (A301/CA1)	80	8
BWIB611	Statistical Learning I	16	8
BWIB612	Introduction to Business Intelligence	12	8
BWIB613	Problem Solving using Simulation	12	8
BWIB621	Statistical Learning II	16	8
BWIB622	Forecasting for Business	16	8
BWIN611	Quantitative Risk Analysis I	16	8
BWIN613	Financial Engineering I	16	8
BWIN614	Investment Theory I	16	8
BWIN615	Financial Modelling and Optimisation	16	8
BWIN621	Quantitative Risk Analysis	16	8
BWIN622	Pricing of Derivatives A	16	8
BWIN623	Financial Engineering II	16	8
BWIN625	Financial Modelling and Optimisation	16	8
BWIR622	Research Module: Financial Engineering and Pricing of Derivatives	32	8
BWIR671	Research Module: Financial Engineering and Financial Modelling	32	8
BWIR672	Research Module: Financial Modelling and Optimisation	32	8
CHEN611	Advanced organic Chemistry	16	8
CHEN612	Advanced physical Chemistry	16	8
CHEN613	Advanced inorganic Chemistry	16	8
CHEN614	Molecular modelling	8	8
CHEN671	Project	48	8
CHEN621	Homogeneous catalysis	8	8
CHEN622	Coal chemistry	8	8

Module code Honours	Descriptive name	Credits	NQF-level
CHEN623	Membrane science and technology	8	8
CHEM621	Polymer chemistry	8	8
CHEM622	Advanced structural clarification	8	8
CHEM623	Environmental chemistry	8	8
CHEM624	Techniques for organic synthesis	8	8
CHEM626	Electrochemistry	8	8
ECON623	Risk Management	16	8
FSKH611	Classical Mechanics	16	8
FSKH612	Quantum Mechanics I	16	8
FSKH613	Electrodynamics	16	8
FSKH614	Plasma Physics	16	8
FSKH671	Project I	8	8
FSKH621	Quantum Mechanics II	16	8
FSKH622	Statistical Mechanics	16	8
FSKH623	Computer Physics (Research)	16	8
FSKH672	Project II	8	8
GGFS671	Introduction to Earth Observation	20	8
GGFS672	Air pollution	20	8
ITRI611	Data Warehouses I	12	8
ITRI612	Linear Programming I	12	8
ITRI613	Databases I	12	8
ITRI614	Information Systems Engineering I	12	8
ITRI615	Computer Security I	12	8
ITRI616	Artificial Intelligence I	12	8
ITRI617	Image Processing I	12	8
ITRI618	Decision Support Systems I	12	8
ITRI621	Data Warehouses II	12	8
ITRI622	Linear Programming II	12	8
ITRI623	Databases II	12	8
ITRI624	Information Systems Engineering II	12	8
ITRI625	Computer Security II	12	8
ITRI626	Artificial Intelligence II	12	8
ITRI627	Image Processing II	12	8
ITRI628	Decision Support Systems II	12	8
ITRI671	Project	32	8

Module code Honours	Descriptive name	Credits	NQF-level
OMBE622	Applied Hydrology	16	8
OMBE623	Groundwater Geology	16	8
OMBE624	Geohydrology	16	8
OMBE625	Introduction to Hydrology and Integrated Water Resources Management	16	8
OMBE673	Research Project	40	8
OMBO611	Introduction to Environmental Management	16	8
OMBO613	Introduction to GIS	16	8
OMBO614	GIS Applications	16	8
OMBO678	Environmental Management I	20	8
OMBO679	Environmental Analysis I	20	8
OMBO681	Environmental Assessment I	20	8
OMBW611	Fundamentals of Waste Management	20	8
OMBW612	Waste Management Law and Governance	16	8
OMBW621	New Waste Management Solutions	16	8
OMSA622	Weeds: interactions and control	16	8
OMSA623	Plant pathology	16	8
OMSB611	Conservation Ecology	16	8
OMSB621 will become OMSB629	Genome Analysis and Bio-informatics	16	8
OMSB624 will become OMSB 613	Biodiversity Planning	16	8
OMSB625 will become OMSB614	Biomonitoring and Risk Assessment	16	8
OMSB627	Herpetology in Practise	16	8
OMSB628	Coral Reef Ecology	16	8
OMSE611	Environmental Soil Science (full-time only, GDKN 122, GDKN 211 and GDKN 221 are pre-requisites for this module)	16	8
OMSE612	Introduction to Landscape Ecology	16	8
OMSE621	Restoration of degraded ecosystems	16	8
OMSE622	Urban Ecology	16	8

Module code Honours	Descriptive name	Credits	NQF-level
OMSE623	Plant ecophysiology and stress physiology	16	8
OMSE625	Advanced Ecotoxicology	16	8
OMSE626	Microbial Ecology	16	8
OMSE674	Research Project	32	8
OMSG611	Environmental geochemistry (full-time only, GLGN 122 and GLGN311 are pre-requisites for this module)	16	8
OMSG621	Environmental Mineralogy (GLGN 122 and GLGN211 are pre-requisites for this module)	16	8
OMSG622	Applied environmental geology (GLGN 112, GLGN221 and GLGN321 are pre-requisites for this module)	16	8
OMSP611	Principles of integrated pest management	16	8
OMSP622	GM crops and integrated pest management	16	8
OMSP623	Nematodes and crops	16	8
OMSP624	Arthropoda/plant interactions	16	8
OMSW611	Aquatic Ecosystems: Pollution and Ecotoxicology	16	8
OMSW622	Phycology	16	8
OMSW624	Environmental Hydrology	16	8
OMSW625	Limnology	16	8
OMSW626	Animal ecology	16	8
OMWE611	Rehabilitation of disturbed areas (full-time only, GDKN 121, GDKN 211 and GDKN 221 are pre-requisites for this module)	16	8
OMWP611	Pest phenology and damage symptoms	16	8
OMWP613	Economic damage and threshold values	16	8
OMWW611	Physical, chemical and biological properties of inland water	16	8
OMWW614 will become OMWW 617	Zoonoses	16	8
OMWW616	Estuarine and near shore marine ecology	16	8
OMWW629 will become OMWW621	Advanced waste water treatment	16	8

Module code Honours	Descriptive name	Credits	NQF-level
STTN611	Research project I (practice directed)	16	8
STTN612	Statistical Data-analysis I: Models	12	8
STTN613	Resampling	12	8
STTN614	Statistical Inference	12	8
STTN615	Stochastic Processes I	12	8
STTN616	Nonparametric estimation methods	12	8
STTN617	Mathematical and Computer-intensive methods I	12	8
STTN618	Financial-driven Statistics I	12	8
STTN621	Research project (Research journal directed)	16	8
STTN622	Statistical Data-analysis II: Time Series	12	8
STTN623	Multivariate Statistics	12	8
STTN624	Discrete Data-analysis	12	8
STTN625	Stochastic Processes II	12	8
STTN626	Probability Theory	12	8
STTN627	Mathematical and Computer-intensive methods II	12	8
STTN628	Financial-driven Statistics II	12	8
TGWN612	Numerical Analysis I	12	8
TGWN613	Partial Differential Equations I	12	8
TGWN614	Financial Mathematics Modelling I	12	8
TGWN615	Modelling I	12	8
TGWN616	Control Theory I	12	8
TGWN617	Fluid Dynamics I	12	8
TGWN622	Numerical Analysis II	12	8
TGWN623	Partial Differential Equations II	12	8
TGWN624	Financial Mathematics Modelling II	12	8
TGWN625	Modelling II	12	8
TGWN626	Control Theory II	12	8
TGWN627	Fluid Dynamics II	12	8
TGWN671	Project	32	8

Module code Honours	Descriptive name	Credits	NQF-level
WISK613	Topology of Metric and Normed Spaces	8	8
WISK615	Differential Equations	16	8
WISN612	Abstract Algebra I	12	8
WISN613	Complex Function Theory	12	8
WISN614	Measure and Integration theory I	12	8
WISN615	Functional Analysis I	12	8
WISN616	Fundamentals of Mathematics	12	8
WISN622	Abstract Algebra II	12	8
WISN623	Fourier/Harmonic/Analysis	12	8
WISN624	Measure and Integration theory II	12	8
WISN625	Functional Analysis II	12	8
WISN626	Evolution of Mathematical Ideas	12	8
WISN627	Matrix Analysis	12	8
WISN628	Topology	12	8
WISN671	Project	32	8

MAGISTER			
Module code Magister Sc	**Descriptive name**	**Credits**	**NQF-level**
BCHN872	Dissertation	135	9
BCHN877	Advanced Biochemistry	45	9
BWIA811	Enterprise-Wide Risk Management	24	9
BWIA812	Enterprise-Wide Risk Management I	24	9
BWIA821	Enterprise-wide Risk Management II	12	9
BWIB818	Business Intelligence	16	9
BWIB821	Data Mining Techniques	12	9
BWIB822	Contemporary Issues in Business Analytics	12	9
BWIB823	Multiple Criteria Decision Making	12	9
BWIN811	Practical Risk Management SAS RD	16	9
BWIN812	Pricing of Derivatives B	24	9
BWIN813	Practical Data Mining	16	9
BWIN815	Industry Integration Project	32	9
BWIN816	Modern Portfolio Theory	16	9
BWIN817	Retail Credit Risk	16	9
BWIN818	Topical Research issues in Risk Analysis	16	9
BWIR826	Industry Directed Research Project	80	9
BWIN872	Dissertation	132	9
CHEM871	Dissertation	180	9
CHEN872	Dissertation	132	9
CHEN874	Advanced Chemistry	48	9
DRKN871	Dissertation	180	9
DRRS871	Dissertation	180	9
ECOM871	Dissertation	240	9
Module code Magister Sc	**Descriptive name**	**Credits**	**NQF-level**
FSKB874	Plasma Physics	12	9
FSKB875	Magnetohydrodynamics	12	9
FSKB877	Cataclysmic variables	12	9
FSKB878	Extragalactic astronomy	12	9
FSKB879	Advanced General Relativity	12	9
FSKB880	High-energy astrophysics and pulsars	12	9
FSKB882	Stellar structure and -evolution	12	9

FSKB885	Geomagnetism and Aeronomy	12	9
FSKB886	Computational Astrophysics	12	9
FSKB887	Radio Interferometry	12	9
FSKB888	Time Series and Data Analysis	12	9
FSKB889	Space Weather	12	9
FSKB890	Observational Cosmology	12	9
FSKB891	Theoretical Cosmology	12	9
FSKM811	Astrophysics I	16	9
FSKM812	Transport Theory	16	9
FSKM813	Astrophysics II	16	9
FSKM814	Heliospheric Physics	16	9
FSKM815	Capita Selecta I	16	9
FSKM821	General Relativity	16	9
FSKS872	Dissertation	132	9
GGFN871	Dissertation	180	9
HDGH871	Dissertation	180	9
HDMG871	Dissertation	180	9
IPMM871	Dissertation	180	9
ITRN872	Dissertation	100	9
ITRW876	Databasisse	32	9
ITRW877	Decision Support Systems	32	9
ITRW878	Artificial Intelligence	32	9
ITRW883	Image Processing	32	9
ITRW884	Information Systems Engineering	32	9
ITRW885	Computer Security	32	9
ITRW886	Data Warehouses	32	8
Module code Magister Sc	**Descriptive name**	**Credits**	**NQF-level**
MKBN871	Dissertation	180	9
NWON871	Dissertation	180	9
OMBO873	Mini dissertation	100	9
OMBO878	Environmental Management 2	40	9
OMBO879	Environmental Analysis 2	40	9
OMBO880	Management of Ecological Drivers in Aquatic Systems	40	9
OMBO881	Management of Ecological Responders in Equatic Systems	40	9
OMBO882	Integrated Waste Management	40	9
OMBO883	Waste Management Law And Governance	40	9
OMWN871	Dissertation	180	9

PLKN871	Dissertation	180	9
RSWW811	Research Method	8	9
RSWW821	Research Communication	8	9
SBEL871	Dissertation	180	9
STTK874	Advanced Resampling Methods	32	9
STTK875	Advanced Statistical Models	32	9
STTK876	Advanced Multivariate Statistics	32	9
STTK877	Advanced Probability Theory	32	9
STTK878	Advanced Time Series Models	32	9
STTK879	Advanced Stochastic Processes	32	9
STTN872	Dissertation	100	9
STTN874	Advanced Survival Models	32	9
TGWN872	Dissertation	100	9
TGWN881	Applicable Analysis I	32	9
TGWN882	Applicable Analysis II	32	9
TGWN883	Modelling I	32	9
TGWN884	Modelling 2	32	9
TGWN887	Principles and Paradigms:Applied Mathematics	32	9
Module code Magister Sc	**Descriptive name**	**Credits**	**NQF-level**
WISK872	Dissertation	100	9
WISN881	Abstract Analysis I	32	9
WISN882	Abstract Analysis II	32	9
WISN883	Algebra I	32	9
WISN884	Algebra II	32	9
WISN885	Discrete Structures I	32	9
WISN886	Discrete Structures 2	32	9
WISN887	Principles and Paradigms: Pure Mathematics	32	9

Philosophiae Doctor			
Module code PhD	**Descriptive name**	**Credits**	**NQF-level**
AECM971	Thesis	360	10
BCHN971	Thesis	360	10
BWIN971	Thesis	360	10
BWIR971	Thesis	360	10
CHEN971	Thesis	360	10
CHEM971	Thesis	360	10
DRKN971	Thesis	360	10
DRRS971	Thesis	360	10
FSKN971	Thesis	360	10
GGFN971	Thesis	360	10
HDGH971	Thesis	360	10
ITRW971	Thesis	360	10
MKBN971	Thesis	360	10
NWON971	Thesis	360	10
OMWN971	Thesis	360	10
PLKN971	Thesis	360	10
SBEL971	Thesis	360	10
STTK971	Thesis	360	10
TGWS971	Thesis	360	10
WISK971	Thesis	360	10

N.29 MODULE OUTCOMES

N.29.1 BACHELOR OF SCIENCE HONOURS

School: Biological Sciences	**Subject Group: Biochemistry**	
Module code: BCHN611	**Semester 1**	**NQF-Level: 8**
Title: **Analytical Biochemistry**		
Module-outcomes: After completion of the module BCHN611, the student should demonstrate: 1. applied knowledge and understanding of numerous analytical techniques that can be used in biochemical investigations. 2. an ability to critically evaluate the sources of knowledge on these analytical techniques from text books, journal publications and internet resources. 3. specialized skills to utilise these analytical techniques to investigate specific biochemical problems including inherited-, non-communicable- and infectious diseases. 4. the ability to effectively present and communicate results obtained with these analytical techniques. 5. an ability to identify and critically reflect on the ethical, legal and social implications, as well as the professional conduct required for biochemical research and diagnostics.		
Method of delivering: Full Time		
Assessment Methods – Formal Formative The formative assessments include individual assignments and discussions. **Assessment Methods – Summative** The summative assessment consists of formal tests or assignments for each of the subsections of the course at appointed times by every student. **Assessment Plan – English** The module mark is calculated by taking the average of all the formal tests and/or assignments.		
School: Biological Sciences	**Subject Group: Biochemistry**	
Module code: BCHN612	**Semester 1**	**NQF-Level: 8**
Title: **Advanced Metabolism**		
Module-outcomes: After completion of the module BCHN612, the student should demonstrate: (a) integrated knowledge and understanding of the theory of human metabolism, the human metabolome and analytical techniques for metabolic profiling; (b) the ability to evaluate the metabolome of humans critically and to trace abnormalities back to a possible enzyme defect, cofactor deficiency, inhibiting compounds like diet, environmental factors or medication; (c) the ability to propose additional analyses to investigate potential metabolic defects and finally to confirm the defect; (d) the ability to identify a possible treatment based on the metabolism, presence of possible toxic substances formed in the alternative metabolism and deficiency of important biological compounds which are not formed due to the defect. (e) the ability to identify ethical issues regarding genetic defects.		
Method of delivering: Full Time		
Assessment methods: **Assessment Methods –**Formative assessments consist of in-class presentations, in-class assignments and take-home assignments. **Assessment Methods – Summative** The summative assessment consists of an examination paper that will be written at an appointed time by every student. **Assessment Plan** The take-home formative assessment assignments contribute 40% and the summative assessment opportunity 60% to the module mark.		

School: Biological Sciences		Subject Group: Biochemistry
Module code: BCHN621	**Semester 2**	**NQF8Level: 8**

Title: **Advanced Molecular Biology**

Module-outcomes:

After completion of the module BCHN621, the student should demonstrate:

1. integrated knowledge and understanding of the forefront and emerging topics, methods, advances and challenges in molecular biology;
2. an ability to assimilate multiple sources of knowledge such as books, journals and the internet on particular topics within the field of molecular biology, and critically evaluate and review this knowledge;
3. an ability to present and communicate the forefront of molecular biology on a particular topic effectively, offer creative insights, rigorous interpretations and solutions to specific problems; the ability to identify, demarcate, analyze, critically reflect on and effectively apply relevant knowledge to address complex problems in molecular biology by using appropriate methods;
4. the ability to identify and address ethical issues in molecular biology based on critical reflection on suitability of different ethical value systems and an understanding of professional conduct required of a professional biochemist.

Method of delivery: Full Time

School: Biological Sciences		Subject Group: Biochemistry
Module code: BCHN622	**Semester 2**	**NQF8Level: 8**

Title: **Bioenergetics**

Module-outcomes:

After completion of the module BCHN622, the student should demonstrate:

1. applied knowledge and understanding of the eukaryotic biochemical pathways and cellular components involved in bioenergetics, as well as the genetics involved.
2. an ability to critically evaluate the sources of knowledge on these topics from text books, journal publications, internet resources. Furthermore, to understand and evaluate the methodologies that was used in these sources.
3. specialized skills to assimilate how these interrelated topics can be associated with inherited-, non-communicable- and infectious diseases in humans.
4. the ability to effectively present and communicate a critical review on these topics, with the ability to identify and predict the consequences of biological problems.
   an ability to identify and critically reflect on the ethical, legal and social implications, as well as the professional conduct required for research and diagnostics related to these biological topics.

Method of delivering: Full Time

Assessment methods:

Assessment Methods – Formal Formative

The formative assessments include individual in-class presentations and discussions.

Assessment Methods – Summative

The summative assessment consists of an examination paper that will be written at an appointed time by every student.

Assessment Plan – English

The participation mark will be determined from an individual class presentation and discussion session on a selected topic. A written examination will follow at the end of the module. The participation mark and examination mark will contribute 30% and 70%, respectively, to the module mark.

School: Biological Sciences	Subject Group: Biochemistry	
Module code: BCHN671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Biochemistry research project**

Module-outcomes:

After completion of the module BCHN671, the student should demonstrate:

(a) sufficient knowledge to plan, conduct and report results of a scientific research project in Biochemistry;

(b) an ability to assimilate multiple sources of knowledge such as books, journals and the internet on particular topics within the field of Biochemistry, and critically evaluate, review and integrate this knowledge to prepare a literature study and motivate a research proposal;

(c) the ability to design project-oriented experiments, identify appropriate methods and singlehandedly perform experiments;

(d) the ability to critically evaluate, interpret, present and communicate results of experiments in a scientific way and write a report on the project;

(e) the ability to identify ethical issues in biological research (theory and applications) , communicate their own point of view as well as those of the scientific, medical and general community and have an understanding of professional conduct required of a professional biochemist.

Method of delivering: Full Time

Assessment Methods – Formal Formative

The formative assessment includes an initial individual oral project plan presentation during March.

Assessment Methods – Summative

The final summative assessment consists of a mark for the written project report and oral presentation of the project.

Assessment Plan – English

The module mark is composed of the initial oral project plan presentation (30%) and final summative assessment (70%). For the latter the oral project presentation and written project report each counts 50%.

Centre: Business Mathematics and Informatics	Subject Group:	
Module code: BWIA 671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Actuarial Risk Management (A301/CA1)**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- Integrated knowledge of the main areas of actuarial practice and critical understanding of the use of the actuarial control cycle to monitor, measure and manage risk effectively.
- The ability to formulate, justify and present plausible and appropriate solutions to business problems
- The ability to behave professionally in a commercial environment and to take relevant factors and issues into account in the formulation of solutions.
- The ability to apply professional integrity, conduct and responsibility required by the actuarial profession.
- Demonstrate the ability to learn independently and as part of a group. Manage time, work to deadlines and prioritise workloads

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Discuss and apply the actuarial control cycle in a variety of practical commercial situations.
- Analyse the main features and risks of financial products and contracts and to propose

and evaluate effecient risk management stategies.
- Present reasoned arguments, both in technical and non-technical language.
- Identify relevant stakeholders and how to take appropriate account of their requirements when giving actuarial advice
- Present information in a professional and ethically sound manner

School: Centre for Business Mathematics and Informatics	**Subject Group: Business Mathematics and Informatics**	
Module code: BWIB611	**Semester 1**	**NQF-Level: 8**

Title: **Statistical Learning I**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Statistical Learning, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate Statistical Learning methods in solving complex problems related to this field.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:
- Describe, compare, combine, apply, and critically examine a range of supervised and unsupervised Statistical Learning models, its assessment and selection, and the techniques associated with these concepts.
- Use the designated software package to explore and manipulate data set(s) associated with a specific problem, apply suitable Statistical Learning methods to the data, and select the most effective method based on a critical assessment of the results.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Statistical Learning.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all operations.
- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.

- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

School: Centre for Business Mathematics and Informatics	**Subject Group: Business Mathematics and Informatics**	
Module code: BWIB612	**Semester 1**	**NQF-Level:8**

Title: **Introduction to Business Intelligence**

Module-outcomes: On completion of the module, the student should be able to demonstrate:

Integrated knowledge and critical understanding with regard to the field of Business Intelligence, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.

- The ability to design, create, retrieve, and present results from a variety of data structures in order to effectively support business decision-making.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others. The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable

Method of delivering:

Assessment methods:

Students have mastered the outcomes if they are able to:
Describe, compare, combine, apply, and critically examine a range of Business Intelligence (BI) principles and practices (e.g. BI framework, architecture, technology trends, operational and decision support data, database fundamentals, dimensional modelling, alternative data warehouse methodologies), and the techniques associated with these concepts.

- Develop various data models from business rules and from other types of data models
- Use the designated software packages to construct diverse data structures, query the data, and develop reports from the retrieved data.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Business Intelligence.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all operations.
- Present information in a professional and ethically sound manner.

- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

School: Centre for Business Mathematics and Informatics	**Subject Group: Business Mathematics and Informatics**	
Module code: BWIB613	**Semester 1**	**NQF-Level: 8**

Title: **Problem Solving using Simulation**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Simulation, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate Simulation methods in solving complex problems.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable.

Method of delivering:

Assessment methods:

Students have mastered the outcomes if they are able to:

- Describe, compare, combine, apply, and critically examine a range of Simulation principles and practices (e.g. Monte Carlo and discrete-event simulation, resampling, queuing theory, and Markov chain), and the techniques associated with these concepts.
- Identify the Simulation methods that can appropriately address a particular problem, select the most suitable method(s), use the designated software packages to apply the selected technique(s), and critically assess and interpret the results.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Simulation.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all operations.

- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

School: Centre for Business Mathematics and Informatics	**Subject Group: Business Mathematics and Informatics**	
Module code: BWIB621	**Semester 2**	**NQF-Level:8**

Title: **Statistical Learning II**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Statistical Learning, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate Statistical Learning methods in solving complex problems related to this field.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable

Method of delivering:

Assessment methods:

Students have mastered the outcomes if they are able to:

- Describe, compare, combine, apply, and critically examine a range of supervised and unsupervised Statistical Learning models, its assessment and selection, and the techniques associated with these concepts.
- Use the designated software package to explore and manipulate data set(s) associated with a specific problem, apply suitable Statistical Learning methods to the data, and select the most effective method based on a critical assessment of the results.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Statistical Learning.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all

operations.
- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module

School: Centre for Business Mathematics and Informatics	**Subject Group: Business Mathematics and Informatics**	
Module code: BWIB622	**Semester 2**	**NQF-Level: 8**

Title: **Forecasting for Business**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Forecasting, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate Forecasting methods in solving complex problems related to this field.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Describe, compare, combine, apply, and critically examine a range of time series and survival models, and the techniques associated with these concepts.
- Use the designated software package to explore and manipulate data set(s) associated with a specific problem, select and apply the most suitable Forecasting method to the data, and critically assess and interpret the results.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Forecasting.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all

operations.
- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN611	**Semester 1**	**NQF-Level: 8**

Title: **Quantitative Risk Analysis I**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- After the completion of this module, the learner should be able to demonstrate integrated knowledge of the theories, methods and techniques in the field of Quantitative Risk Analysis.
- The learner should be able to demonstrate the ability to interrogate multiple sources of knowledge in the modelling of financial and insurance risk management.
- Demonstrate an understanding of risk classification and risk measurement concepts and techniques

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:
- Implement his/her specialist knowledge to analyse and evaluate market risk.
- Explain the modelling and management of market risk in financial institutions.
- Develop / propose an integrated risk measurement (e.g. Value-at-Risk) framework by applying statistical methods and techniques.
- Explain the concepts of risk classification and analyse and criticize risk measurement concepts in financial risk management.
- Show an awareness of how individual risks might be categorised in different ways.
- Describe the relationship between systematic risk, non-systematic or specific risk, and concentration of risk.
- Describe the properties and limitations of common risk measures.
- Recommend a specific choice of model based on the results of both quantitative and qualitative analysis of financial or insurance data.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN613	**Semester 1**	**NQF-Level: 8**

Title: **Financial Engineering I**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and understanding of the use of stochastic calculus theory to model and price financial securities.
- The ability to analyse different types of risk and apply the appropriate hedging instrument in each case.
- The ability to communicate effectively, orally and in writing
- The ability to identify, evaluate and address accurately his/ her learning needs in a self-directed manner, and to facilitate collaborative learning processes.

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Formulate valuation problems in mathematical forms using appropriate notation
- Critically evaluate modern financial theories and select the appropriate instruments for different risk management applications.
- Price simple derivative securities, using appropropriate software, if applicable.
- Develop and communicate his or her ideas and opinions in well-formed arguments, using appropriate academic, professional, or occupational discourse.

Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN614	**Semester 1**	**NQF-Level: 8**

Title: **Investment Theory I**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and understanding of the principles of portfolio selection, diversification and asset pricing.
- The ability to apply the principles of risk management and control to the appraisal, selection and management of investments;
- The ability to communicate effectively, orally and in writing and to make use of appropriate technologies in all communications to lay and professional audiences
- Identify, evaluate and address accurately his or her learning needs in a self-directed manner, and to facilitate collaborative learning processes.

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Discuss and develop portfolio investment strategies working individually or in groups
- Think independently and solve complex portfolio choice problems, select assets and manage portfolios.
- Analyse and critically evaluate the performance of an investment manager.
- Develop solutions to corporate, risk and investment management problems
- Develop and communicate his or her ideas and opinions in well-formed arguments, using appropriate academic, professional, or occupational discourse.

Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN615	**Semester 1**	**NQF-Level: 8**

Title: **Financial Modelling and Optimisation I**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Financial Modelling and Optimisation, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate numerical approaches in solving complex optimisation problems relevant in finance.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Describe, formulate, apply, and critically examine a range of financial optimisation models, its assessment and selection, and the solution techniques associated with these models.
- Use the designated software package to capture the mathematical models associated with a specific problem, apply suitable optimisation algorithms to find solutions, and select the most effective algorithm based on a critical assessment of the results.
- Work independently and be well prepared for all seminars. Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Financial Modelling and Optimisation.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN621	**Semester 2**	**NQF-Level: 8**

Title: **Quantitative Risk Analysis**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- After the completion of this module, the learner should be able to demonstrate integrated knowledge of the theories, methods and techniques in the field of Quantitative Risk Analysis.
- The learner should be able to demonstrate the ability to interrogate multiple sources of knowledge in the modelling of financial and insurance risk management.
- Demonstrate an understanding of risk classification and risk measurement concepts and techniques.
- Demonstrate the ability to use statistical methods and techniques (e.g. univariate and multivariate distributions, correlations, time series, etc.) to analyse risk concepts (e.g. market risk, credit risk, operational risk and underwriting risk).
- Demonstrate the ability to critically evaluate financial risk management problems in financial institutions and provide solutions to these problems.
- Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications.
- Demonstrate the ability to apply and implement risk models in software packages (e.g SAS/IML and MS Excel).
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Implement his/her specialist knowledge to analyse and evaluate credit risk.
- Explain the modelling and management or credit risk, in financial institutions.
- Develop / propose an integrated risk measurement (e.g. Value-at-Risk) framework by applying statistical methods and techniques.
- Explain the concepts of risk classification and analyse and criticize risk measurement concepts in financial risk management.
- Show an awareness of how individual risks might be categorised in different ways. (Market Risk vs. Credit Risk)
- Recommend a specific choice of model based on the results of both quantitative and qualitative analysis of financial or insurance data.
- Analyse quantitative credit data by applying statistical methods (e.g. univariate and multivariate distributions, correlations, time series, etc.)
- Analyse and implement financial risk models in software packages (e.g SAS/IML and MS

Excel).

- Present information in a professional and ethical sound manner
- Develop, optimise and take responsibility for own learning needs, able to track own learning progress and apply, evaluate and reflect on relevant learning strategies, management of all resources to successfully realise all outcomes of the module
- Take responsibility to co-operate effectively as a member of a group to ensure that task outcomes are met.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN622	**Semester 2**	**NQF-Level: 8**

Title**: Pricing of Derivatives A**

Module-outcomes:

- Critical understanding and knowledge of single-period and multi-period discrete time financial market models and continuous time models; and integrated knowledge of continuous time hedging strategies. Strong backgrounds in calculus, linear algebra, real analysis and probability theory are recommended
- The ability to formulate and apply fundamental theorems of Financial Mathematics, the Feynman-Kac Stochastic Representation Formula, the Martingale Representation Theorem, the Girsanov Theorem, and the Ito Formula. The ability to derive continuous time hedging strategies.
- The ability to plan and conduct research according to standard protocol and to employ appropriate processes, procedures and techniques.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable.

Method of delivering: Full Time

Assessment methods:

Centre: Business Mathematics and Informatics

Module code: BWIN623

Title**: Financial Engineering II**

Module-outcomes:

- After the completion of this module, the learner should be able to demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of the mathematical modelling of financial problems (e.g. general options and interest derivatives pricing).
- Demonstrate an understanding of numerical procedure and techniques in modelling finical instruments
- Demonstrate the ability to derive mathematical formulas to price derivatives by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- Demonstrate the ability to critically evaluate real world problems in financial pricing and provide solutions to these problems.
- Demonstrate the ability to present and communicate academic/professional work effectively.

- Demonstrate the ability to apply and implement mathematical approaches in derivative prising using designated software packages (e.g SAS/IML and MS Excel).
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments.

Method of delivering:

Assessment methods:

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN625	**Semester 2**	**NQF-Level: 8**

Title: **Financial Modelling II**

Module-outcomes:

- After the completion of this module, the learner should be able to demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of the mathematical formulation of financial optimisation problems.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate numerical approaches in solving complex optimisation problems relevant in finance.
- Demonstrate the ability to derive mathematical formulas to solve financial optimisation problems by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- Demonstrate the ability to critically evaluate real world problems in financial optimisation and provide solutions to these problems.
- Demonstrate the ability to present and communicate academic/professional work effectively.
- Demonstrate the ability to apply and implement numerical approaches for solving financial optimisation problems using designated software packages (e.g SAS/IML and MS Excel).
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments.

Method of delivering: Full Time

Assessment methods:
Students have mastered the outcomes if they are able to:

- Conduct and write a report with reference to the current academic discourse on a specified financial optimisation problem.
- Describe, formulate, apply, and critically examine a range of financial optimisation models, its assessment and selection, and the solution techniques associated with these models.
- Explain the concepts of numerical methods used in Financial Modelling and Optimisation for e.g., Simplex Method for linear programming and Branch-and-Bound for Integer Linear Programming.
- Work independently and be well prepared for all seminars. Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Financial Modelling and Optimisation.
- Analyse and implement numerical approaches in solving financial optimisation problems in software packages (e.g SAS/IML and MS Excel).
- Present information in a professional and ethical sound manner

- Use the designated software package to capture the mathematical models associated with a specific problem, apply suitable optimisation algorithms to find solutions, and select the most effective algorithm based on a critical assessment of the results

Centre: Business Mathematics and Informatics:	**Subject Group:**	
Module code: BWIR622	**Semester 2**	**NQF-Level: 8**

Title: **Research Module: Financial Engineering and Pricing of Derivatives**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- After the completion of this module, the learner should be able to demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of the mathematical modelling of financial problems (e.g. general options, derivatives pricing, continuous time hedging strategies).
- Demonstrate an understanding of numerical procedure and techniques in modelling finical instruments.
- The ability to formulate and apply fundamental theorems of Financial Mathematics.
- The ability to derive continuous time hedging strategies.
- Demonstrate the ability to derive mathematical formulas to price derivatives by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- Demonstrate the ability to critically evaluate real world problems in financial engineering and derivative pricing and provide solutions to these problems.
- Demonstrate the ability to present and communicate academic/professional work effectively.
- Demonstrate the ability to apply and implement mathematical approaches in derivative prising using designated software packages (e.g SAS/IML, MatLab and MS Excel).
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments.

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Implement his/her specialist knowledge to analyse and evaluate financial instruments.
- Conduct and write a report with reference to the current academic discourse on a specified financial instrument.
- Describe, compare, combine, apply, and critically investigate, through a research project, a range of contiguous claims pricing models, its assessment and selection, and the techniques associated with contiguous claims.
- Explain the relationship between a volatility smile and the risk-neutral probability measure used in binomial pricing
- Explain the concepts of numerical methods used in Financial Engineering and derivative pricing for e.g. Least Squares Monte Carlo, Finite Differences for pricing exotic options found in insurance, single-period and multi-period discrete time financial market models, the Feynman-Kac Stochastic Representation Formula, the Martingale Representation Theorem, the Girsanov Theorem, the Ito Formula
- Deriving continuous time hedging strategies, solving simple stochastic differential equations analytically and solving more complex stochastic differential equations using numerical methods.
- Work independently and be well prepared for all seminars. Contribute to discussions

during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Financial Engineering and Pricing of Derivatives.
- Analyse and implement financial engineering and derivative pricing models in software packages (e.g SAS/IML, MatLab and MS Excel).
- Present information in a professional and ethical sound manner.

Implement and analysing using software package (e.g MS Excel or SAS/IML and SAS/ETS) to implement numerical procedures to price more general (including path-dependent) options and derive hedging strategies using for e.g. binomial trees, finite difference methods and Monte Carlo simulation.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIR671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Research Module: Financial Engineering and Financial Modelling**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- After the completion of this module, the learner should be able to demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of the mathematical modelling of financial problems (e.g. general options and interest derivatives pricing, financial optimisation problems).
- Demonstrate an understanding of numerical procedure and techniques in modelling finical instruments.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate numerical approaches in solving complex optimisation problems relevant in finance.
- Demonstrate the ability to derive mathematical formulas to price derivatives by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- Demonstrate the ability to critically evaluate real world problems in financial pricing and optimisation and provide solutions to these problems.
- Demonstrate the ability to present and communicate academic/professional work effectively.
- Demonstrate the ability to apply and implement mathematical approaches in derivative prising and financial optimisation using designated software packages (e.g SAS/IML and MS Excel).
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments.

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Implement his/her specialist knowledge to analyse and evaluate financial instruments.
- Conduct and write a report with reference to the current academic discourse on a specified financial instrument.
- Describe, formulate, apply, and critically examine a range of financial optimisation models, its assessment and selection, and the solution techniques associated with these models.
- Explain the relationship between a volatility smile and the risk-neutral probability measure used in binomial pricing

- Explain the concepts of numerical methods used in Financial Engineering and Optimisation for e.g. Least Squares Monte Carlo, Finite Differences for pricing exotic options found in insurance, Simplex Method for linear programming and Branch-and-Work independently and be well prepared for all seminars. Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Financial Engineering and Optimisation.
- Analyse and implement financial engineering and optimisation models in software packages (e.g SAS/IML and MS Excel).
- Present information in a professional and ethical sound manner
- Implement and analysing using software package (e.g MS Excel or SAS/IML and SAS/ETS) to implement numerical procedures to price more general (including path-dependent) options using for e.g. binomial trees, finite difference methods and Monte Carlo simulation.

Use the designated software package to capture the mathematical models associated with a specific problem, apply suitable optimisation algorithms to find solutions, and select the most effective algorithm based on a critical assessment of the results.

Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIR672	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Research Module: Financial Modelling and Optimisation**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- After the completion of this module, the learner should be able to demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of the mathematical formulation of financial optimisation problems.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate numerical approaches in solving complex optimisation problems relevant in finance.
- Demonstrate the ability to derive mathematical formulas to solve financial optimisation problems by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- Demonstrate the ability to critically evaluate real world problems in financial optimisation and provide solutions to these problems.
- Demonstrate the ability to present and communicate academic/professional work effectively.
- Demonstrate the ability to apply and implement numerical approaches for solving financial optimisation problems using designated software packages (e.g SAS/IML and MS Excel).
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments.

Method of delivering: Full Time

Assessment methods: Students have mastered the outcomes if they are able to:

- Conduct and write a report with reference to the current academic discourse on a specified financial optimisation problem.
- Describe, formulate, apply, and critically examine a range of financial optimisation models, its assessment and selection, and the solution techniques associated with these models.

- Explain the concepts of numerical methods used in Financial Modelling and Optimisation for e.g., Simplex Method for linear programming and Branch-and-Bound for Integer Linear Programming.
- Work independently and be well prepared for all seminars. Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Financial Modelling and Optimisation.
- Analyse and implement numerical approaches in solving financial optimisation problems in software packages (e.g SAS/IML and MS Excel).
- Present information in a professional and ethical sound manner
- Use the designated software package to capture the mathematical models associated with a specific problem, apply suitable optimisation algorithms to find solutions, and select the most effective algorithm based on a critical assessment of the results.

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEN611	**Semester 1**	**NQF-Level: 8**

Title: **Advanced Organic Chemistry**

Module-outcomes:
At the end of this module the student should:

- have an extensive and systematic knowledge of the molecular orbital theory, especially with reference to the boundary orbital theory, and the application thereof to explain the course of thermic pericyclic reactions (Theme 1)
- understand and be able to apply the reactions, mechanisms and principles of nucleophilic substitution in carbonyl compounds, as well as have an integrated understanding of the way in which kinetics and thermodynamics may influence the reaction course and the formation of products (Theme 2);
- have a good understanding of i) the most important industrial chemical processes as well ii) the importance of developing new processes that are more economical and environmentally friendly (Theme 3); and
- know and be able to apply multi-step organic synthesis techniques and advanced experimental techniques (Theme 4).

Method of delivering: Full Time

Assessment methods:
Participation mark

- Theory 2 assignments 70%
- Continuous participation in class 30%
- Practicals Practical report 50%
- Oral tests on experiments 50%

The theory and practical marks each contributes 50% to the participation mark where the theory mark is obtained from the three themes (T1 = 20%, T2 = 20% and T3 = 10%).

Examination mark
Summative assessment consists of a paper of 4h on the theory that will be written at an appointed time by every student.
Module mark
Participation mark: Examination mark is 1:1 and the passing mark is 50%.

School: Physical and Chemical Sciences	Subject Group: Chemistry	
Module code: CHEN612	**Semester 1**	**NQF-Level: 8**

Title: **Advanced Physical Chemistry**

Quantum chemistry and spectroscopy

Module-outcomes:
At the end of this section of the module the student should:

- have an extensive and systematic knowledge and critical understanding of the quantum mechanical principles for translation (particle in a one-dimensional potential well), vibration (harmonic oscillator) and rotation (rigid rotor); to describe this mathematically as well as be able to apply them to the theoretical foundation of molecular spectroscopy;
- have an extensive and systematic knowledge of the perturbation and variation theory as advanced quantum mechanical techniques in obtaining approximate solutions for quantum mechanical systems with non-exact solutions;
- be able to combine the principles of molecular symmetry and group theory to obtain insights into molecular spectroscopy that are not otherwise obtainable;
- have extensive knowledge of the origin and nature of vibration (or infrared), rotation (or microwave) and electronic (or visible/ultraviolet) spectra of diatomic and polyatomic molecules, including those of symmetric rotors (prolate and oblate molecules), aromatic compounds (D_{6h} point group) and coordination compounds of the transition metals (O_h point group);
- use quantum mechanical entities and the group theory in describing the electronic states for polyatomic molecules and spectroscopic transitions between them.

Statistical thermodynamics

Module outcomes:

At the end of this part of the module the student should:

- have an extensive and systematic knowledge and critical understanding of the distribution of molecular energy states; Boltzmann distribution; statistical weight; configurations; molecular distribution function; translation, vibration, rotation and electronic distribution functions and ensembles;
- be able to deduce, apply and evaluate the thermodynamic functions of internal energy, heat, work, entropy, enthalpy, free energy, heat capacities and equilibrium constants from the statistical principles;
- demonstrate the ability to solve abstract and unknown problems related to statistical thermodynamic principles and thermodynamic functions and to communicate the solutions in a prescribed format orally or in writing individually or as a group.

Advanced Reaction Kinetics

Module outcomes:

At the end of this section the student should:

- have an extensive and systematic knowledge and critical understanding of the following kinetic principles, and be able to apply, analyse and evaluate them and solve problem statements: reaction rate, reaction order, rate constant, half lives, Arrhenius equation, activation energy, rate law, rate-determining reaction step,

elementary reaction steps, flow-equilibrium approach and relaxation times;

- be able to explain briefly how rate equations can be determined experimentally and how the necessary rate equations can be deduced;
- be able to explain how reaction mechanisms can be determined and how interaction between theoretical and experimental methods takes place;
- be able to deduce a rate equation and apply it to reactions in equilibrium;
- be able to describe and use applications of reaction kinetics to enzyme reactions, surface processes, homogeneous and heterogeneous catalysis photochemical reactions as well as to solve problem statements involving them.

Method of delivering: Full Time

Assessment methods:

Quantum chemistry and spectroscopy: Prof E.L.J. Breet

Assessment method:

The contribution of this sub-module to the participation mark for CHEN612 (according to allocated credit marks) consists of the marks of (1) two written class tests and (2) the written report on an experiment (E1), based on the rotation/vibration and electronic spectra of selected compounds. The contribution of this sub-module to the examination mark is in the same ratio than the contribution to the total number of credits for CHEN612. In practice the contribution of each of the three sub-modules are added up to calculate the final participation and examination mark. Then the module mark is the average of the participation mark and the examination mark for the three modules.

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEN613	**Semester 1**	**NQF-Level: 8**

Title: **Advanced Physical Chemistry**

Module-outcomes:

At the end of this module the student should:

1. have an extensive and systematic knowledge and critical understanding of bonding in inorganic molecules and specifically in transition metal coordination compounds in such a way that the most important properties of these molecules can be predicted;
2. demonstrate the ability to understand reaction mechanisms of inorganic substances, namely ligand substitution, electron transfer, ligand reactions, stereochemical changes, photochemical reactions, solid state reactions and electrochemical reactions of coordination compounds in such a way that kinetic and equilibrium data can be interpreted mechanistically and to apply the knowledge of reaction mechanisms and bonding to plan inorganic syntheses;
3. be able to apply a variety of advanced synthesis techniques in inorganic chemistry.

Method of delivering: Full Time

Assessment methods:

Participation mark:

• Theory:	Assignments	8%
	2 class tests	17%
• Practicals:	Preliminary practical reports	8%
	Final practical reports	17%

Examination mark:

- 3h paper on the theory contents of course 50% (minimum 40%)

Module mark:

- Participation mark + Examination mark 100% (minimum 50%)

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEN614	**Semester 1**	**NQF-Level: 8**

Title: **Molecular modelling**

Module-outcomes:
At the end of this module the student should

- have an understanding of the variety of mathematical models developed for the description of molecules;
- be able to choose a suitable model for his/her particular molecule or reaction and do the necessary mathematical processing with a commercial modelling package;
- be able to interpret the calculated modelling data and apply them to experimental data;
- understand the modelling information in the chemical literature.

Method of delivering: Full Time

Assessment methods:
The methodology used in this module does not lend itself to formative assessment, thus no participation mark is built up.

The assessment is done on a computer. Because of its practical nature 3½ hours are available for the assessment.

One summative assessment takes place during which the following are measured:

Theoretical section

- Theoretical insights 50%
- Ability to interpret molecular modelling results.
- Practical section 50%
- Practical skills to interpret molecular modelling results

Skills in interpreting self-calculated molecular modelling results

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEN671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Project**

Module-outcomes:
At the end of this module the student should:

- have the ability to demonstrate knowledge of safety measures and procedures in the laboratory;
- demonstrate the ability how to tackle, execute and complete a research project by
- being able to identify and analyze a problem, collection of relevant information and data, interpretation, analysis and evaluation of the information and data and the planning and communication of the research project

Method of delivering: Full Time

Assessment methods:
In addition to the results obtained during the project, the effort that was put into the project as well as the execution and presentation of the project will be assessed.
Summative assessment consists of a weighed mark composed of the following: project proposal (5%), summary (5%), poster presentation (15%), oral presentation (15%), research article (30%) and carrying out of the project (30%)

School: Physical and Chemical Sciences	Subject Group: Chemistry	
Module code: CHEN621	**Semester 2**	**NQF-Level: 8**

Title: **Homogeneous catalysis**

Module-outcomes:
At the end of this module the student should

- know and understand the fundamental concepts of transition metal chemistry that are important in homogeneous catalysis;
- understand which type of organometallic complexes can act as pre- or catalysts;
- know and apply the most important homogeneously-catalysed organic reactions; and
- know the industrial application of homogeneous catalysis.

Method of delivering: Full Time

Assessment methods:
The module mark consists of a single summative assessment in the form of a single paper of 1.5h to be written on the indicated day and date by every student (see Year programme). The required mark for a pass is 50%.

School: Physical and Chemical Sciences	Subject Group: Chemistry	
Module code: CHEN622	**Semester 2**	**NQF-Level: 8**

Title: **Coal Chemistry**

Module-outcomes:
At the end of the module the student should

- have extensive and systematic knowledge of the pyrolysis and combustion of coal as a source of energy and of industrial compounds;
- be able to describe and discuss critically the chemical and physical changes during the coal treatment processes of SASOL;
- be able to do independent research and development work within the field of coal chemistry;
- solve abstract and unknown problems related to coal chemistry processes and communicate these solutions in an accountable manner in a prescribed format individually or as a group;
- have extensive and systematic knowledge regarding the formation of fly-ash during the coal treatment processes and be able to propose creative solutions for the use thereof.

Method of delivering: Full Time

Assessment methods:
Formative assessment consists of the written solutions to the problem statements which contribute 50% to the participation mark. During a tutorial every student will present an extensive problem statement allocated to him/her beforehand.. This presentation will be evaluated by the other students and lecturers concerned. This provides the other 50% of the module mark. A summative assessment opportunity consisting of a 2h paper will be written. This summative assessment will provide the examination mark. The final mark or module mark for this module will be composed of a 60% contribution by the summative assessment opportunity (examination) and a 40 % contribution by the formative assessment opportunities (participation mark).

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEN623	**Semester 2**	**NQF-Level: 8**

Title: **Membrane science and technology**

Module-outcomes:
At the end of this module the student should

- have a basic knowledge of the concepts and definitions used in membrane science;
- have an idea of the physical and chemical properties of the polymer materials from which membranes are manufactured;
- understand the basic separation methods of membranes and be able to apply them to develop suitable membranes;
- understand the most general characterisation techniques for membranes.

Method of delivering: Full Time

Assessment methods:
Participation mark:

- Theory On-going formative assessment 67%
  1 Problem solution 33%

Examination mark:
Summative assessment opportunity consists of a single 2h paper on the theory. This paper will be written on the indicated day and date by every student (see Year programme).
Module mark:
Participation mark : Examination mark is 1 : 1 and 50% should be obtained for a pass.

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEM621	**Semester 2**	**NQF-Level: 8**

Title: **Polymer Chemistry**

Module-outcomes:
At the end of this module the student should

- know important terms in polymer chemistry;
- know, understand and be able to apply synthesis methods and reaction mechanisms of the most important polymerisation reactions;
- know and understand some properties of polymer materials; and
- know and be able to apply general characterisation methods.

Method of delivering: Full Time

Assessment methods:
Module mark:
Assignment : Examination mark : Practical mark is 1 : 4 and 50% is required to pass.
Formative assessment consists of an assignment on a specific theme in polymer chemistry (20% of the module mark).
Summative assessment consists of a single1.5h paper (80% of the module mark) that will be written by the student on the indicated day and date (see Year program).

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEM622	**Semester 2**	**NQF-Level: 8**

Title: **Advanced structural clarification**

Module-outcomes:
At the end of this module the student should have an overview

- of the basic 1D and (^{1}H, ^{13}C, DEPT) techniques;

- of 2D NMR techniques
    - ^{1}H-^{1}H Correlations (COSY);
    - ^{1}H-^{13}C Correlations (HETCOR, HMQC, HMBC);
    - ^{13}C-^{13}C Correlations (Inadequate);
    - ^{1}H-^{1}H spatial neighbouring proton-proton interactions (NOE, NOESY, ROESY);
- of the NMR spectroscopy of other important half spin nuclei.

Method of delivering: Full Time

Assessment methods:
Formative assessment consists of the solutions to the written problem statements. The final mark for this module is composed of a 100% contribution of the formative assessment opportunities.

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEM623	**Semester 2**	**NQF-Level: 8**

Title: **Environmental Chemistry**

Module-outcomes:
At the end of this module the student should

- define the term environmental chemistry and to understand, give and interpret the basic principles of environmental chemistry;
- give and interpret the basic principles and chemical processes in:
    - water chemistry and water pollution processes
    - atmospheric chemistry and pollution processes
    - soil chemistry and soil pollution processes;
- understand, give and interpret the basic principles of environmental risk assessment and management.

Method of delivering: Full Time

Assessment methods:
Formative assessment consists of oral and/or written problem solving or tests. A summative assessment consisting of an examination opportunity contributes the remaining 50% of the module mark.

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEM624	**Semester 2**	**NQF-Level: 8**

Title: **Techniques for Organic synthesis**

Module-outcomes:
At the end of this module the student should be able to predict

- synthesis routes from small molecules to more complex ones;
- certain target molecules by using functional group transformations;
- multi-step syntheses for target molecules.

Method of delivering: Full Time

Assessment methods:
Formative assessment (100%) consists of an oral presentation of his/her findings to his/her co-students and lecturers (50%) and a written report of the specific literature study (50%).

School: Physical and Chemical Sciences	**Subject Group: Chemistry**	
Module code: CHEM626	**Semester 2**	**NQF-Level: 8**
Title: **Electrochemistry**		
Module-outcomes: Upon the successful completion of this module the student should be able to demonstrate the following: a) integrated knowledge and critical understanding of the theoretical foundation with regard to (i) electrolysis cells, electron transfer reactions (redox reactions), mass transfer, and electrical potential, (ii) the importance of the electrolyte solution as well as the electrical double layer, (iii) the kinetics of electron transfer reactions, (iv) the experimental setup and the factors affecting it, and (v) specific electrochemical techniques employed in the laboratory in order to study electron transfer, and b) experimental skills such as (i) the application of the Nernst equation to calculate the basic thermodynamic quantities (e.g. potential), (ii) the setup and use of a three electrode cell coupled to a potentiostat, (iii) the application of specific electrochemical techniques that include cyclic voltammetry, linear polarisation, hydrodynamic methods and potential step methods so as to study electron transfer reactions.		
Method of delivering: Full Time		
Assessment methods: The student has mastered the outcomes of this module when he/she can successfully 'defend' his/her newly acquired knowledge by • submitting five worked problems related to the theoretical aspects of this module, • submitting reports on five electrochemistry experiments that were conducted in the laboratory highlighting data acquisition and data manipulation that serves to convey to the student the link between electrochemical theory and practice, and • writing a test that serves to test the student's grasp of the theoretical aspects of this module. The participation mark will be determined from the average of the five worked problems (40%) and the five experimental reports (60%). The participation mark will be will be combined with the test/examination mark in the ratio 1:1 to calculate the module mark.		
Centre: Business Mathematics and Informatics	**Subject:**	
Module code: ECON623	**Semester**	**NQF-Level: 16**
Title: **Risk Management**		
Module-outcomes:		
Method if delivery:		
Assessment methods:		
School: Physical and Chemical Sciences	**Subject Group: Physics**	
Module code: FSKH611	**Semester 1**	**NQF-Level: 8**
Title: **Classical Mechanics**		
Module-outcomes: Upon completion of this course the student should be able to derive, understand and be able to apply the following by identifying problems and solving them creatively: - Newtonian mechanics - Lagrangian mechanics including the derivation of constraints and formulating the Lagrange function and solving these problems using the Euler-Lagrange equations - Central-force problems and rigid-body problems - Hamiltonian mechanics including Legendre transformations, canonical transformations, and canonical invariants		

- Noether's theorem: Deriving conservation laws and finding symmetries
- Particle collisions

Method of delivering: Full Time

Assessment methods:
Home assignments, class tests, examination

School: Physical and Chemical Sciences	**Subject Group: Physics**	
Module code: FSKH612	**Semester 1**	**NQF-Level: 8**

Title: **Quantum Mechanics** I

Module-outcomes:
Upon completion of this course the student should understand the basic principles of quantum mechanics and its implication on the atomic and sub-atomic level:

- Understand the central concepts and principles of quantum mechanics: the Schrödinger equation, the wave function and its physical interpretation, stationary and non-stationary states, time evolution and expectation values.
- Interpret and discuss physical phenomena in light of the uncertainty relation.
- Gain a basic understanding of the formalism and 'language' of quantum mechanics and how it relates to linear algebra.
- Grasp the concepts of spin and angular momentum, as well as their quantization- and addition rules.

Secondly, the student should master the basic mathematical methods used in quantum mechanics:

- Be able to independently solve the Schrödinger equation for simple one-dimensional systems.
- Use the solution to compute probabilities, expectation values, uncertainties and time evolution.
- Similarly, solve simple problems in two and three dimensions in various coordinate systems, e.g. by using separation of variables in the Schrödinger equation.
- Give concise physical interpretations and arguments for the validity of the mathematical solutions.
- Be able to work in Dirac and matrix notation.

Method of delivering: Full Time

Assessment methods:
Class tests, dicussions, assignments, examination

School: Physical and Chemical Sciences	**Subject Group: Physics**	
Module code: FSKH613	**Semester 1**	**NQF-Level: 8**

Title: **Electrodynamics**

Module-outcomes:
The students will develop an understanding of

- the potential formulation of electrodynamics
- dipole radiation
- radiation from accelerated point charges
- applications of radiation theory to astrophysically important rdiation mechanisms
- relativistic electrodynamics.

Method of delivering: Full Time

Assessment methods:
Weekly homework assignments, class participation, class tests and final examination.

School: Physical and Chemical Sciences	Subject Group: Physics	
Module code: FSKH614	**Semester 1**	**NQF-Level: 8**

Title: **Plasma Physics**

Module-outcomes: Upon completion of this course the student would:

- Have a general knowledge of the occurrence of plasmas, especially space plasmas, and the applications of plasma physics.
- Be able to describe the motion of singly charged particles in increasingly complex electric and magnetic fields.
- Derive and understand the meaning of a complete set of fluid equations for a plasma.
- Have a working knowledge of plasma wave properties, specifically plasma oscillations, electron plasma waves, ion (acoustic) waves and electromagnetic waves in magnetic fields with different orientations.
- Understand diffusion and mobility in weakly-ionised gases and diffusion in fully-ionised plasmas.
- Understand the meaning of distribution functions, and study the equations of kinetic theory.
- Apply the above knowledge to identify and creatively solve problems in plasma physics.

Method of delivering: Full-time

Assessment methods:
Class tests, discussions, assignments, examination

School: Physical and Chemical Sciences	Subject Group: Physics	
Module code: FSKH671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Project I**

Module-outcomes:
Upon completion of this module, the student should be familiar with the particular research methodology of one, or a combination of, Physics, Astronomy and Astrophysics, Space Physics, and Physics in Application, which includes

- with guidance, to identify and scientifically formulate a problem statement
- a thorough investigation of existing advanced knowledge as reflected in relevant scientific literature
- to conduct appropriate research for solving the problem
- scientific evaluation of the results within the context of the problem statement, and
- scientific communication of the results in the form of a report and presentation

Method of delivering: Full Time- Research & Presentation

Assessment methods:
Student will be assessed in an integrated manner on:

- identifying a problem in one of or a combination of Physics, Astronomy and Astrophysics, Space Physics, and Physics in Application, and the scientific formulation of such problem
- a scientific literature study
- conducting relevant research utilising appropriate methodology towards solving the problem
- scientific evaluation of the results within the context of the problem statement, and
- scientific communication of the results in the form of a report which meets the requirements of scientific prescriptions

School: Physical and Chemical Sciences	Subject Group: Physics	
Module code: FSKH621	**Semester 2**	**NQF-Level: 8**

Title: **Quantum Mechanics II**

Module outcomes: Upon successful completion of this module the student should have a formal knowledge of the physical and mathematical basis of the following aspects in quantum mechanics:

- Non-degenerate and degenerate perturbation theory
- Application of the above to the hydrogen atom
- Multiparticle systems
- Time-dependent perturbation theory and the application thereof on radiative transitions in simple systems
- The semi-classical description of the interaction between radiation and charged particles
- Quantization of the electromagnetic field.

Apart from the formal aspects, students will also apply their knowledge to solving relevant quantum-mechanical problems covering all of the above aspects.

Method of delivering: Contact (Lectures)

Assessment methods:
Class tests, homework problems, examination.

School: Physical and Chemical Sciences	Subject Group: Physics	
Module code: FSKH622	**Semester 2**	**NQF-Level: 8**

Title: **Statistical Mechanics**

Module-outcomes:
1. Knowledge of Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein statistics for the description of classical and quantum-mechanical thermodynamic systems.
2. A wide range of applications on laboratory and astrophysical systems, by way of problem solutions and computational physics

Method of delivering: Full Time- Lectures

Assessment methods:
Class tests, homework problems, examination.
Participation mark (40%) calculated from frequent class tests and assignments; 60% from final exam.

School: Physical and Chemical Sciences	Subject Group: Physics	
Module code: FSKH623	**Semester 2**	**NQF-Level: 8**

Title: **Computer Physics (Research)**

Module-outcomes:
After completing this module the student will have the skills and necessary background knowledge to

- Solve differential equations (partial and ordinary) as applicable to classical physics of which examples include planetary motion, oscillatory systems, wave propagation, trajectories of moving bodies and potentials and fields
- Apply the fast Fourier transform and calculate a power spectrum from signals or

periodic data.
- Simulate physical systems involving stochastic processes (e.g. random walk and diffusion) using Monte Carlo methods.
- Be able choose an appropriate scheme to integrate and differentiate numerically.
- To compute, visualize and communicate data and results in a scientific manner.

Throughout this course you will also learn about and use additional software packages (tools) and become more familiar with a scientific programming language.

Method of delivering: Full Time (Research)

Assessment methods:
Student will be assessed by means of assignments in the form of limited dissertations pertaining to particular problems and the solving of these using a computer. The student has to demonstrate that he/she has mastered a particular technique and found the correct solution, and must present this scientifically.

School: Physical and Chemical Sciences	**Subject Group: Physics**	
Module code: FSKH672	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Project II**

Module-outcomes:
Upon completion of this module, the student should be familiar with the particular research methodology of one or a combination of Physics, Astronomy and Astrophysics, Space physics, and Physics in Application, which includes:
- with guidance, to identify and scientifically formulate a problem statement
- a thorough investigation of existing advanced knowledge as reflected in relevant scientific literature
- to conduct appropriate research for solving the problem
- scientific evaluation of the results within the context of the problem statement, and
- scientific communication of the results in the form of a report

Method of delivering: Full Time (Navorsing)

Assessment methods:
Student will be assessed in an integrated manner on:
- identifying a problem in one of, or a combination of, Physics, Astronomy and Astrophysics, Space Physics, and Physics in Application, and the scientific formulation of such problem
- a scientific literature study
- conducting relevant research utilising appropriate methodology towards solving the problem
- scientific evaluation of the results within the context of the problem statement, and
- scientific communication of the results in the form of a report which meets the requirements of scientific prescriptions.

School: Geo- and Spatial Sciences	**Subject Group:**	
Module code: GGFS671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Introduction to Earth Observation**

Module-outcomes:
On completion of the module, the candidates should be able to demonstrate:
1. integrated knowledge of the principles and fundamentals of earth observation and a critical understanding regarding its application to environmental science,
2. ability to interrogate multiple sources of knowledge, including primary scientific sources, to evaluate the application of earth observation to environmental science to build knowledge and processes of knowledge production,
3. ability to apply and critically judge the relevance of a range of observation methods, as well as an awareness of the spatial and temporal context of the different methods, to obtain information about an earth system process, in order to solve practical and theoretical problems,

4. ability to analyse, select and apply scientific research methods to observations in order to address environmental problems and then to communicate the findings in an academically appropriate format,
5. the ability to identify, critically reflect on and effectively solve problems by using appropriate observations from a variety of different platforms,
6. demonstrate an awareness of the scope and complexity of ethical and value systems from both the environmental and human perspective with regard to earth observation.

Method of delivering: Full Time

Assessment methods:

School: Geo- and Spatial Sciences	**Subject Group:**	
Module code: GGFS672	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Air pollution**

Module-outcomes:

On completion of the module students should be able to:

1. Integrate multiple sources of information and knowledge to assess air quality of an area, accounting for air pollution emissions, ambient air quality, transport of air pollutants and prevailing meteorology;
2. Understand and critically assess the principles and implementation of air pollution modelling;
3. Independently investigate literature on the current state of knowledge, recognise current research needs and formulate appropriate research responses in the area of air pollution;
4. Demonstrate the ability to provide insight as an expert and provide potential solutions for an area experiencing air pollution problems;
5. The ability to take full responsibility for his/her work and to recognise the moral and ethical issues that relate to air pollution information and data collection and to conduct him/herself in the appropriate manner.

Method of delivering:

Assessment criteria:

Students have mastered the outcomes if they are able to:

1. Source, integrate and interpret literature independently;
2. Understand the input requirements of air pollution models, interpret air pollution modelling outputs and understand and account for their limitations;
3. Integrate collected knowledge and data to assess the air quality of a region taking into account:
    a. pollution emissions
    b. ambient air quality
    c. atmospheric transport of pollutants from the area and outside the area
    d. the prevailing meteorology
4. Independently identify research needs in air pollution and devise a research plan to investigate appropriate solutions.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Computer Science and Information Systems**	
Module code: ITRI611	**Semester 1**	**NQF-Level: 8**

Title: **Data Warehouses I**

Module-outcomes:

Upon successful completion of the module the students will be able to:

- Discuss concepts of data warehousing, the data warehouse lifecycle, alternative data warehousing methodologies, dimensional modelling, requirements collection and extract, load and transform (ETL) functions;
- Setup suitable software products; collect requirements and develop a dimensional model;
- Perform ETL;

- Create a data warehouse browser;
- Develop suitable documentation.

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Computer Science and Information Systems**	
Module code: ITRI612	**Semester 1**	**NQF-Level: 8**

Title: **Linear Programming I**

Module-outcomes:
After completion of this module, students should know the following and be able to apply it:

- Introduction to modelling and linear programming
- Linear algebra and geometric representations
- The simplex method
- Artificial variables and convergence aspects
- Implementation aspects, data handling and optimisation
- Duality and sensitivity analysis

Complexity aspects and other algorithms

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Subject Group: Computer Science and Information Systems**	
Module code: ITRI613	**Semester 1**	**NQF-Level: 8**

Title: **Databases I**

Module-outcomes:
LEARNING OUTCOMES
Upon successful completion of the module the students will be able to:

More theoretically:

- Discuss the purpose and architecture of a typical DataBase Management System (DBMS);
- Write an SQL statement in Relational Algebra (RA), convert a RA to SQL and to discuss a Relational Algebra expression as basis for a query;
- Describe the way SQL and other approaches are supposed to execute;
- Explain the way very large files are managed and do calculations to determine the cost implications;
- Describe the organization and functioning of different index approaches and do calculations to determine the cost implications.

More practically (based on the Oracle DBMS):

- Describe the Oracle Database Architecture and prepare the Database Environment according to Oracle's Administration Workshop I;

Apply the typical functions of a DBA to the Oracle Database Management System. The functions to apply include: Creating an Oracle Database; Managing the Oracle Instance; Managing the Oracle DB Storage; Administering User Security; Managing Oracle Schema Objects; Managing Data and Concurrency, Undo Data; Implementing Oracle DB Security and handles Database Maintenance.

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI614	**Semester 1**	**NQF-Level: 8**

Title: **Information Systems Engineering I**

Module-outcomes:
Upon successful completion of the module the students will be able to:

- Understand and apply project management in the IT context;
- understand and manage project management process groups;
- understand and apply project integration management;
- understand and apply scope management;
- understand and apply time management;
- understand and apply cost management;
- understand and apply quality management;
- understand and apply human resources management;
- understand and apply communication management;
- understand and apply risk management;
- understand and apply procurement management; and
- understand and apply project stakeholder management.
- integrate project management skills to manage an IT project

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI615	**Semester 1**	**NQF-Level: 8**

Title: **Computer Security I**

Module-outcomes:

CONTEXT

On theoretical level the learner should have insight and basic knowledge of main concepts of computer and information security. The learner is sensitised to security problems in the world we live in and should be able to recognise appropriate controls for the threats.

Upon successful completion of the module the learners will be able to:

- Discuss concepts of computer and information security and weaknesses in computerised environments and understand how the threats can be controlled.
- Know basic encryption and decryption schemes as well as the most important encryption systems generally used.
- Understand operating system controls, and reliable operating systems.
- Identify security problems in computer systems, programs and information in businesses and recommend measures to address these.
- Understand that security systems and controls should be completed meticulously and in the agreed manner and that confidential information should be handled as such.
- Understand that computer resources should be used ethically and responsibly.

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI616	**Semester 1**	**NQF-Level: 8**

Title: **Artificial Intelligence I**

Module-outcomes:

After completion of this module, the students should be able to:

- describe the principles of knowledge-based agents;
- define propositional logic (both syntax and semantics);
- draw inferences in propositional logic;
- define predicate logic (both syntax and semantics);
- translate problem descriptions in predicate logic;
- draw inferences in predicate logic;
- construe resolution proofs;
- build a simple proof feeder for predicate logic;
- work together in groups;
- communicate effectively, orally as well as in writing, by using appropriate technology; and act in an ethical way in regard to all aspects concerning artificial intelligence.

Method of delivering: Full Time / Part Time

Assessment methods:

Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI617	**Semester 1**	**NQF-Level: 8**

Title: **Image Processing I**

Module-outcomes:

Context:

On theoretical level, the student should have insight and a basic knowledge of concepts and mathematical background of image processing. From a practical perspective students should demonstrate the ability to apply this knowledge to solve image processing problems.

Upon successful completion of the module the students will be able to:

- Discuss basic concepts of image processing with reference to examples of the use of image processing, different imaging modalities, human visual perception, image acquisition, sampling and quantization, representation of digital images and relationships between pixels;
- Discuss and practically implement image enhancement in the spatial domain with reference to grey level transforms as well as spatial filters for smoothing and sharpening of images;
- Discuss and practically implement image enhancement in the frequency domain with reference to the Fourier transform and its properties as well as smoothing, sharpening and homomorphic filters;
- Discuss and practically implement colour image processing with reference to the different colour models and both pseudo-colour and full-colour processing;

Discuss and practically implement different image compression algorithms.

Method of delivering: Full Time / Part Time

Assessment methods:

Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI618	**Semester 1**	**NQF-Level: 8**
Title: **Decision Support Systems I**		
Module-outcomes: Upon successful completion of the module the students will be able to: • Formulate models by means of spreadsheets; • Perform sensitivity analysis; • Formulate and solve Linear Programming models (including transportation and network models); • Formulate and solve Integer Programming models; • Formulate and solve Non-linear Programming models.		
Method of delivering: Full Time / Part Time		
Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation)		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Computer Science and Information Systems**	
Module code: ITRI621	**Semester 2**	**NQF-Level: 8**
Title: **Data Warehouses II**		
Module-outcomes: Upon successful completion of the module the students will be able to: • Demonstrate insight and a basic knowledge of the following concepts of data warehousing: technical data warehousing architecture, more advance dimensional modelling, Business Intelligence (BI) applications and maintenance of BI systems. • Create an OLAP cube; • Use MDX; • Create end-user applications.		
Method of delivering: Full Time / Part Time		
Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Computer Science and Information Systems**	
Module code: ITRI622	**Semester 2**	**NQF-Level: 8**
Title: **Linear Programming II**		
Module-outcomes: After successful completion of this module, the students should be able to know and apply the following: ▪ Decomposition techniques for large scale LP ▪ Stochastic programming ▪ Integral programming ▪ Minimum-cost network flow algorithms ▪ Transportation and allocation problems ▪ Maximum flow algorithms ▪ Shortest path algorithms.		
Method of delivering: Full Time / Part Time		
Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI623	**Semester 2**	**NQF-Level: 8**

Title: **Databases II**

Module-outcomes:
Upon successful completion of the module the students will be able to:

More theoretically:

- Discuss and do computations to illustrate the (time) cost implications regarding the sorting of large volumes of data;
- Describe the typical working of the different query operators and how it can be implemented by means of different approaches or algorithms;
- Do computations to compare different algorithms used to implement query operators;
- Analyse a given (SQL) query and to discuss the way a typical query optimizer would implement the query;

More practically (based on Oracle SQL Tuning):

- Describe the Oracle Database Architecture;
- Describe what attributes of a SQL statement can make it perform poorly and list the tools (in Oracle) to tune SQL.
- Use "Oracle SQL Developer" for Database development tasks;
- Discuss the Oracle Optimizer and do exercises to test different approaches;
- Discuss/describe the different aspects of Optimization/Tuning based on the "*Oracle Database 11g: SQL Tuning Workshop*". These include things like: Execution Plans, tracing an Application; different Optimizer Operators (tables, indexes, Join's etc.); Optimizer Statistics; the use of Bind variables; the SQL Tuning Advisor and the SQL Access Advisor.

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI624	**Semester 2**	**NQF-Level: 8**

Title: **Information Systems Engineering II**

Module-outcomes:
Upon successful completion of the module the students will be able to:

- Define and explain what Information System Engineering is.
- Define and explain system development methodologies.
- Understand and apply STRADIS (Structured Analysis, Design, and Implementation of Information Systems).
- Understand and apply IE (Information Engineering).
- Understand and apply RUP (Rational Unified Process).
- Understand and apply XP (Extreme Programming).
- Understand and apply SSM (Soft Systems Methodology).
- Understand and apply ETHICS (Effective Technical and Human Implementation of Computer-based Systems.
- Understand and apply MULTIVIEW 1 and 2.
- Give a critical review and comparison of the system development methodologies.
- Explain the acceptance and selection of system development methodologies in practice.

Method of delivering: Full Time / Part Time

Assessment methods:Formative and summative assessment (Tests, exams, prac evaluation).

School: Computer, Statistical and	Subject Group: Computer Science and

Mathematical Sciences	Information Systems	
Module code: ITRI625	**Semester 2**	**NQF-Level: 8**

Title: **Computer Security II**

Module-outcomes:

CONTEXT

On theoretical level the student should have insight and basic knowledge of main concepts of computer and information security. The learner is sensitised to security problems in the world we live in and should be able to recognise appropriate controls for the threats in areas such as databases and networks.

MODULE OUTCOMES

Upon successful completion of the module the students will be able to:

- Discuss database concepts regarding information security and understand how threats can be controlled.
- Discuss network security threats and possible countermeasures.
- Discuss administrative security within an IT environment and its economic aspects.
- Identify and discuss privacy and legal issues within computer security.
- Understand that security systems should be completed meticulously and in the agreed manner and that confidential information should be handled as such.
- Understand that computer resources should be used ethically and responsibly. The students should know social and ethical issues within computer and information security.

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI626	**Semester 2**	**NQF-Level: 8**

Title: **Artificial Intelligence II**

Module-outcomes:
After successful completion of this module, the students should be able to:

- define artificial intelligence and evaluate a definition critically;
- describe the historical bases and history of the subject;
- discuss logical agents and the environments in which they operate;
- define and apply the concept 'rationality' on intelligent agents;
- solve problems by using various informed and uninformed search methods;
- describe the history and applications of neural networks;
- explain the biological inspiration for neural networks;
- discuss various neural network models and architectures and use them to solve practical problems;
- integrate information from various modules and use them to solve practical problems (the outcome will be reached by means of one or more integrated evaluations);
- work together in groups;
- communicate effectively, orally as well as in writing, by using appropriate technology; and
- perform ethically in all aspects regarding artificial intelligence.

Method of delivering: : Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI627	**Semester 2**	**NQF-Level: 8**
Title: **Image Processing II**		
Module-outcomes: Context: This module builds on the concepts already mastered in ITRI617, Image Processing I. On theoretical level, the student should have insight and a basic knowledge of concepts and mathematical background of image processing. From a practical perspective students should demonstrate the ability to apply this knowledge to solve image processing problems. Module-outcomes: Upon successful completion of the module the students will be able to: • Discuss the use of mathematical morphology in image processing. • Discuss different image segmentation techniques with reference to edge detection and linking as well as thresholding of images. • Discuss the representation and description of images with reference to the description of boundaries and regions as well as the use of principal component analysis. • Discuss the practical use of image processing.		
Method of delivering: Full Time / Part Time		
Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Computer Science and Information Systems**	
Module code: ITRI628	**Semester 2**	**NQF-Level: 8**
Title: **Decision Support Systems II**		
Module-outcomes: Upon successful completion of the module the students will be able to demonstrate insight and knowledge of the following: • Heuristics • Goal Programming and the Analytical Hierarchy Process • Simulations • Project Management • Forecasting models		
Method of delivering: Full Time / Part Time		
Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and Information Systems	
Module code: ITRI671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Project**

Module-outcomes:

This course provides the student with the opportunity to acquire practice-aimed knowledge with regard to:

- client management;
- project planning;
- project management;
- data acquisition;
- problem solving; and
- implementation of a client's specific practical problem.

Methods of reporting in the practice are learned, for example the way in which a written report, as well as an oral report or a paper, should be presented regarding the finished project.

Method of delivering: Full Time / Part Time

Assessment methods:
Formative and summative assessment (Tests, exams, practical evaluation).

School: Geo and Spatial Sciences	Subject Group: Hydrology/Geohydrology	
Module code: OMBE622	**Semester 2**	**NQF-Level: 8**

Title: **Applied Hydrology**

Module-outcomes:
After completion of the module, the student will demonstrate knowledge and critical comprehension of the following:

- Risk assessment methodologies (stochastic and fuzzy logic).
- Development and application of analytical models in the field of hydrology and geohydrology.
- Introduction to numerical groundwater and surface water modelling.
- Analytical element modelling (groundwater).
- Mine flooding modelling (open pit and underground).
- Flood peak estimation through applying the Rational and SCS methods - other methods are left for self-study.
- Flood line determination.
-

Method of delivering: Full-time
The method of teaching/presentation will be governed by the subject material and the unique class requirements. Teaching methods will include formal lectures by lecturer, interactive contact sessions, self-study, project work, practical, excursions

Assessment methods:
Methods: Tests, assignments and exam

- After completion of the module, the student should be able to:
- Setup an analytical model through the use of Excel.
- Perform risk analysis making use of analytical models.
- Describe the setup, operation, constraints and boundary conditions associated with a numerical groundwater and surface water models.
- Apply the Analytical Element Model to groundwater problems.
- Perform a mine flooding prognosis for both open pit and underground mines.
- Calculate a flood peak making use of the Rational method and the SCS method.
- Use a flood peak estimation and calculate the associated flood lines.

School: Geo and Spatial Sciences	Subject Group: Hydrology/Geohydrology	
Module code: OMBE623	**Semester 2**	**NQF-Level: 8**

Title: **Groundwater Geology**

Module-outcomes:

After completion of the module, the student will demonstrate the following:

- Have an integrated knowledge of the geology of South Africa.
- Have a critical understanding of the theories and the geophysical methods (Magnetometer, Electro-Magnetic, Resistivity, Gravitational, Seismic and Radiometric) applied in groundwater investigations.
- Be able to develop conceptual models by making use of geological and hydrogeological information.
- Be able to plan and execute geophysical surveys.
- The ability to select, evaluate and apply a range of different but appropriate geophysical systems and techniques related to geohydrology.
- Be able to interpret geophysical results and write a geophysical report.

Method of delivering: Full-time

The method of teaching/presentation will be governed by the subject material and the unique class requirements. Teaching methods will include formal lectures by lecturer, student self-study, discussion groups, student presentations, videos, demonstrations, practical field work and field visits.

Assessment methods:

Methods: Tests, assignments and exam

- After completion of the module, the student should be able to:

- Use, explain and apply key definitions, terminologies, concepts, principles and other requirements related to groundwater geology correctly.
- Interrogate the meaning and application of key instruments and principles related to groundwater geology.
- Source new resources and utilise the resources provided to extract, analyse, summarise and/or apply the relevant information to solve problems posed in assignments, tests and examinations.
- Accurately, coherently and appropriately present information generated from fieldwork in a written format.
- Achieve the learning objectives in an effective and expeditious manner.

School: Geo and Spatial Sciences	Subject Group: Hydrology/Geohydrology	
Module code: OMBE624	**Semester 2**	**NQF-Level: 8**

Title: **Geohydrology**

Module-outcomes:

- After completion of the module, the student will demonstrate knowledge and critical comprehension of the following:

- Basic groundwater terminology and definitions.
- Borehole slug test analysis and interpretation.
- Various borehole pump test techniques and the application thereof including the analysis and interpretation of pump test results.
- Identification of groundwater flow regimes and fracture positions based on pump test data.
- Borehole tracer tests and the application thereof.
- Calculation / estimation of sustainable yield of a borehole.
- Recharge calculation methods and the application thereof.
- Groundwater assessments and groundwater reserve determinations.
- Applicable interpolation techniques for groundwater level maps.
- Basic groundwater modelling concepts both on regional and local scale.

Method of delivering: Full-time
The method of teaching/presentation will be governed by the subject material and the unique class requirements. Teaching methods will include formal lectures by lecturer, student self-study, discussion groups, student presentations, videos, demonstrations and practical field work.

Assessment methods:
Methods: Tests, assignments and exam

- After completion of the module, the student should be able to:
- Apply Darcy's law taking into account effective hydraulic conductivity.
- Use step and multi-rate pump test data to recommend the appropriate pumping rate for the constant rate test.
- Analyse and interpret pump test data to determine applicable aquifer parameters.
- Identify groundwater flow regimes and fracture positions based on pump test data.
- Recommend the sustainable yield of a borehole based on the methods described in the pump test manual.
- Estimate recharge based on the following methods: Chloride, EARTH, SVF, CRD and Isotopes.
- Perform a groundwater assessment and a groundwater reserve determination.
- Do basic groundwater modelling on aquifer scale as well as wellfield scale.

School: Geo and Spatial Sciences	**Subject Group: Hydrology/Geohydrology**

Module code: OMBE625	**Semester 2**	**NQF-Level: 8**

Title: **Introduction to Hydrology and Integrated Water Resources Management**

Module-outcomes:
Students have mastered the outcomes if they are able to:

- Demonstrate knowledge to enable engagement and critique of current research and practices within the field of hydrology and integrated water resources management and to engage in systematic and disciplined thinking about the matters and issues related to the scarce water resource.
- Are able to interrogate multiple sources of knowledge in hydrology and integrated water resources management, and have the ability to evaluate knowledge and processes of knowledge production.
- To apply and critically judge the effectiveness of the implementation of appropriate strategies and techniques to the solution of problems related to hydrology and integrated water resources management.
- Analyse and apply specialised problem solving skills in hydrology and integrated water resources management.
- Analyse, select and effectively apply carefully supervised scientific research methods to reflect on and then address hydrological and integrated water resources management problems and communicate the research findings in an academically appropriate format.
- Demonstrate an ability to operate effectively within a system of integrated water resources management.
- Recognise and deal responsibly with the moral and ethical issues that relate to hydrology and integrated water resource management.

Method of delivering: Full time only. Teaching methods will include formal lectures by lecturer, student self-study, discussion groups, student presentations, videos, demonstrations and case study work.

Assessment methods:
Formative: Individual tutorials. Individual and group assignments. Class tests. Practical exercises and reports after completion of certain study units.
Summative: Theoretical and/or practical exam at the end of the module.

School: Geo and Spatial Sciences	Subject Group:	
Module code: OMBE673	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Research Project**		
Module-outcomes: • On completion of the module the student should under supervision of a study leader be able to undertake and complete scientific research on a given topic and present the results in the format of a scientific paper. • The student must be able to comprehend and apply the scientific research process in order to ensure that the research methodology as well as the results comply with the requirements of scientific endeavour.		
Method of delivering: Teaching and learning will be undertaken through delivery techniques relevant to the specific requirements and background of the particular subject. Initially formal lectures will be presented by the lecturere and will gradually be replaced with self-study. Other techniques that will be applied include group work, simulations, modelling, lectures, literature studies, etc		
Assessment methods: Formative assessment of knowledge and skills. Continious evaluation of different phases of the research procedure. Summative assessment of knowledge and skills. The completed research report will be evaluated and scored by at least two competent assessors		
School: Geo and Spatial Sciences	**Subject Group:**	
Module code: OMBO611	**Semester 1**	**NQF-Level: 8**
Title: **Introduction to Environmental Management**		
Module-outcomes: 1.Critically discuss the definition of environmental management. 2. Demonstrate an in-depth understand of the Deming Cycle (PDCA) and how it relates to environmental management. 3. Provide a holistic perspective of the key challenges facing environmental management and sustainability. 4. Critically discuss the strengths and weaknesses of different environmental management approaches and tools. 5. Critically reflect on the governance, biophysical, social and economic dimensions of sustainability and how it relates to environmental management		
Method of delivering:		
Assessment methods: Written and oral assignments completed individually and as a member of a group.		
School: Geo and Spatial Sciences	**Subject Group:**	
Module code: OMBO613	**Semester 1**	**NQF-Level: 8**
Title: **Introduction to GIS**		
Module-outcomes: At the end of the module the student should be able to demonstrate: 1. An integrated knowledge of and engagement in GIS and critical understanding and application of theories and techniques relevant to GIS. 2. The ability to collect and manage spatial data in both file format and database management format and understand the complex nature of spatial data and how they are different from non-spatial data. 3. The ability to select, apply and critically judge the effectiveness of spatial data with a view to map making. 4. A critical understanding of how GIS aids in management decisions. 5. The ability to analyze, select and effectively apply scientific research methods to address spatial problems and then communicate the research findings in an appropriate academic format.		

Method of delivering:

Assessment methods:
Theoretical and/or practical exam at the end of the module

School: Geo and Spatial Sciences	**Subject Group:**	
Module code: OMBO614	**Semester 1**	**NQF-Level: 8**

Title: **GIS Applications**

At the end of the module the student should be able to demonstrate:

1. An integrated knowledge of and engagement in GIS and critical understanding of the theoretical underpinnings of organizational and analytical procedures within GIS.
2. An ability to critically interrogate multiple sources of knowledge within the field of GIS, and critically evaluate and review that knowledge and the manner in which the knowledge was produced with a view to using GIS.
3. The ability to apply spatial analysis to address real world spatial problems and mapping applications and critically evaluate how GIS assists management decisions.
4. Advanced ability to effectively apply GIS processes to spatial data analysis and to develop a critical understanding of the limitations of GIS methodologies.
5. Proficiency in the use of GIS techniques to create maps that are fit for purpose and effectively convey the information.
6. The ability to analyse, select and effectively apply scientific research methods to address spatial problems and then communicate the research findings in an appropriate academic format.
7. The ability to recognise the moral and ethical issues that relate to sensitive spatial data and to treat them in a responsible manner.

Method of delivering:

Assessment methods: Theoretical and/or practical exam at the end of the module

School: Geo and Spatial Sciences	**Subject Group:**	
Module code: OMBO678	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Environmental Management I**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

1. Integrated knowledge of and a critical understanding regarding concepts, principles, topics and instruments relevant to environmental management according to the principles of equity, sustainability and efficiency.
2. The ability to interrogate multiple sources of knowledge in environmental management, and to evaluate knowledge and processes of knowledge production.
3. The ability to apply and critically judge the effectiveness of the implementation of a range of relevant methods, systems and procedures required to solve practical and theoretical problems in environmental management.
4. The ability to identify, critically reflect on and effectively solve problems related to environmental management.
5. Ability to critically analyse, select and apply scientific research methods to address environmental management problems and then to communicate the findings in an academically appropriate format.
6. Demonstrate an ability to act as an expert in the field of environmental management.
7. The ability to take full responsibility for his/her work and to recognise the moral and ethical issues that relate to sensitive environmental data and to treat them in a responsible manner.

Method of delivering:

Assessment methods:
The learning process will continually be enhanced through the following:
Individual tutorials.
Individual and group assignments.
Individual and/or group presentations.
Practical exercises and reports after completion of certain study units and/or excursions

School: Geo and Spatial Sciences	**Subject Group:**	
Module code: OMBO679	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Environmental Analysis I**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

1. Knowledge of and engagement in the field of environmental assessment, an understanding of the concepts, principles, theories and instruments relevant to environmental assessment, as well as an understanding of how to apply such knowledge in a particular context.
2. An ability to interrogate multiple sources of knowledge in environmental assessment and to evaluate knowledge and processes of knowledge production.
3. An understanding of the complexities and uncertainties of selecting or applying appropriate procedures, processes or techniques to practical and theoretical problems in environmental assessment.
4. An ability to use a range of specialised skills to identify, analyse and address complex or abstract problems drawing systematically on the body of knowledge and methods appropriate to environmental assessment.
5. An ability to critically review information gathering, evaluation and management processes in environmental assessment in order to develop creative responses to problems and issues.
6. An ability to present and communicate academic, professional or occupational ideas and texts effectively to a range of audiences, offering creative insights, rigorous interpretations and solutions to problems and issues relevant to environmental assessment.
7. Demonstrate an ability to act as an expert in the field of environmental assessment.
8. An ability to take full responsibility for his/her work and to recognise the moral and ethical issues that relate to sensitive environmental data and to treat them in a responsible manner.

Method of delivering:

Assessment methods:
The achievement of module outcomes will be tested in the following ways:
Theoretical and/or oral exam at the end of the module.

School: Geo- and Spatial Sciences	**Subject Group: Geography and Environmental Management**	
Module code: OMBO681	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Environmental Assessment 1**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Knowledge of and engagement in the field of environmental assessment, an understanding of the concepts, principles, theories and instruments relevant to environmental assessment, as well as an understanding of how to apply such knowledge in a particular context.
- An ability to interrogate multiple sources of knowledge in environmental assessment and to evaluate knowledge and processes of knowledge production.
- An understanding of the complexities and uncertainties of selecting or applying

appropriate procedures, processes or techniques to practical and theoretical problems in environmental assessment.

- An ability to use a range of specialised skills to identify, analyse and address complex or abstract problems drawing systematically on the body of knowledge and methods appropriate to environmental assessment.
- An ability to critically review information gathering, evaluation and management processes in environmental assessment in order to develop creative responses to problems and issues.
- An ability to present and communicate academic, professional or occupational ideas and texts effectively to a range of audiences, offering creative insights, rigorous interpretations and solutions to problems and issues relevant to environmental assessment.
- Demonstrate an ability to act as an expert in the field of environmental assessment.
- An ability to take full responsibility for his/her work and to recognise the moral and ethical issues that relate to sensitive environmental data and to treat them in a responsible manner.

Method of delivering: Teaching methods may include formal lectures by lecturer, student self-study, discussion groups, student presentations, videos, demonstrations and case study work

Assessment methods: The learning process will continually be enhanced through the following:

- Individual tutorials;
- Individual and group assignments;
- Individual and/or group presentations;
- Class tests; and
- Practical exercises.

The achievement of module outcomes will be tested in the following ways:
Theoretical and/or oral exam at the end of the module.

School:	**Subject Group:**	
Module code: OMBW611	**Semester 1**	**NQF-Level: 8**

Title: **Fundamentals of Waste Management**

Module-outcomes:
At the end of the module the student should be able to:

- An integrated knowledge of and engagement in integrated waste management and critical understanding and application of theories, techniques and requirements relevant to waste management;
- The ability to gather multiple sources of knowledge and information within the field of integrated waste management, and evaluate, review and apply this knowledge;
- An understanding of the complex nature of knowledge transfer applicable to integrated waste management and how it relates to unfamiliar contexts and other fields of environmental management.
- The ability to select, evaluate and apply a range of different but appropriate tools, techniques, requirements and best practices related to integrated waste management, and to reflect on and propose suggestions to effectively manage waste throughout the entire waste management life cycle.

Method of delivering:

Assessment methods:
The learning process will continually be enhanced through the following: Class tests; and Assessment forms by lectures on achievement of learning objectives.

School:	Subject Group:	
Module code: OMBW612	**Semester 1**	**NQF-Level: 8**

Title: **Waste Management Law and Governance**

Module-outcomes:
At the end of the module the student should be able to:

- An integrated knowledge of and engagement in integrated waste management legislation and governance, and critical understanding and application of these legal requirements (including international obligations, policies, laws, regulations, norms and standards, etc) relevqant to waste management;
- The ability to gather multiple sources of knowledge and information applicable to waste management legislation and governance, and evaluate, review and apply this knowledge;
- An understanding of the complex nature of knowledge transfer applicable to waste management legislation and governance, and how it relates to unfamiliar contexts and other fields of environmental management.
- The ability to select, review, evaluate and apply a range of different but appropriate legislative requirements related to integrated waste management, and to reflect on and propose suggestions to effectively manage waste within the South African legal framework.

Method of delivering:

Assessment methods:
The learning process will continually be enhanced through the following: Class tests; and Assessment forms by lectures on achievement of learning objectives.

School:	Subject Group:	
Module code: OMBW621	**Semester 2**	**NQF-Level: 8**

Title: **New Waste Management Solutions**

Module outcomes:
At the end of the module the student should be able to:

- An integrated knowledge and understanding of integrated waste management solutions and technologies, and understanding the application of these solutions and technologies as it relates to integrated waste management;
- The ability to gather multiple sources of knowledge and information within the field of waste management innovation and technology, and evaluate, review and apply this knowledge;
- An understanding of the complex nature of knowledge transfer applicable to integrated waste management solutions and technologies and how it relates to unfamiliar contexts and other fields of environmental management, and more specifically to integrated waste management;
- The ability to select and evaluate a range of different but appropriate solutions and technologies related to integrated waste management, and to reflect on and propose suggestions to divert waste away from landfilling by implementing the proposed technologies;

Method of delivering:

Assessment methods:
"The learning process will continually be enhanced through the following:
Class tests; and
Assessment forms by lectures on achievement of learning objectives."

School: Biological Sciences	Subject Group: Zoology	
Module code: OMSA622	**Semester 2**	**NQF-Level: 8**
Title: **Weeds: interactions and control**		
Module-outcomes: After completion of this module, the student will be able to: • integrate detailed knowledge of the identification and classification of weed species and understand the interactions between crops, weeds and other pest and diseases organisms. • have a critical understanding of herbicide activity, selectivity and transformation in the plant and soil, and the use of bio-herbicides and herbicide safeners. • analyse problems and develop and evaluate solutions regarding weed identification and management and develop weed management strategies. • demonstrate and awareness of the scope and complexity of ethical and value systems from both the environmental and human perspective with regard to use of agrochemicals. • conduct theory driven arguments to solve complex challenges within the field of integrated weed management. • communicate weed management strategies to stakeholders.		
Method of delivering: Method of delivering: Fulltime and part-time		
Assessment methods: Oral presentations, written assignments, examination		
School: Biological Sciences	**Subject Group: Zoology**	
Module code: OMSA623	**Semester 2**	**NQF-Level: 8**
Title: **Plant pathology**		
Module-outcomes: After completion of this module, the student will be able to: • integrate knowledge of the principles of taxonomy and general characteristics of plant disease causing organisms and understand types of diseases and disease epidemiology on economically important crops. • demonstrate detailed knowledge of disease epidemiology, interactions between pathogens, environment and plants and yield loss determination and apply these in development of integrated disease management strategies. • select, evaluate and apply a range of different but appropriate disease management strategies and recommend management strategies. • demonstrate an awareness of the scope and complexity of ethical and value systems from both the environmental and human perspective with regard to disease management decisions in complex agricultural environments. • plan and conduct research on the effect of diseases on plants, do damage evaluations and interpret data. • produce and communicate information and demonstrate ability to present and communicate academic principles of integrated disease pest management to stakeholders.		
Method of delivering: Full time and part-time		
Assessment methods: Oral presentations, written assignments, examination		
School: Biological Sciences	**Subject Group: Botany / Zoology**	
Module code: OMSB611	**Semester 1**	**NQF-Level: 8**
Title: **Conservation Ecology**		
Module-outcomes: After completion of this module, the student will be able to: • Have a broad knowledge of the fundamental theory and recent developments of Conservation Ecology, as derived from multiple sources within the field of specialization. • Assess the system processes and identify research problems associated with		

Conservation Ecology.
- Select and apply various methodologies required to practice Conservation Ecology.
- Be aware of the scope and complexity of ethical and value systems from both the environmental and human perspective.
- Make informed decisions about conservation management by integrating principles of ecology and conservation biology.
- Simulate communicating conservation management strategies to stakeholders

Method of delivering: Full time and part time

Assessment methods:Written assignments, oral presentations and written exam.

School: Biological Sciences	**Subject Group: Botany / Microbiology**	
Module code: OMSB629	**Semester 1**	**NQF-Level: 8**

Title: **Genome Analysis and Bio-informatics**

Module-outcomes:
- After completion of this module, the student will be able to:
- Demonstrate applied knowledge and critical understanding regarding aspects relevant to genome analysis and bioinformatics.
- Demonstrate an ability to interrogate multiple sources of knowledge in genome analysis and bioinformatics and to evaluate knowledge and processes of knowledge production.
- Demonstrate the ability to apply and critically judge the effectiveness of the implementation of a range of relevant methods, systems and procedures required to solve practical and theoretical problems in genome analysis and bioinformatics.
- Demonstrate your skills regarding elementary research techniques, group work, report writing and problem solving.
- Demonstrate the ability to critically reflect and effectively solve problems related to genome analysis and bioinformatics.
- Effectively identify, evaluate and address his/her learning needs in a self-directed manner, and to facilitate collaborative learning processes.
- Demonstrate the ability to present and communicate academic ideas and text effectively to a range of audiences of problems and issues in genome analysis and bioinformatics.

Method of delivering: Contact and Distance

Assessment methods: Written assignments, oral presentation and written examination

School: Geo- and Space Sciences	**Subject Group: Geography**	
Module code: OMSB624 will become OMSB613	**Semester 1**	**NQF-Level: 8**

Title: **Biodiversity Planning**

Module-outcomes:

After completion of this module, the student will be able to:
- Applied knowledge pertaining to the field of conservation planning and the manner in which it is applied and implemented in South Africa.
- An ability to critically interrogate multiple sources of knowledge within the field of biodiversity conservation, and critically evaluate and review that knowledge and the manner in which it was produced with a view to facilitate conservation action.
- The skill of selecting the appropriate methodologies and procedures for identifying and spatially mapping areas of critical importance for biodiversity conservation.
- The ability to access, interpret and discuss information on conservation and biodiversity planning initiatives in South Africa.
- The ability to interpret and treat sensitive data on critical and sensitive biodiversity in responsible manner.

Method of delivering: Full time and part time

Assessment methods: Written assignments, oral presentation and written examination

School: Biological Sciences	Subject Group: Zoology / Botany	
Module code: OMSB625 will become OMSB614	**Semester 1**	**NQF-Level: 8**

Title: **Biomonitoring and Risk Assessment**

Module-outcomes:
After completion of this module, the student will be able to:

- Have a broad knowledge of the fundamental theory and recent developments of Biomonitoring and Risk Assessment, as derived from multiple sources within the field of specialization.
- Assess the environmental/taxonomic processes and identify research problems associated with Biomonitoring and Risk Assessment.
- Select and apply various methodologies required to develop Biomonitoring and Risk Assessment programs.
- Be aware of the scope and complexity of ethical and value systems from both the environmental and human perspective.
- Make informed decisions about species or habitat management based on the outcomes of Biomonitoring and Risk Assessment programs.
- Simulate communicating outcomes management suggestions from Biomonitoring and Risk Assessment programs to stakeholders.

Method of delivering: Full time and part time

Assessment methods:
Written assignments, oral presentation and written examination.

School: Biological Sciences	Subject group: Zoology	
Module code: OMSB627	**Semester 2**	**NQF-Level: 8**

Title: Herpetology in Practise

Module-outcomes:
After completion of this module, the student will be able to:

- Integrated knowledge and critical understanding of the herpetology discipline.
- Ability to critically interrogate multiple sources of knowledge within the field of herpetology, and critically evaluate and review that knowledge.
- Ability to select and apply knowledge and skills to correctly make use of appropriate methods and techniques to work with amphibians and reptiles.
- Ability to integrate specimen characteristics and other aids to correctly identify species of herpetofauna.
- Skills and knowledge to assess causes that threaten herpetofauna as well as awareness of issues surrounding the conservation of herpetofauna including threats and management.
- Ability to critically judge the ethical/professional conduct of the herpetologist and to apply this conduct.

Method of delivering: Full time

Assessment methods:
Written assignments, oral presentation and written examination..

School: Biological Sciences	Subject group: Zoology	
Module code: OMSB628	**Semester 2**	**NQF-Level: 8**

Title: Coral Reef Ecology

Module-outcomes:

- An integrated knowledge and critical understanding of coral reef ecology.
- The ability to locate and interrogate multiple sources of knowledge related to coral reef ecology.
- The ability to critically evaluate and contextualize the knowledge and accompanying insights.

- The ability to correctly select and apply knowledge and skills to make use of appropriate methods and techniques relevant to coral reef ecology.
- The ability to identify and classify the different animal and algal taxa associated with coral reefs, and the ecological roles that they play.
- Skills, knowledge and insights to assess pressures and changes that threaten coral reefs.
- Skills, knowledge and insights of management and conservation options related to coral reefs.
- The ability to identify and formulate the ethical and health considerations of working and research on coral reefs.

Method of delivering: Full time

Assessment methods:
Written assignments, oral presentation and written examination

School: Geo- and Spatial Sciences	**Subject Group: Geology**	
Module code: OMSE611	**Semester 1**	**NQF-Level: 8**

Title: **Environmental Soil Science (GDKN 122, GDKN 211 and GDKN 221 are pre-requisites for this module)**

Module-outcomes:
On completion of this module the student should:

- have an understanding of how to apply fundamental knowledge, such as soil mechanics and the double layer theory, to evaluate/interrogate environmental soil issues and the rehabilitation practices thereof
- have an understanding the complexities of soils sampling and analysis procedures and techniques with application to solving unfamiliar problems relating to soils in the environment;
- have the ability to use the range of specialized skills applied in soil science to identify, evaluate and address complex problems in the soil environment;
- have the ability to critically review information gathered from field and soil analytical data, in specialized contexts like soil erosion and soil nutrient availability be able to develop creative responses to environmental soil problems and issues;
- be able to present and communicate scientific knowledge of soils and creative insights into environmental soil problems, academically and professionally to managers and decision makers;
- be able to operate effectively within a soil environmental setting, understanding the integrated and interrelated nature of the different properties of soils;
- be able to self-critically evaluate ongoing learning and professional development and be able to employ learning strategies to address personal needs and the needs of other students;
- be fully accountable and take full responsibility for his/her own decision-making, actions, and delivered work as well as his/her use of both academic, laboratory or natural resources.

Method of delivering: Full time

Assessment methods:

- Work assignments during the semester.
- Semester test.
- Examination at the end of the module.

School: Biological Sciences	Subject Group:Botany	
Module code: OMSE612	**Semester 1**	**NQF-Level: 8**

Title: **Introduction to Landscape Ecology**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- integrated knowledge of and engagement in the field of landscape ecology and critical understanding of the scope and context of landscape ecology, scale and scaling, patterns and processes in the landscape and analyses methods of landscape structure and function.
- the ability to critically evaluate the principles and concepts of landscape ecology and integrate them with other aspects of environmental management.
- the ability to critically interrogate peer-reviewed scientific publications in the field of landscape ecology and critically evaluate and review how scale, scaling, patterns and processes are addressed by studying various case studies.
- the ability to select, evaluate and effectively apply different methods in landscape structure and function analyses to reflect on and then address complex environmental problems in urban environments.
- the ability to identify, demarcate, analyse, critically reflect on and effectively address complex problems related to scale and scaling in environmental sciences and apply landscape ecological principles based on the theoretical background.
- accurate, coherent, appropriate and creative presentation and verbal communication skills of current and previous landscape ecological research with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism.
- the role and accountability of humans/industry as part of the environment and protection thereof in an ethically responsible manner.

Method of delivering: Full time and part time

Assessment methods:
Written assignments, oral presentation and written examination

School:Biological Sciences	Subject Group: Botany	
Module code: OMSE621	**Semester 2**	**NQF-Level: 8**

Title: **Restoration of degraded ecosystems**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- integrated knowledge of the different biomes, land use types and capability classes, including land tenure, land reform, as well as the socio-economic and bio-physical factors that could influence the long-term sustainability of rangeland management strategies.
- understand the complex nature of community based natural resource management principles in rangeland management and restoration ecology.
- an ability to critically evaluate the role of plant- and animal functional types in ecosystem dynamics, their role in ecosystem services and be able to apply them in the development of models to understand changes in plant populations and rangeland management.

- the ability to select, evaluate and effectively apply different multivariate data analysis techniques used in terrestrial ecology and rangeland management.
- understand, evaluate and apply all the principles necesarry to develop a restoration management plan.
- the ability to critically interrogate and use peer-reviewed scientific publications in the field of rangeland management and restoration ecology.
- accurate, coherent, appropriate and creatively present through written and verbal communication skills current rangeland management and restoration applications with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism.
- the role and accountability of humans/industry as part of the environment and protection thereof in an ethically responsible manner

Method of delivering: Full time and part time

Assessment methods: Written assignments, oral presentation and written examination.

School:Biological Sciences	**Subject Group:Botany**	
Module code: OMSE622	**Semester 2**	**NQF-Level: 8**

Title: **Urban Ecology**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- integrated knowledge of and engagement in the field of urban ecology and critical understanding of the scope and historical development of urban ecology, different approaches in urban ecological studies and the application of urban ecological principles in conservation of biodiversity and ecosystem services , urban planning and design and urban agriculture.
- the ability to critically evaluate the principles and concepts of urban ecology and integrate them with other aspects of environmental management
- the ability to critically interrogate peer-reviewed scientific publications and integrate them with urban ecological theories and discuss how they could be used to advance sustainability and resilience of urban areas
- the ability to analyse, select, and effectively apply scientific methods in conceptual approaches such as urbanization gradients, landscape ecology, ecosystem budgets and urban social-ecological systems to reflect on and then address complex environmental problems in urban environments.
- the ability to identify, demarcate, analyse, critically reflect on and effectively address complex problems related to an increase in urbanization and apply urban ecological principles based on the theoretical background
- accurate, coherent, appropriate and creative presentation and verbal communication skills of current and previous urban ecological research with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism
- • the role and accountability of humans/industry as part of the environment and protection thereof in an ethically responsible manner

Method of delivering: Full time and part time

Assessment methods: Written assignments, oral presentation and written examination.

School:Biological Sciences	Subject Group: Botany	
Module code: OMSE623	**Semester 2**	**NQF-Level: 8**
Title: **Plant ecophysiology and stress physiology**		
Module outcome: After completing the module you should be able to: • Integrate and assess the various physiological and biochemical stress responses of plants and to critically understand the interaction between plants and its environment. • Demonstrate an understanding of the basic concepts of plant stress, acclimation and adaptation. • Identify, analyse, evaluate and to critically reflect the challenges of plant survival. • Effectively implement stress adaptations and acclimations and to develop and communicate his or her own ideas of plant responses to environmental stress. • Analyse, select and effectively apply plant strategies to address environmental impacts. • Demonstrate the ability to identify, demarcate, analyse, critically reflect on and effectively address challenges related to plant stress and survival and to apply physiological and biochemical principals with current environmental challenges. • Demonstrate the ability to take full responsibility for his or her own work, decision-making and use of resources.		
Method of delivering: Full time and part time		
Assessment methods: Written assignments, oral presentation and written examination.		
School:Biological Sciences	**Subject Group: Zoology**	
Module code: OMSE625	**Semester 2**	**NQF-Level: 8**
Title: **Advanced Ecotoxicology**		
Module-outcomes: On completion of the module, the student should be able to demonstrate: • integrated knowledge of and engagement in the field of ecotoxicology and critical understanding and application of toxicity testing using standard test methods, exposure routes, mode of action of toxicants, biotransformation, detoxification, biodegradation and biomarkers in the field of environmental risk assessment. • an understanding of bioaccumulation, the effects of contaminants at increasing levels of ecological organization, and the regulatory aspects of the field addressing the technical issues of risk assessment. • he/she can discuss the principles and concepts of ecotoxicology and integrate this with other aspects of environmental management. • the ability to critically interrogate peer-reviewed scientific publications and integrate it with ecotoxicological theories and discuss how it could be used to address environmental pollution events. • he/she has the ability to evaluate national/international trends in ecotoxicology and integrating it with theoretical peer-reviewed published knowledge. • an ability to present and communicate the concept of risk analysis in ecotoxicology and how it relates to environmental pollution. • the role and accountability of humans/industry as part of the environment and protection thereof in an ethically responsible manner.		
Method of delivering: Fulltime and part-time		
Assessment methods: Written assignments, oral presentation and open book written examination		

School: Biological Sciences	Subject Group: Microbiology	
Module code: OMSE626	**Semester 2**	**NQF-Level: 8**
Title: **Microbial Ecology**		
Module-outcomes: On completion of the module, the student should be able to demonstrate: • Integrated knowledge of and engagement in the field of microbial ecology as well as its application to environmental problems. • That he/she can discuss the principles and concepts of microbial ecology and integrate this with aspects of environmental management. • An understanding of the interactions between the physical, chemical and biological properties of ecosystems inhabited by microorganisms, as well as the complexities surrounding the selection and application of appropriate methods for microbial ecology research. • The ability to evaluate national/international trends in microbial ecology and integrate it with theoretical peer-reviewed published knowledge to solve unfamiliar problems in microbial ecology. • The ability to critically judge the role and accountability of humans/industry as part of the environment and protection thereof in an ethically responsible manner. • The ability to effectively communicate academic and professional ideas and texts to a range of audiences, offering creative responses to environmental issues. • Self-regulated learning skills and accountability for own work, learning and use of resources..		
Method of delivering: Full time and part time		
Assessment methods: Written assignments, oral presentation and written examination		
School: Biological Sciences / Geo and Spatial Sciences	**Subject Group: Botany / Zoology / Microbiology / Hydrology**	
Module code: OMSE674	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Research Project**		
Module-outcomes: After completion of the module, the student should demonstrate: • an understanding of the theories, research methods and techniques relevant to the particular research project including how to interrogate multiple sources and critically reviewing information gathering. • an understanding of the complexities and uncertainties of selecting and applying standard techniques to the unfamiliar problem of the research project. • an ability to use a range of specialised skills to identify, analyse and address complex or abstract problems as part of resolving the research question. • an ability to present and communicate academic, professional or occupational ideas and concepts effectively to a range of audiences. • an ability to apply, in a self-critical manner, learning strategies which effectively address own professional and ongoing learning needs as a researcher with integrity: integrity towards his/her own conduct as a researcher, but also treating the environment and biota with respect.		
Method of delivering: Full time or part time		
Assessment methods: • Presentation at mini-conference, as well as marks for research related skills training, e.g. project proposal, literature review, statistics assignment. Research report written in the prescribed format.		

School:	Subject Group:	
Module code: OMSG611	**Semester 1**	**NQF-Level: 8**

Title: **Environmental geochemistry (GLGN112 and GLGN311 are pre-requisites for this module)**

Module-outcomes:

On completion of this module the student should be able to demonstrate the ability:

- to apply knowledge of the theories, research methodologies, and techniques relevant to Environmental Geochemistry and to interrogate and evaluate multiple sources of knowledge in this field;
- to understand the complexities and uncertainties of selecting, applying or use of appropriate procedures or techniques to a range of unfamiliar abstract problems relevant to Environmental Geochemistry;
- to apply a range of specialized skills in the field of Environmental Geochemistry through the analysis of complex problems, drawing on previous knowledge and a range of methods appropriate to the field;
- to critically judge the ethical and professional conduct of self and others, take responsibility for own work and practices as well as to effect change in conduct where necessary, with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism;
- to produce accurate, coherent, appropriate and creative presentation and communication of innovative and new professional ideas/texts/methods/research findings etc. to a range of audiences, through critically reviewing information, processing, synthesizing, managing and evaluating information/data offering critical and creative insight and solutions to problems;
- to operate effectively within a team/system and/or manage a team/group and demonstrate logical and critical understanding of the roles of all role players/ team members in order to solve complex problems, monitoring the progress of the team/group and taking responsibility for task outcomes and application of appropriate resources;
- to apply self-critical learning skills with the use of specific learning strategies of known and new resources to successfully realize all outcomes of this module.

Method of delivering: Full time

Assessment methods: Written assignments, oral presentations, partial open book examination

School: Geo and Spatial Sciences	Subject Group:Geology	
Module code: OMSG621	**Semester 2**	**NQF-Level: 8**

Title: **Environmental Mineralogy (GLGN 122 and GLGN211 are pre-requisites for this module)**

Module-outcomes:

On completion of these outcomes the student should be able to demonstrate:

- integrated knowledge of and engagement in environmental mineralogy, and critical understanding and application of theories and current research methodologies and techniques relevant to environmental mineralogy;
- the ability to critically review information to give accurate, coherent, appropriate and creative presentation and communication of new scientific findings, investigative methods and research findings in the field of environmental mineralogy to peers, with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism;
- self-regulating learning skills by developing own learning-strategies;
- the ability to critically judge the ethical conduct of others in the application of solutions regarding (potential) pollution of the environment en endangering life, as

well as critical reflection on the suitability of different ethical value systems applied in environmental mineralogy;
- take full responsibility for own work, decision-making and use of resources, as well as full accountability for decisions and actions of others where appropriate (group work).

Method of delivering:Full time

Assessment methods:
- oral reporting relating to prepared work;
- some assessment tests;
- individual and group assignments submitted as written papers or oral presentations during contact sessions.

Formal examination at the end of the semester.

School: Geo and Spatial Sciences	**Subject Group: Geology**	
Module code: OMSG622	**Semester 2**	**NQF-Level: 8**

Title: **Applied environmental geology (GLGN 112, GLGN221 and GLGN321 are pre-requisites for this module)**

Module-outcomes:
On completion of this module, the successful learner should be able to demonstrate their ability to:
- apply knowledge of the theories, research methodologies, and techniques relevant to Applied Environmental Geology and interrogate and evaluate multiple sources of knowledge in this field;
- understand the complexities and uncertainties of selecting, applying or transferring appropriate procedures or techniques to a range of unfamiliar abstract problems;
- apply a range of specialized skills in the field of Environmental Geology through the analysis of complex problems, drawing on the body of knowledge and a range of methods appropriate to the field;
- critically judge the ethical and professional conduct of self and others, take responsibility for own work and practices as well as to effect change in conduct where necessary, with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism;
- produce accurate, coherent, appropriate and creative presentation and communication of innovative and new professional ideas/texts/methods/research findings etc. to a range of audiences, through critically reviewing information, processing, synthesizing, managing and evaluating information/data offering critical and creative insight and solutions to problems;
- operate effectively within a team/system and/or manage a team/group and demonstrate logical and critical understanding of the roles of all role players/ team members in order to solve complex problems, monitoring the progress of the team/group and taking responsibility for task outcomes and application of appropriate resources;
- apply self-critical learning skills with the use of specific learning strategies of known and new resources to successfully realize all outcomes of this module.

Method of delivering: Fulltime

Assessment methods: Written assignments, oral presentations, partial open book examination

School: Biological Sciences	Subject Group:Zoology	
Module code: OMSP611	**Semester 1**	**NQF-Level: 8**
Title: **Principles of integrated pest management**		
Module-outcomes: After completion of this module, the student will be able to: • integrate knowledge of host plant resistance and biological-, cultural- and chemical control and critically understand the principles of integrated pest management. • understand the impact of pest management measures in complex agricultural systems. • select, evaluate and apply a range of different and appropriate pest management strategies to solve problems encountered in the field of pest management. • demonstrate an awareness of the scope and complexity of ethical and value systems from both the environmental and human perspective with regard to pest management decisions. • conduct theory driven arguments to solve complex challenges within the field of integrated pest management. • • produce and communicate information and demonstrate ability to present and communicate academic principles of integrated pest management to stakeholders.		
Method of delivering: Full time and part time		
Assessment methods: Oral presentations, written assignments, examination		
School: Biological Sciences	**Subject Group:Zoology**	
Module code: OMSP622	**Semester 2**	**NQF-Level: 8**
Title: **GM crops and integrated pest management**		
Module-outcomes: After completion of this module, the student will be able to: • integrate knowledge of genetically modified crops, resistance evolution processes, insect resistance management to enhance Integrated Pest Management startegies. • understand the target and-non-target effects of genetically modified crops or co-used products in the environment, and be able to apply ecological models in a risk assessment process. • be able to critically investigate sources of knowledge within the field of genetically modified crops, and critically evaluate that knowledge. • demonstrate an awareness of stewardship responsibilities and application thereof in the context of genetically modified crops. • prepare and present oral and written reports and use appropriate platforms to communicate academic principles regarding use of biotechnology in agriculture.		
Method of delivering: Full time and part time		
Assessment methods: Oral presentations, written assignments, examination		
School: Biological Sciences	**Subject Group:Zoology**	
Module code: OMSP623	**Semester 2**	**NQF-Level: 8**
Title: **Nematodes and crops**		
Module-outcomes: After completion of this module, the student will be able to demonstrate: • applied knowledge about Nematology, an understanding of the relevant theories and research methodologies, how to integrate, evaluate and practically apply such knowledge. • an understanding of the complexities and uncertainties of selecting and applying appropriate standard procedures, processes or techniques to unfamiliar problems		

experienced in Nematology.

- an ability to use a range of specialised skills to identify, analyse and address complex or abstract problems drawing systematically on the body of knowledge and methods used in Nematology research.
- an ability to identify and address ethical issues related to Nematology research based on critical reflection and ethical value systems, take full responsibility and accountability for own work, learning and decision-making and use of resources.
- an ability to critically review information gathering, evaluation and management processes in Nematology to develop creative solutions, present and communicate academic, professional and occupational ideas effectively to a range of audiences in the field of Nematology.

Method of delivering: Full time and part time

Assessment methods: Oral presentations, written assignments, examination

School: Biological Sciences	**Subject Group:Zoology**	
Module code: OMSP624	**Semester 2**	**NQF-Level: 8**

Title: **Arthropoda/plant interactions**

Module-outcomes:

After completion of this module, the student will be able to:

- apply basic knowledge of economically important phytophagous mites (Acari) species and integrate this knowledge in the context of integrated pest management.
- integrate knowledge of chemical ecological- and physical interactions, between plants, and between arthropods and plants, and be able to develop sound pest management strategies exploiting these interactions.
- design and evaluate appropriate research experiments to study arthropod behavioural responses to specific plant traits.
- demonstrate an awareness of ethical responsibilities accompanying the study of arthropod behaviour.
- produce and communicate information and demonstrate ability to present and communicate academic principles and the complexities of arthropod-plant interactions to fellow scientists.

Method of delivering Full time and part time:

Assessment methods: Oral presentations, written assignments and exam

School: Biological Sciences	**Subject Group: Zoology**	
Module code: OMSW611	**Semester 1**	**NQF-Level: 8**

Title: **Aquatic Ecosystems: Pollution and Ecotoxicology**

Module-outcomes:

On completion of the module, the student should be demonstrate:

- knowledge of a broad range of methods to infer aquatic ecosystem health based on the community structure of aquatic biota across various trophic levels.
- knowledge of appropriate monitoring methodologies used to assess anthropogenic impacts and pollution on the quality of inland waters.
- interpretation and application of appropriate indices and assessment techniques used to infer aquatic ecosystem health.
- determine appropriate monitoring methods for application in a wide variety of aquatic habitat types.
- independent assessment and interpretation of data without external influence or duress.
- synthesis of data and evaluation of information arising from diverse sources regarding microbiological, ecotoxicological and biological monitoring of pollution in aquatic ecosystems.
- the ability to use and distinguish appropriate sources of information.

Method of delivering: Full time or part time

Assessment methods: Oral presentations, written assignments and exam.

School: Biological Sciences	Subject Group: Botany	
Module code: OMSW622	**Semester 2**	**NQF-Level: 8**

Title: **Phycology**

Module-outcomes:

On completing the module the student should be able to demonstrate:

- Integrated knowledge of and engagement in phycology as well as critical understanding and application of certain theories (such as the theory of symbiosis), research methodologies and techniques relevant to the field of phycology.
- An ability to critically interrogate multiple sources of knowledge within the field of phycology, e.g. structure and characteristics of various algal taxa, and critically evaluate and review this knowledge and the manner in which the knowledge was produced in order to explain and compare the structure of different groups of algae with one another.
- The ability to select, apply and critically judge the effectiveness of the implementation of a range of relevant skills, techniques, methods and procedures generally used in phycology.
- The ability to analyse, select and effectively apply carefully supervised scientific research methods to reflect on and then address complex or abstract problems and contribute to positive change within the field of phycological research.
- Supervised research skills by selecting and implementing suitable research methods to effectively execute a planned research design, report research findings and produce conclusions in the form of acceptable academic assignments.
- The ability to identify, demarcate, analyse, critically reflect on and effectively address complex challenges related to the formation of algal blooms and to be able to write assignments, that are strengthened with theory-driven arguments, on these problems.
- An ability to apply, in a self-critical manner, learning strategies which effectively address his/her own professional and ongoing learning needs in disciplines that relate to the study of algae.

Method of delivering Full time and part time:

Assessment methods: Assignments, class tests, presentations and written examination

School: Biological Sciences	Subject Group: Zoology	
Module code: OMSW624	**Semester 2**	**NQF-Level: 8**

Title: **Environmental Hydrology**

Module-outcomes:

- Applied knowledge of environmental hydrology and demonstrate an understanding of the research methodologies, methods and techniques, to interrogate multiple sources of knowledge and to evaluate knowledge relevant to the fields of hydrology and aquatic ecology, as well as an understanding of how to apply such knowledge in a particular context.
- An understanding of the complexities of selecting, applying appropriate processes or techniques to assess ecological drivers and responders in environmental hydrology.
- An ability to use a range of specialised skills to identify, analyse and address environmental hydrology issues drawing systematically on the body of knowledge and methods appropriate to the fields of hydrology and aquatic ecology.
- An ability to critically review information gathering, evaluation and management processes in the different disciplines that constitute of environmental hydrology in order to develop creative responses to problems and issues.
- An ability to identify and address ethical issues based on critical reflection on the suitability of different ethical value systems to specific areas in the fields of hydrology, aquatic ecology and water resources management and to take full responsibility for own work, learning, decision-making and use of resources.
- An ability to present and communicate academic and professional ideas and texts effectively to a range of audiences, offering creative insights, rigorous interpretations

and solutions to problems and issues with regard to environmental hydrology (environmental drivers: water quality, hydrology and geomorphology and environmental responders: riparian vegetation, macroinvertebrates and fish) and the water resources management application thereof.

- An ability to apply, in a self-critical manner, learning strategies which effectively address own professional and ongoing learning needs the disciplines that relate to environmental hydrology.

Method of delivering: Full time

Assessment methods: Assignments, presentations and a written examination paper at the end of the semester..

School: Biological Siences	**Subject Group: Zoology**	
Module code: OMSW625	**Semester 2**	**NQF-Level: 8**

Title: **Limnology**

Module-outcomes:

After completion of the module, the student should demonstrate:

- integrated knowledge of and engagement in limnology and critical understanding and application of the ecological principles relevant to freshwater ecology.
- an ability to critically interrogate multiple sources of knowledge (e.g. freshwater ecology and limnology) within the field of ecology, and critically evaluate and review that knowledge and the manner in which the knowledge was produced with a view to understanding the relationship between physico-chemical changes and algal and benthic biology interactions.
- the ability to select, apply and critically judge the effectiveness of the implementation of a range of appropriate observations and sampling techniques with a view to determining the limnological interactions and functions in freshwater ecosystems.
- supervised research skills by selecting and implementing appropriate sampling designs in freshwater lentic habitats to effectively execute a planned research design, report research findings and produce conclusions in an acceptable academic format i.e. practical reports.
- an ability to identify and address ethical issues based on critical reflection on the suitability of different ethical value systems to specific areas in the field of limnology and to take full responsibility for own work, learning, decision-making and use of resources.
- the ability to identify, demarcate, analyse, critically reflect on and effectively address complex challenges related to changes in physico-chemical characteristics of lentic freshwater systems and apply evidence-based solutions with theory-driven ecological arguments.
- an ability to apply, in a self-critical manner, learning strategies which effectively address own professional and ongoing learning needs the disciplines that relate to limnology.

Method of delivering: Full time (Only students partaking in the ASU exchange programme)

Assessment methods: Written and oral assignments, practical report and written examination at the end of the module.

School: Biological Siences	**Subject Group: Zoology**	
Module code: OMSW626	**Semester 2**	**NQF-Level: 8**

Title: **Animal Ecology**

Module-outcomes:

After completion of the module, the student should demonstrate:

- integrated knowledge of and engagement in animal ecology and critical understanding and application of the ecological principles relevant to animal ecology.
- an ability to critically interrogate multiple sources of knowledge (e.g. relationships of animals to their physical, chemical and biological habitats) within the field of ecology, and critically evaluate and review that knowledge and the manner in which the knowledge was produced with a view to understanding the relationship between these

habitat and their distributions.

- the ability to select, apply and critically judge the effectiveness of the implementation of a range of appropriate observations and sampling techniques with a view to determining the ecological functions in terrestrial ecosystems.
- supervised research skills by selecting and implementing appropriate sampling designs in terrestrial ecosystems to effectively execute a planned research design, report research findings and produce conclusions in an acceptable academic format i.e. practical reports.
- an ability to identify and address ethical issues based on critical reflection on the suitability of different ethical value systems to specific areas in the field of animal ecology and to take full responsibility for own work, learning, decision-making and use of resources.
- the ability to identify, demarcate, analyse, critically reflect on and effectively address complex challenges related to increased human activities terrestrial ecosystems and apply evidence-based solutions with theory-driven ecological arguments.
- an ability to apply, in a self-critical manner, learning strategies which effectively address own professional and ongoing learning needs the disciplines that relate to animal ecology.

Method of delivering: Full time (Only students partaking in the ASU exchange programme)

Assessment methods: Written and oral assignments, practical report and written examination at the end of the module.

School:Geo- and Spatial Sciences	**Subject Group: Geology**	
Module code: OMWE611	**Semester 1**	**NQF-Level: 8**

Title: **Rehabilitation of disturbed areas**

Module-outcomes:

On completion of the module, the student should demonstrate:

- the ability to apply extensive and systematic knowledge and critical understanding of the natural and anthropogenic causes of landscape degradation including soil, surface water and groundwater, the interaction between different environments and material attributes regarding rehabilitation and remedial techniques and rehabilitation and remedial techniques with the aim to restore disturbed landscapes;
- the ability to interrogate and evaluate multiple sources of knowledge in rehabilitation sciences will also be achieved;
- understanding of complex factors and processes that contribute to degradation and must be able to characterize, analyze, evaluate and rehabilitation, and remedial techniques must be able to be applied to solve problems;
- the ability to apply a range of specialized rehabilitation related skills through the analysis of environmental disturbances by referring to the body of knowledge and methodologies available in this field;
- the ability to evaluate and apply ethical and professional conduct and to evaluate the conduct of others or as part of a group;
- to function as responsible professionals with understanding and respect for intellectual property as well as copy write and plagiarism conventions;
- the ability to present ideas, methods and research findings in a coherent, appropriate and creative way to a number of different audiences;
- the ability to critically review information, processing and evaluating information and data to offer creative insights and solutions to problems;
- the ability to operate, manage group exercises and demonstrate critical understanding of the roles of group members and monitoring the progress of task outcomes in order to solve complex problems;
- the ability application of self-critical learning skills using different learning strategies of recognized and innovative resources to successfully achieve all outcomes of this module

Method of delivering: Full time

Assessment methods:
Formative assessment of knowledge in the form of assignments that are done individually or in groups.
Summative assessment through formal examination at the end of the module

School: : Biological Sciences	**Subject Group: Zoology**	
Module code: OMWP611	**Semester 1**	**NQF-Level: 8**

Title: **Pest phenology and damage symptoms**

Module-outcomes:
After completion of this module, the student will be able to demonstrate:

- applied knowledge of pest phenology and damage symptoms and demonstrate an understanding of the research methodologies, methods and techniques, to interrogate multiple sources of knowledge and to evaluate knowledge relevant to the fields of entomology, plant pathology, nematology and acarology, as well as an understanding of how to apply such knowledge in a particular context.
- an understanding of the complexities of selecting, applying appropriate processes or techniques to unfamiliar problems in the fields of entomology, plant pathology, nematology and acarology.
- an ability to use a range of specialised skills to identify, analyse and address pest problems drawing systematically on the body of knowledge and methods appropriate to the fields of entomology, plant pathology, nematology and acarology.
- an ability to gather and critically review information, evaluate and manage processes in the fields of entomology, plant pathology, nematology and acarology in order to develop creative responses to problems.
- an ability to present and communicate academic and professional information and ideas effectively to a range of audiences, offering creative insights, rigorous interpretations and solutions to problems and issues with regard to pests (insects, mites, nematodes and fungi) and the damage they cause.
- an ability to apply, in a self-critical manner, learning strategies which effectively address own professional and ongoing learning needs the fields of entomology, plant pathology, nematology and acarology

Method of delivering: Fulltime and part-time

Assessment methods Oral presentations, written assignments, insect collection and exam.

School: Biological Sciences	**Subject Group: Zoology**	
Module code: OMWP613	**Semester 1**	**NQF-Level: 8**

Title: **Economic damage and threshold values**

After completion of this module, the student will be able to:

- integrate knowledge of host plant resistance and biological-, cultural- and chemical control and critically understand the principles of integrated pest management.
- understand the impact of pest management measures in complex agricultural systems.
- select, evaluate and apply a range of different and appropriate pest management strategies to solve problems encountered in the field of pest management.
- demonstrate an awareness of the scope and complexity of ethical and value systems from both the environmental and human perspective with regard to pest management decisions.
- conduct theory driven arguments to solve complex challenges within the field of integrated pest management.
- produce and communicate information and demonstrate ability to present and communicate academic principles of integrated pest management to stakeholders.

Method of delivering: Full Time or Part Time

Assessment methods: Oral presentations, written assignments and exam.

School: Biological Sciences	Subject Group: Botany / Zoology	
Module code: OMWW611	**Semester 1**	**NQF-Level: 8**

Title: **Physical, chemical and biological properties of inland water**

Module-outcomes:
At the completion of this module the student should be able to demonstrate

- knowledge of interactions between water quality variables and the structure of aquatic communities at all trophic levels.
- knowledge of management interventions to reverse anthropogenic impacts on the quality of inland waters.
- interpretation of data in relation to guidelines and ability to determine appropriate actions and responses.
- determine existing levels of water quality based on known or previously determined parameters.
- independent assessment and interpretation of data without external influence or duress.
- synthesis of data and evaluation of information arising from diverse sources regarding management actions and the assessment and remediation of water quality in aquatic ecosystems
- demonstrate the ability to use and distinguish appropriate sources of information

Method of delivering: Full time or part time

Assessment methods: Assignments, presentations and written examination.

School: Biological Sciences	Subject Group: Zoology	
Module code: OMWW614 will become OMWW617	**Semester 1**	**NQF-Levelv: 8**

Title: **Zoonoses**

Module-outcomes:

- On completion of the module, the student should be able to demonstrate:
- an understanding of the epidemiology of different types of zoonotic diseases.
- the knowledge to differentiate between food-borne, vector-borne and water-borne diseases.
- an understanding of medical, veterinary and economic importance of zoonotic diseases.
- an understanding of zoonotic pathogen genetics and immunological response of hosts.
- an understanding and application of different diagnostic techniques for zoonotic diseases.
- communication skills to advise the community or stakeholders on preventative and control strategies during disease outbreak.
- a morally responsible and ethical correct action in the face of a zoonotic outbreak.

Method of delivering: Full time or part time provided that students attend practicals

Assessment methods: Assignments, practical reports and written examination paper.

School: Biological Siences	Subject Group: Zoology	
Module code: OMWW616	**Semester 1**	**NQF-Level: 8**

Title: **Estuarine and near shore marine ecology**

Module-outcomes:
After completion of the estuarine and near shore marine ecology module, the student should demonstrate:

- Integrated knowledge of and engagement in estuarine and near shore marine ecology and critical understanding and application of the ecological principles relevant to estuarine and near shore marine ecology.
- An ability to critically interrogate multiple sources of knowledge (e.g. inter tidal ecology

and estuarine ecology) within the field of ecology, and critically evaluate and review that knowledge and the manner in which the knowledge was produced with a view to understanding the relationship between habitat (physical, chemical, biological) and biological interactions.

- The ability to select, apply and critically judge the effectiveness of the implementation of a range of appropriate observations and sampling techniques with a view to determining the ecological functions in intertidal and estuarine ecosystems.
- Supervised research skills by selecting and implementing appropriate sampling designs in the Tsitsikamma intertidal zone and estuary to effectively execute a planned research design, report research findings and produce conclusions in an acceptable academic format i.e. practical reports.
- An ability to identify and address ethical issues based on critical reflection on the suitability of different ethical value systems to specific areas in the fields of estuarine and marine ecology and their management and to take full responsibility for own work, learning, decision-making and use of resources.
- The ability to identify, demarcate, analyse, critically reflect on and effectively address complex challenges related to increased human activities in marine and estuarine regions and apply evidence-based solutions with theory-driven ecological arguments
- An ability to apply, in a self-critical manner, learning strategies which effectively address own professional and ongoing learning needs the disciplines that relate to estuarine and marine ecology.

Method of delivering: Full time

Assessment methods:
Short theoretical and practical assignments completed as an individual or in groups that may be evaluated. Pracitcal reports based on the projects compelted during the compulsory field trip. Presentations by students related to the most recent information related to estuarine and near shore marine ecology. Writing an examination paper at the end of the semester.

School: Biological Siences	**Subject Group: Microbiology**	
Module code: OMWW629 changes to OMWW621	**Semester 2**	**NQF-Level: 8**

Title: **Advanced Water Treatment**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- applied knowledge and critical understanding regarding aspects relevant to water quality as well as the complex nature of water resources.
- the ability to apply and critically judge the effectiveness of the implementation of a range of relevant methods, systems and procedures required to solve practical and theoretical problems in water.

your skills regarding elementary research techniques, group work, report writing and problem solving.
the ability to take full responsibility for his/her work.
the ability to critically reflect and effectively solve problems related to water.
the ability to present and communicate academic ideas and text effectively to a range of audiences of problems and issues in water purification and treatment.

Method of delivering: Full time and part time.

Assessment methods: Assessment methods: Short assignments completed individually or in groups, that may be evaluated. Tutorials by individuals or groups. Written examination at the end of the module

School: Computer, Statistical and Mathematical Sciences	Subject Group: Statistics and Operational Research	
Module code: STTN611	**Semester 1**	**NQF-Level: 8**
Title: Projek I: **Research project I (practice directed)**		
Module-outcomes: This module offers the student the opportunity to learn practical knowledge related to client management, project planning, data collection, inference and interpretation of a practical statistical problem. Practical methods of reporting results are also taught. This includes the way in which a written report, an oral report, or an academic article on a completed statistics project should be presented. After successful completion of the module the student will be able to successfully advise and oversee the planning and execution of surveys and experiments as well as the analysis of data obtained in this way. The student will also be able to make sound, scientific conclusions based on the study because the practical statistical problem is coordinated with the client from the very beginning phases of the project. Data will be collected in a meaningful way, inference concerning the research questions will be conducted and a professional report accompanied by a professional oral presentation of the workwill be delivered.		
Method of delivering: Full time		
Assessment methods: A report and a presentation.		
School: Computer, Statistical and Mathematical Sciences	**Vakgroep: Statistics and Operational Research**	
Module code: STTN612	**Semester 1**	**NQF-Level: 8**
Title: **Statistical Data-analysis I: Models**		
Module-outcomes: The objective of this module is to introduce the student to the theory and practical implementation of more advanced linear statistical models and offers the student the opportunity to master various experimental designs. Analysis of Variance (ANOVA) models as well as generalised linear models will be applied, diagnostic and remedial methods for these models will be discussed, post-hoc tests related to these models will be investigated, and various modifications of the ANOVA models for various scenarios will be discussed (including multi-factor models, block design models, models with continuous covariates, nested factor models, models for repeated measures, random factor models, and incomplete block design models). Model fitting methods are studied and the software packages R and SAS will be used for practical problem solving. Upon successful completion of this module, the student will understand the theoretical concepts related to the models discussed and will be able to apply the correct method to collect data for specific problems, and thereby sensibly implement the appropriate models. R and SAS programs will be used to conduct the analysis.		
Method of delivering: Full time		
Assessment methods: Class tests, assignments, and exam.		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Statistics and Operational Research	
Module code: STTN613	**Semester 1**	**NQF-Level: 8**
Title: **Resampling**		
Module-outcomes: New computer-intensive bootstrap inference methods and techniques are taught and applied where classical methods are not applicable. Students learn to derive bootstrap estimators of standard errors of estimators, to compute bootstrap confidence intervals, to do hypothesis testing and other inference by applying bootstrap methods to linear regression,time series models, and model selection techniques. The programming language R will be employed in order to practically implement the bootstrap. Having completed the course, the student will be able to identify which problems and inference tasks can be solved by applying the bootstrap method, and will be able to use R to perform statistical inference for certain problems which were previously not possible.		
Method of delivering: Full time		
Assessment methods: Class tests, assignments, and exam.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN614	**Semester 1**	**NQF-Level: 8**
Title: **Statistical Inference**		
Module-outcomes: The module focuses on conventional as well as recently developed inference techniques that can be applied in many practical areas. Methods regarding generalised p-values and generalised confidence intervals are included. A few special cases of the generalised methods are then emphasised and exact statistical methods are developed for these cases. The new methods play an important role in inference about linear models. Bayesian theory is also discussed, as well as non-parametric methods. After completing the module, the student should be able to apply these inference methods to a wide variety of practical areas The computer packages SAS, Statistica, R and Fortran are used in the inference process to address problems relating to estimation, hypothesis testing, Bayesian inference, exact non-parametric methods, generalized confidence intervals, comparing two normal populations, variance analysis and regression..		
Method of delivering:Full time		
Assessment methods: Class tests, assignments, and exam.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN615	**Semester 1**	**NQF-Level: 8**
Title: **Stochastic Processes I**		
Module-outcomes: This module provides the student with the opportunity to master the fundamentals of stochastic processes. After introductory sessions on probability theory and the basic concepts of stochastic processes, discrete time Markov chains are discussed. Attention is given to transition probabilities, the Chapman-Kolmogorov equations, classification of states, limiting behaviour, branching processes, modeling and simulation of Markov chains, and applications to financial models. The study of continuous time Markov processes includes the Poisson process, the Forward and Backwards Kolmogorov equations, basic applications, non-homogeneous Markov processes, and the modelling		

and simulation of Markov processes.

Having completed the module, the learner will be able to identify stochastic processes and carry out the appropriate probability calculations.

Method of delivering: Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN616	**Semester 1**	**NQF-Level: 8**

Title: **Nonparametric estimation methods**

Module-outcomes:
This module presents the student with the opportunity to master aspects of well-known permutation methods and nonparametric smoothing methods (such as density function estimation). Specifically, the student must master kernel function estimators (including certain elements pertaining to these estimators), kernel density estimators, deviation criteria such as the MSE and MISE criteria (including their asymptotic versions), asymptotic notation, Taylor expansions, different kernel functions, canonical kernel functions, optimal kernel function theory, higher order kernel functions, theory regarding the behaviour of the boundary points, estimators of derivatives, band-width estimators, cross-validation, the plug-in principle, multivariate estimation methods, and nonparametric regression methods.

Permutation tests, which cover many aspects of statistical inference (including survival analysis), forms a large part of this module.

After the successful completion of this module the student should be able to demonstrate the necessary statistical and mathematical expertise to be able to apply the above concepts and techniques in practical situations that require nonparametric hypothesis testing via permutation tests, as well as smoothing techniques

Method of delivering: Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN617	**Semester 1**	**NQF-Level: 8**

Title: **Mathematical and Computer-intensive methods I**

Module-outcomes:
At the end of this module, students will be able to

- perform Monte Carlo integration and master so-called "importance sampling"
- discuss different methods used to generate data from various distributions
- discuss Markov Chain Monte Carlo (MCMC) algorithms and be able to draw the necessary theoretical conclusions from them.
- master "Saddle Point" approaches as well as be able to make the necessary theoretical conclusions related to this.
- apply the above techniques in Bayesian Inference

After successful completion of this module, students will have the necessary computer and statistical skills to apply the above principles and techniques in practical situations.

Method of delivering: Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Statistics and Operational Research	
Module code: STTN618	**Semester 1**	**NQF-Level: 8**
Title: **Financial-driven Statistics I**		
Module-outcomes: The content of the module will equip students to deal with the complexity of censored and truncated data sets found in financial and economic fields. Estimation of the survival function, the cumulative failure rate (hazard rate) and measures of centrality, as well as estimation methods for more complicated censored data structures, smoothing techniques, hypothesis testing and Bayesian survival methods are included. After successful completion of the module, the student will be able to deal with censored and truncated data sets and inference on the topics mentioned above. Specifically, students will have the skills to critically evaluate survival models and effectively implement them in various fields of application such as in the field of insurance. Appropriate estimation methods will be used for lifetimes and other parameters such as, for example, transitions rates (statistical models will be built for, inter alia, the transition between multiple states and mortalities). Tests for consistency of estimators will be implemented., In addition, simple assurance and annuity contracts and the application of survival models to these contracts will be investigated.. SAS, R, Statistica will be used for calculation purposes.		
Method of delivering: Full time		
Assessment methods: Class tests, assignments, and exam.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN621	**Semester 2**	**NQF-Level: 8**
Title: **Research project (Research journal directed)**		
Module-outcomes: This module offers the student the opportunity to learn research methods related to the management of the project, study planning, ethical issues regarding research, data collection, literature handling, reference/bibliography list management, inference, and interpretation of a particular practical problem. The contents of the manual for postgraduate students of the university must be studied. Methods of reporting as required by research journals are taught. Upon successful completion of this module the student will successfully be able to write a simple research report or article with all above elements in place. A completed research report in the form of an article related to a practical problem must be submitted.		
Method of delivering:Full time		
Assessment methods: A written research article.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN622	**Semester 2**	**NQF-Level: 8**
Title: **Statistical Data-analysis II: Time Series**		
Module-outcomes: This module offers the student the opportunity to study stationary, non stationary as well as seasonal time series models, to identify specific models in practice and to apply inference techniques related to estimating relevant parameters and making forecasts. The implementation of software packages like R, SAS, STATISTICA and others to deal with		

time series analysis will be learned and applied.

Having completed the module the student will be able to use time series data in practical situations, to identify the presence of time dependent relations, to estimate relevant parameters and to do forecasting by using software packages such as R, SAS, STATISTICA or other applicable packages

Method of delivering: Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN623	**Semester 2**	**NQF-Level: 8**

Title: **Multivariate Statistics**

Module-outcomes:
The module supplies the student with a general theoretical background as well as practical abilities to gain knowledge on selected topics in multivariate statistics, such as inference of multivariate mean vectors, multivariate linear models, principal components, factor analysis, canonical correlation analysis, discriminant analysis, classification and cluster analysis. The application of programming packages such as R, SAS and STATISTICA in the above-mentioned cases will be studied.

Having completed the module, the student will be able to apply inference models on practical situations of selected topics in multivariate statistics, such as: the comparison of multivariate mean vectors, prediction and model fitting of multivariate linear models, determining principal components of complex populations, performing canonical correlation analysis, to differentiate and classify observations of different populations and to apply cluster analysis. Program packages such as R, SAS and STATISTICA are used.

Method of delivering:Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN624	**Semester 2**	**NQF-Level: 8**

Title: **Discrete Data-analysis**

Module-outcomes:
The purpose of this module is to provide the learner with the ability to do various types of inference associated with categorical data. Asymptotic methods, the O- and o-notations, convergence of stochastic sequences, convergence of movements and the δ-method for determining asymptotic distributions form part of the module. Methods for model identification, model fitting, and parameters estimation (for log-linear models, logistic and logit models) are also included. The use of SAS and R to do computations will also be studied.

Having completed the module, the learner will be able to handle basic categorical (or discrete) data, do inference using log-linear, logistic and logit models, apply model fitting criteria to do model selection, do parameter estimation for these models and make practical interpretations.

Method of delivering:Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Statistics and Operational Research	
Module code: STTN625	**Semester 2**	**NQF-Level: 8**
Title: **Stochastic Processes II**		
Module-outcomes: At the end of this module, the student will have gathered knowledge on specific continuous time stochastic processes such as Brownian motion, the Ornstein-Uhlenbeck process, geometric Brownian motion, and Levy processes. The learner's knowledge of Stochastic Calculus, based upon the Ito integral, will be developed and the student will be adept at using stochastic differential equations. The learner will be able to apply the gained knowledge in order to identify continuous time stochastic processes, to demonstrate their applications, and to make use of basic Stochastic Calculus		
Method of delivering:Full time		
Assessment methods: Class tests, assignments, and exam.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN626	**Semester 2**	**NQF-Level: 8**
Title: **Probability Theory**		
Module-outcomes: This module provides the student with knowledge concerning basic concepts of probability theory, including sigma-algebras, measure spaces and product spaces, as well as the following fundamental theorems of probability theory: the Borel-Cantelli theorem, the Central Limit Theorem, the monotone convergence theorem, Fubini's theorem, Kolmogorov consistency theorem, the Radon Nikodym theorem, and the law of large numbers. Upon completion of the module the student will have the necessary basic knowledge to tackle subsequent modules in advanced probability theory and to be able to do basic statistical research. The student will also be able to understand the basis of advanced stochastic processes with a view to dealing with (and doing researching on) advanced statistical, financial and other problems.		
Method of delivering:Full time		
Assessment methods: Class tests, assignments, and exam.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN627	**Semester 2**	**NQF-Level: 8**
Title: **Mathematical and Computer-intensive methods II**		
Module-outcomes: Upon completion of this module, students will be able to • have detailed knowledge of the fundamental aspects concerning the implementation of parallel computation in the R software package; • discuss classification and cluster analysis with special emphasis on the following methods: linear discrimination, classification trees, hierarchical cluster analysis, k-means cluster analysis and multidimensional scaling; • fully discuss cross validation and explain how it is used in model selection; • Apply validation methods in time series models. After successful completion of this module, students will have the necessary computer and		

statistical skills to apply the above principles and techniques in practical situations.

Method of delivering:Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Statistics and Operational Research**	
Module code: STTN628	**Semester 2**	**NQF-Level: 8**

Title: **Financial-driven Statistics II**

Module-outcomes:
Upon completion of this module the students should have knowledge and skills in the application of the principles, methods and theory to solve problems related to the following topics:

- Conditional Heteroskedastic models and, more specifically the ARCH, GARCH, I-GARCH, GARCH-M, exponential GARCH, CHARMA and stochastic volatilty models;
- various non-linear models and tests for non-linearity (both parametric and non-parametric);
- High frequency data analysis and its application to market data;
- extreme value theory and its application to share returns;
- Multivariate time series models.

After successful completion of this module, students will have the necessary mathematical and statistical skills to apply the above principles and techniques in practical situations, especially with regard to the analysis of market data.

Method of delivering:Full time

Assessment methods:
Class tests, assignments, and exam.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN612	**Semester 1**	**NQF-Level: 8**

Title: **Numerical Analysis I**

Module-outcomes:
Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:
Introduction to numerical analysis (mathematical preliminaries, error analysis, computer programming); solution of systems of linear and non-linear equations; interpolation and approximation; numerical differentiation and integration; numerical linear algebra (eigenvalues and eigenvectors).

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN613	**Semester 1**	**NQF-Level: 8**

Title: **Partial Differential Equations I**

Module-outcomes:
Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:
Second order partial differential equations, including the classification of equations, boundary, initial and eigenvalue problems, the questions of existence, uniqueness, stability, construction, separation of variables, divergence theorem and related results and

applications.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN614	**Semester 1**	**NQF-Level: 8**

Title: **Financial Mathematics Modelling I**

Module-outcomes:
At the end of this module the student should be able to demonstrate knowledge and insight to model and solve financial decision modelling problems using suitable mathematical methods and computer programmes:
principles of fixed income investments, interest rate theory, cash flows, bonds and annuities;
principles and methods to model and solve and analyse investment choices under uncertainty
mean variance analysis, optimal portfolio modelling, capital asset pricing model, factor modelling and the utility function framework.

Method of delivering: Full Time

Assesseringsmetodes:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group:**	
Module code: TGWN615	**Semester 1**	**NQF-Level: 8**

Title: **Modelling I**

Module-outcomes:
Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:
Dimensional analyses: Examples of models that are chosen based on the student's previous knowledge and future aims with regards to studies and research;
Modelling with systems (differential/linear) equations;
Introductory relationship between modelling and optimisation;
Using computer programming skills to solve practical phenomena.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN616	**Semester 1**	**NQF-Level: 8**

Title: **Control Theory I**

Module-outcomes:
Upon completion of this module, and taking into account prior learning, the student should be able to do the following:
Demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:

- Introduction to control theory and mechanical systems.

- Mathematical foundations (amongst other matrix theory and matrix solutions of linear differential equations);
- linear control systems;
- theory of stability;
- calculus of variations;
- optimal control;
- applications.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN617	**Semester 1**	**NQF-Level: 8**

Title: **Fluid Dynamics I**

Module-outcomes:
Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:

Euler and Lagrange coordinates, material derivatives and control volumes, Reynolds transport theorem. Conservation of mass, momentum and energy. Rotation and rate of shear. Constitutive equations. Viscosity coefficients. Navier-Stokes equations. Newtonian fluids. Boundary conditions.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN622	**Semester 2**	**NQF-Level: 8**

Title: **Numerical Analysis II**

Module-outcomes:
Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:

Introduction to numerical analysis (overview of TGWN612); numerical solution of ordinary differential equations (single and systems, initial and boundary conditions); partial differential equations.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: TGWN623	**Semester 2**	**NQF-Level: 8**
Title: **Partial Differential Equations II**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Distribution theory, including the space of testing functions, distributions, operations on distributions, convergence of a sequence of distributions, differentiation of distributions, regularization, distributions of slow descent, Fourier and Laplace transforms of distributions.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN624	**Semester 2**	**NQF-Level: 8**
Title: **Financial Mathematics Modelling II**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Modelling and construction of financial derivative securities; Stochastics modeling of security prices; Computational and numerical techniques to calculate derivative prices.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN625	**Semester2**	**NQF-Level: 8**
Title: **Modelling II**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: The estimation, interpretation and stabilisation of models, if necessary; The use of different simulation methods; Solving non-linear problems; Using computer programming to solve practical phenomena.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: TGWN626	**Semester 2**	**NQF-Level: 8**
Title: **Control Theory II**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Introduction to optimal control theory and mechanical systems. Mathematical foundations; a variety of applications (amongst others minimum time problems and minimum fuel problems); singular cases.		
Method of delivering: Full Time		
Assessment methods: Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN627	**Semester 2**	**NQF-Level: 8**
Title: **Fluid Dynamics II**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Flow lines, vorticity. Kelvin's theorem, Bernoulli and Crocco equations. Vorticity equation. Ideal fluids. Stream function, complex potential and complex velocity. Uniform flow. Source and sink flow. Cylinder flow with and without circulation. Blasius laws. Force and moment. Joukowski transformation. Different types of airfoils. Exact solution of Navier-Stokes equations for a few solvable problems.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN671	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Project**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: The estimation, interpretation and stabilisation of models, if necessary; The use of different simulation methods; Solving non-linear problems; Using computer programming to solve practical phenomena.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: WISK613	**Semester 1**	**NQF-Level: 8**
Title: **Topology of Metric and Normed Spaces**		
Module-outcomes: After succesful completion of this module, the student will be able to demonstrate fundamental knowledge of and skills in the methods, abstract proofs, application of fundamental theorems in proofs and further theoretic development with respect to the following topics: Metric spaces, which include topological concepts, completeness of metric spaces, examples of some classical complete and incomplete metric spaces and the completion of metric spaces; vector spaces and normed spaces, which include Banach spaces and examples of the same, Schauder bases, compactness in normed spaces and its role in the characterisation of finite dimensional normed spaces; linear and bounded linear operators on normed spaces, linear functionals and bounded linear functionals and the algebraic dual space of a vector spaces and the concept algebraic reflexive space; spaces of bounded linear operators on normed spaces, which include (continuous) dual spaces of of normed spaces, some examples of dual spaces and the characterisation of dual spaces of classical normed spaces.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISK615	**Semester 1**	**NQF-Level: 8**
Title: **Differential Equations**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Differential equations: analytical and numerical solutions; Introduction to partial differential equations: analytical and numerical solutions; Derivation of the Black-Scholes equation as a partial differential equations and solving of this equation using a PDE numerical solution.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN612	**Semester 1**	**NQF-Level: 8**
Title: **Abstract Algebra I**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Groups – Sylow theorems, classification of finite groups; Rings – Prime and maximal ideals, unique factorisation domains, Noetherian rings; Fields – Field extensions, applications to geometrical constructions. Galois theory.		
Method of delivering: Full Time		
Assessment methods:Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: WISN613	**Semester 1**	**NQF-Level: 8**
Title: **Complex Function Theory**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: Möbius transformations; Montel's theorem; Riemann mapping theorem; infinite products of analytic functions; approximation of analytic functions; analytic continuation; harmonic functions; entire functions of finite order; the range of analytic functions.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN614	**Semester 1**	**NQF-Level: 8**
Title: **Measure and Integration Theory I**		
Module-outcomes: Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics: sigma-algebras, measurable spaces, Borel sets, measurable functions, Borel functions, monotone classes of functions, measure theory, image of a measure, integration theory, properties of the integral, monotone convergence theorem, Fatou's lemma, Lebesgue's dominated convergence theorem, comparison of the Lebesgue- and Riemann-integrals, evaluation of Lebesgue integrals, continuity and differentiability of functions defined by Lebesgue integrals.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN615	**Semester 1**	**NQF-Level: 8**
Title: **Functional Analysis I**		
Module-outcomes: After completion of this module students should, taking into account preceding studies, be able to demonstrate fundamental knowledge of, and skill in the underlying principles, the methods, the use and application of the theory, pertaining to the following subjects: Metric spaces: Introduction to metric spaces; some classical examples; topological concepts; convergence of sequences; Cauchy sequences and completeness of metric spaces; examples of important complete and incomplete metric spaces. Vector spaces and normed spaces: convergence of sequences and series in normed spaces; Schauder bases; finite dimensional normed spaces; compactness in normed spaces and its role in the characterisation of finite dimensional normed spaces. Linear and bounded linear operators on normed spaces; linear functionals and bounded linear functionals and the algebraic dual space of a vector space; the concept of algebraically reflexive space; the algebraic reflexivity of finite dimensional spaces. Spaces of bounded linear operators on normed spaces; dual spaces of normed spaces; some examples of dual spaces of well known normed spaces. The Hahn-Banach theorem for the extension of linear functionals and some applications;		

adjoint operators on dual spaces; reflexive Banach spaces; the Uniform Boundedness Theorem and some applications; weak and strong convergence of sequences in normed spaces; the Open Mapping Theorem and the Closed Graph Theorem and some applications.

Method of delivering: Full Time

Assessment methods:

Formative assessment: Homework assignments, a project and/or class tests, semester test(s).

Summative assessment: Examination of 3 hours in which the achievement of the outcomes of the module by means of practical, theoretical and insight questions are assessed.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN616	**Semester 1**	**NQF-Level: 8**

Title: **Fundamentals of Mathematics**

Module-outcomes:
After completion of this module students should, taking into account preceding studies, be able to demonstrate fundamental knowledge of, and skill in the underlying principles, the methods, the use and application of the theory, pertaining to the following subjects:

Axioms of set theory (ZFC), consequences of the axiom of choice, operations on sets, cardinal and ordinal numbers,

A selection of topics based on the following: Boolean algebras, the development of the natural and the real number systems, the Schröder-Bernstein theorem, well-orderings, cardinal and ordinal arithmetic.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Vakgroep: Mathematics and Applied Mathematics**	
Module code: WISN622	**Semester 2**	**NQF-Level: 8**

Title: **Abstract Algebra II**

Module-outcomes:
Upon completion of this module, the student should be able to demonstrate knowledge and skills in applying the underlying fundamental principles, methods and applicable theory to solve problems regarding selected aspects of the following topics:
Rings – Radicals,chain conditions.
Modules over rings – Basic definitions and properties, free modules, exact sequences, simple and semisimple modules, Hom, projective and injective modules, flat modules, purity.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: WISN623	**Semester 2**	**NQF-Level: 8**
Title: **Fourier/Harmonic Analysis**		
Module-outcomes: After completion of this module students should, taking into account preceding studies, be able to demonstrate fundamental knowledge of, and skill in the underlying principles, the methods, the use and application of the theory, pertaining to the following subjects: Fourier Series on the circle group, convergence of Fourier series, the (harmonic) conjugate function, Hardy spaces.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN624	**Semester 2**	**NQF-Level: 8**
Title: **Measure and Integration Theory II**		
Module-outcomes: Upon completion of this module, students should be able to demonstrate fundamental knowledge of, and skill in the underlying principles, the methods, the use and application of the theory, pertaining to the following subjects: theorems of Fubini and Radon-Nikodym, extension of measures and Caratheodory's theorem, Lebesgue-Stieltjes integrals, function spaces, types of convergence, uniform integrability.		
Method of delivering: Full Time		
Assessment methods: Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN625	**Semester 2**	**NQF-Level: 8**
Title: **Functional Analysis II**		
Module-outcomes: After completion of this module students should, taking into account preceding studies, be able to demonstrate fundamental knowledge of, and skill in the underlying principles, the methods, the use and application of the theory, pertaining to the following subjects: Inner product spaces and Hilbert spaces; orthonormality; orthogonal complements and direct sums; complementary subspaces in Hilbert spaces and orthogonal projections; orthonormal sequences; Bessel's inequality. The Riesz Theorems for bounded linear functionals and bounded sesquilinear functionals on Hilbert spaces: The characterisation of bounded linear functionals, as well as bounded sesquilinear functionals on Hilbert spaces in terms of the inner products on the Hilbert spaces; the Hilbert adjoint of a bounded linear operator on inner product spaces; introductory study of self adjoint operators. Spectral theory of bounded linear operators on normed spaces; spectral theory and the spectral representation of bounded self-adjoint operators on Hilbert spaces. If time permits, additional topics can be discussed, in dialogue with the participating students.		
Method of delivering: Full Time		

Assessment methods:

Formative assessment: Homework assignments, a project and/or class tests, semester test(s).

Summative assessment: Examination of 3 hours in which the achievement of the outcomes of the module by means of practical, theoretical and insight questions.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN626	**Semester 2**	**NQF-Level: 8**

Title: **Evolution of Mathematical Ideas**

Module-outcomes:
Upon completion of this module the student should be able to do the following:
Introduction to the history of mathematics; knowledge of the history of mathematics with emphasis on matters like important persons and viewpoints, development of ideas, application of methods and solution of problems according to the knowledge of that era.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN627	**Semester 2**	**NQF-Level: 8**

Title: **Matrix Analysis**

Module-outcomes:
After completion of this module, the students should have

- knowledge on different classes of matrices and applications on matrix functions and canonical forms. The students also need to demonstrate skills in the applications of matrix theory. Subjects includes the following:
- Basic properties of the eigenvalue problem;
  Diagonalizing through similarity transformation;
  Canonical forms for example the Jordan form;
- Matrix polynomials and functions of (diagonalizable) matrices;
- Matrix norms;
- Systems of differential equations and matrices;
  Special classes of matrices;
- Differential equations and limits.

Method of delivering: Full Time

Assessment methods:
Formative assessment in the form of class tests and assignments and summative assessment in the form of an examination paper.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN628	**Semester 2**	**NQF-Level: 8**

Title: **Topology**

Module-outcomes:
After completion of this module students should, taking into account preceding studies, be able to demonstrate fundamental knowledge of, and skill in the underlying principles, the methods, the use and application of the theory, pertaining to the following subjects:

basic topological concepts, continuity, compactness, nets and the inadequacy of sequences, product spaces and Tychonoff's theorem, normal sets and Urysohn' lemma, nets and filters, separation axioms and regularity, compactness (revisited), local en para-compactness,

compactifications, metrisability, connectedness.
Method of delivering: Full Time
Assessment methods: Formative assessment: Homework assignments, a project and/or class tests, semester test(s). Summative assessment: Examination of 3 hours in which the achievement of the outcomes of the module by means of practical, theoretical and insight questions

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN671	**Semester 1 & 2**	**NQF-Level: 8**

Title: **Project**

Module-outcomes:
At completion of this module the student should:

- have mastered introductory research methods in the subject;
- be able to read and understand literature in a mathematical journal;
- be able to handle references and sourcing;
- be able to perform scientific literature searches;
- be able to apply knowledge and skill from different subdisciplines in an integrated fashion in the solution of mathematical problems;
- be able to communicate the subject content orally and in written form (in appropriate scientific language and appropriate programmes);
- be able to work together in a team on a subject."

Method of delivering: Full Time

Assessment methods:
Dissertation and oral presentation

N.29.2 MASTERS

Unit/Centre/Focus Area: Centre for Human Metabolomics		
Module code: BCHN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation (Biochemistry)**		
Module-outcomes: **Knowledge**: Upon completion of this module, the student should have sufficient knowledge of the relevant scientific literature and be able to plan and conduct advanced empirical scientific research. **Skills**: Upon completion of this module students will be able to • Formulate a scientific question • Design project-oriented experiments; • Singlehandedly perform experiments using advanced analytical procedures; • Present and interpret results of experiments in a scientific manner; • Write a dissertation; • Explore current and emerging trends a field of research. **Values:** At the end of this course students will be able to identify ethical issues in biological research (theory and applications) and communicate their own point of view as well as those of the scientific, medical and general community. Furthermore, students will have developed a skills pertaining to using advanced analytical apparatus, experimentation, and higher interpretive thinking and scientific writing.		
Method of delivering:		
Assessment methods: Final module assessment: Dissertation (100%)		
Unit/Centre/Focus Area: Centre for Human Metabolomics		
Module code: BCHN877	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced Biochemistry**		
Module-outcomes: **Knowledge**: Upon completion of this module, the student should have sufficient knowledge of the relevant scientific literature and be able to plan and conduct advanced empirical scientific research. **Skills**: Upon completion of this module students will be able to • Formulate a scientific question • Design project-oriented experiments; • Singlehandedly perform experiments using advanced analytical procedures; • Present and interpret results of experiments in a scientific manner; • Write a dissertation; • Explore current and emerging trends a field of research. **Values:** At the end of this course students will be able to identify ethical issues in biological research (theory and applications) and communicate their own point of view as well as those of the scientific, medical and general community. Furthermore, students will have developed a skills pertaining to using advanced analytical apparatus, experimentation, and higher interpretive thinking and scientific writing.		
Method of delivering:		
Assessment methods: Final module assessment: Oral presentation (25%) Dissertation (75%)		

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIA811	**Semester 1**	**NQF-Level: 9**
Title: **Enterprise-wide Risk Management**		
Module-outcomes: Objectives On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of: (i)the ERM Concept and Framework. (ii)the ERM Process. (iii)Risk Categories and Classification. (iv)Risk Modelling and Aggregation of Risks. (v)Risk Measurement and Assessment. (vi)Risk Management Tools and Techniques. (vii)Economic Capital. The student will also as an individual or as a member of a group demonstrate the ability to: (a)identify, analyse and deal with complex and/or real world problems and issues drawing systematically and creatively on the theory, research methods and literature (b)use advanced information retrieval and processing skills (c)perform a critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data (d)undertake a study of the literature and current research (e)effectively present and communicate the results to specialist and non-specialist audiences using the resources of an academic/professional discourse through integrated assessment of objectives (i) to (vii) in the form of project(s).		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIA812	**Semester 1**	**NQF-Level: 9**
Title: **Enterprise-Wide Risk Management I**		
Module-outcomes: outcomes: On completion of the module, the student should be able to demonstrate: • After the completion of this module, the learner should be able to demonstrate integrated knowledge of the theories, methods and techniques in the field of Enterprise Risk Management. • The learner should be able to demonstrate the ability to interrogate multiple sources of knowledge in the modelling of financial and non-financial risks. • Demonstrate an understanding of risk classification and risk measurement concepts and techniques. • Demonstrate the ability to use statistical methods and techniques (e.g. univariate and multivariate distributions, correlations, time series, etc.) to analyse risk concepts (e.g. market risk, credit risk, operational risk and underwriting risk). • Demonstrate the ability to critically evaluate financial risk management problems in financial institutions and provide solutions to these problems. • Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications. • Demonstrate the ability to apply and implement risk models in software packages (e.g SAS/IML and MS Excel). • Demonstrate the ability to take full responsibility for his or her own work in practical assignments		
Method of delivering:		

Assessment methods: Students have mastered the outcomes if they are able to:

- Implement his/her specialist knowledge to analyse and evaluate financial and non-financial risks.
- Explain the modelling and management of financial and non-financial risks in financial institutions.
- Develop / propose an integrated risk measurement framework by applying statistical methods and techniques.
- Explain the concepts of risk classification and analyse and criticize risk measurement concepts in financial risk management.
- Show an awareness of how individual risks might be categorised in different ways.
- Describe the properties and limitations of common risk measures.
- Recommend a specific choice of model based on the results of both quantitative and qualitative analysis of financial or insurance data.
- Analyse quantitative data by applying statistical methods (e.g. univariate and multivariate distributions, correlations, time series, etc.)
- Analyse and implement financial risk models in software packages (e.g SAS/IML and MS Excel).
- Present information in a professional and ethical sound manner
- Develop, optimise and take responsibility for own learning needs, able to track own learning progress and apply, evaluate and reflect on relevant learning strategies, management of all resources to successfully realise all outcomes of the module
- Take responsibility to co-operate effectively as a member of a group to ensure that task outcomes are met.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIA821	**Semester 2**	**NQF-Level: 9**

Title: **Enterprise-wide Risk Management II**

Module-outcomes:

- On completion of the module, the student should be able to demonstrate:
- Integrated knowledge of the main areas of enterprisewide risk management and critical understanding of the approaches to monitor, measure and manage risk effectively on a integrated and holistic manner.
- The ability to formulate, justify and present plausible and appropriate solutions to business problems
- The ability to behave professionally in a commercial environment and to take relevant factors and issues into account in the formulation of solutions for enterprisewide risk management.
- The ability to apply professional integrity, conduct and responsibility required by the actuarial profession.
- Demonstrate the ability to learn independently and as part of a group. Manage time, work to deadlines and prioritise workloads

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Identify and assess the different risks an enterprise if exposed to, and propose and evaluate efficient risk management stategies.
- Demonstrate an understanding of risk management (including regulatory) frameworks and regimes that promote and guide the use of risk management.
- Demonstrate an understanding of economic measures of value and their uses in corporate decision making.

- Demonstrate an understanding of capital allocation tachniques and the role of risk measures Present reasoned arguments, both in technical and non-technical language.
- Identify relevant stakeholders and demonstrate the relevance of risk measurement and management to all stakeholders.
- Present information in a professional and ethically sound manner.
- Develop, optimise and take responsibility for own learning needs, able to track own learning progress and apply, evaluate and reflect on relevant learning strategies, management of all resources to successfully realise all outcomes of the module
- Take responsibility to co-operate effectively as a member of a group to ensure that task outcomes are met.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIB818	**Semester 1**	**NQF-Level: 9**

Title: **Business Intelligence**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Business Intelligence, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to design, create, retrieve, and present results from a variety of data structures in order to effectively support business decision-making.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable..

Method of delivering: Full time (Contact)

Assessment methods:
Students have mastered the outcomes if they are able to:

- Describe, compare, combine, apply, and critically examine a range of Business Intelligence (BI) principles and practices (e.g. BI framework, architecture, technology trends, operational and decision support data, database fundamentals, dimensional modelling), and the techniques associated with these concepts.
- Develop various data models from business rules and from other types of data models
- Use the designated software packages to construct diverse data structures, query the data, and develop reports from the retrieved data.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Business Intelligence.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all operations.

- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIB821	**Semester 2**	**NQF-Level: 9**

Title: **Data Mining Techniques**

Module-outcomes:
After completion of module BWIB821 the student should to demonstrate:

- Advanced and integrated knowledge and critical understanding with regards to data mining principals and models.
- Specialised knowledge with regard to the use of data preparation in the field of data mining.
- An ability to appropriately deal with the principles and best practices of data mining in scenarios.
- An ability to conceptually design and develop data mining models to solve problems in the field of data mining.
- Plan and conduct research according to standard protocol and employ appropriate protocols, conventions, processes, procedures and techniques to solve problems in the field of data mining.
- Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications to lay and professional audiences.

Method of delivering:

Assessment methods:
The student has reached the outcome if he/she has the ability to:

- Analyse and critically evaluate the development of data mining models (e.g. cluster analysis, decision tress, regression models, neural networks).
- Describe, compare, combine, apply and critically examine a range of data preparation techniques (e.g transform raw data into a suitable form, extract appropriate data, transform data, incorporate non-numeric data,) (in the field of data mining techniques).
- Critically evaluate the current principles and best practices of data mining in specific scenarios.
- Demonstrate the ability to apply and implement data mining models in software packages (e.g. SAS Enterprise Miner) on real world datasets.
- Develop data mining models using the applicable data preparation techniques.
- Construct and write a technical report that contains the results of a research study to solve problems in the broad field of data mining.
- Present information in a professional and ethically sound manner.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIB822	**Semester 2**	**NQF-Level:9**

Title: **Contemporary Issues in Business Analytics**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Analytical Customer Relationship Management (ACRM), to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the effectiveness of a range of appropriate ACRM methods in maximising the lifetime value of an organization's customers.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable.

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Describe, compare, combine, apply, and critically examine a range of supervised and unsupervised statistical models, optimisation models, and the techniques associated with these concepts.
- Identify the analytical methods that can appropriately address particular business questions in the field of CRM, select the most suitable method(s), use the designated software packages to apply the selected technique(s) to data, and critically assess and interpret the results.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of ACRM.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on theoretical principles and real-world problems.
- Act professionally, e.g. hand in assignments on time and be punctual in all operations.
- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different seminars relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIB823	**Semester 2**	**NQF-Level: 9**

Title: **Multiple Criteria Decision Making**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and critical understanding with regard to the field of Multiple Criteria Decision Making, to enable engagement with and critical evaluation of various principles and techniques relevant to this field.
- The ability to identify, select, apply, interpret, and critically judge the appropriateness of a range of mathematical programming formulations in solving complex optimisation problems relevant in finance.
- The ability to identify and critically evaluate the ethical/professional conduct of himself/herself and others in different cultural/social/professional environments, and to effect the appropriate change in such conduct

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Describe, formulate, apply, and critically examine a range of financial optimisation models, its assessment and selection, and the solution techniques associated with these models.
- Use the designated software package to capture the mathematical models associated with a specific problem, apply suitable optimisation algorithms to find solutions, and select the most effective course of action based on a critical assessment of the results.
- Work independently and be well prepared for all seminars. Contribute to discussions during seminars and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Multiple Criteria Decision Making.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIN811	**Semester 1**	**NQF-Level: 9**

Title: **Practical Risk Management SAS RD**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- After the completion of this module, the learner should be able to demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of risk analysis.
- Identify methods of configuring SAS Risk Dimensions.
- Understand the usage of SAS functions and subroutines. Understand the use of projects within a Risk Dimensions environment.
- Demonstrate the ability to critically evaluate financial risk management problems in financial institutions and provide solutions to these problems.
- Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications.
- Demonstrate the ability to apply and implement risk models in SAS Risk Dimensions.
- Demonstrate the ability to take full responsibility for his or her own work in practical assignments

Method of delivering:

Assessment methods: Students have mastered the outcomes if they are able to:

- Implement his/her specialist knowledge to analyse and evaluate financial risk.
- Explain the modelling and management of financial risk in financial institutions.
- Develop / propose an integrated risk measurement framework in SAS Risk Dimensions
- Define basic terms used in risk analysis
- Identify methods of configuring Risk Dimensions
- Understand the usage of SAS functions and subroutines.
- Understand the use of projects within a Risk Dimensions environment
- Create a risk analysis environment, of limited scope, in the SAS Institute's risk management solution, SAS Risk Dimensions.
- Present information in a professional and ethical sound manner
- Develop, optimise and take responsibility for own learning needs, able to track own learning progress and apply, evaluate and reflect on relevant learning strategies, management of all resources to successfully realise all outcomes of the module
- Take responsibility to co-operate effectively as a member of a group to ensure that task outcomes are met

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIN812	**Semester 1**	**NQF-Level: 9**

Title: **Pricing of Derivatives B**

Module-outcomes:

- Critical understanding and knowledge of interest rate derivative pricing models; and integrated knowledge of discrete-time and continuous-time interest rate models. Integrated knowledge of multifactor interest rate models. Strong backgrounds in Pricing of Derivatives A and numerical methods are recommended
- The ability to formulate and apply short rates and forward rate models.
- The ability to construct the LIBOR market and the Swap market models.
- The ability to plan and conduct research according to standard protocol and to employ appropriate processes, procedures and techniques.
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.
- The ability to take full responsibility his/her work, decisions, and use of resources, as well as full accountability for the actions and decisions of others where applicable.

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Describe, compare, combine, apply, and critically investigate, through a research project, a range of interest rate derivative pricing models, its assessment and selection, and the techniques associated with contiguous claims.
- Use MatLab to implement basic numerical procedures to price interest rate derivative instruments in continuous time.
- Work independently and be well prepared for all seminars.
- Contribute to discussions during lectures and demonstrate knowledge of the relevant concepts and methods in various forms of assessment, by providing insight into – and solutions to – problems/questions with the correct use of terminology appropriate to the field of Interest Rate Theory.
- Demonstrate that he/she can successfully complete a research project independently and individually apply the knowledge and skills – that were gained by means of the class discussions and literature study – on theoretical principles and real-world problems.

- Act professionally, e.g. hand in a research project on time and be punctual in all operations.
- Present information in a professional and ethically sound manner.
- Critically evaluate and consider the ethical implications of decisions in appropriate contexts.
- Continuously reflect on how the different lectures relate to each other by integrating applicable knowledge, skills and values from different sub-modules in the problem solving process.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN813	**Semester 1**	**NQF-Level: 9**

Title: **Practical Data Mining**

Module-outcomes:
At the end of this module the student should be able to explore and analyse data sets with the techniques studied in this module. Furthermore, the student must be able to make future predictions based on the patters occurring in historical data.
Knowledge: At the end of the course students will have acquired knowledge and insight about the application of data mining concepts in a practical context.
Module-outcomes:
Skills: After successful completion of the course students will be able to independently and by using the Enterprise Miner system of SAS, apply data mining techniques on data sets from the industry.

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN815	**Semester 1**	**NQF-Level: 9**

Title: **Industry Integration Project**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and understanding of practical project management including the formulation of the user requirement, the planning, scheduling and costing of the project, the determination of a base line, the execution and monitoring of the project, documentation and the presentation of the results.
- The the ability to identify, formulate and solve business/ decision making problems using appropriate qualitative and quantitative tools
- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.
- The ability to contribute and learn cooperatively in groups within various roles and learn on his/her own initiative, by applying learning strategies in a critical manner to effectively address the professional and ongoing needs of himself/herself and others.

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Formulate, plan, schedule and cost a practical business management problem.
- Demonstrate technical writing skills through writing a project proposal document
- Demonstrate oral communication skills by presentations during the formal project meeting (Business Case, Project Proposal, Project Review, Project Close-out)
- Demonstrate the ability to manage a project from conception to execution, by conducting a real-world project, monitored on a hands-on way.

- Ability to effectively manage meetings through tools such as meeting agendas, minutes and meeting document packs.
- Demonstrate that he/she can successfully complete group assignments, solve or deal with issues related to diversity in groups, and individually apply the knowledge and skills – that were gained by means of the group discussions and assignments – on real-world problems.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIN816	**Semester 1**	**NQF-Level: 9**

Title: **Modern Portfolio Theory**

Module-outcomes:
On completion of the module, the student should be able to demonstrate:

- Advanced and integrated knowledge and understanding of the principles of investment management, including risk control techniques
- The ability to apply the principles of risk management and control to the appraisal, selection
- and management of investments.
- The ability to communicate effectively, orally and in writing and to make use of appropriate technologies in all communications to lay and professional audiences.
- The ability to take full responsibility of his/her own work and practices.

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Discuss and develop portfolio investment strategies working individually or in groups
- Think independently and solve complex portfolio choice problems, select assets and
- manage portfolios.
- Analyse and critically evaluate the performance of an investment manager.
- Make persuasive case reports and business solutions to investment professionals.
- Develop solutions to corporate, risk and investment management problems
- Present information in a professional and ethically sound manner;
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIN817	**Semester 1**	**NQF-Level: 9**

Title: **Retail Credit Risk**

Module-outcomes:
After completion of module BWIN817 the student should to demonstrate:

- Advanced and integrated knowledge and critical understanding with regard to the development of predictive models (i.e. scorecards) in the field of retail credit risk.
- Specialised knowledge with regard to the use of logistic regression in the field of retail credit risk.
- An ability to appropriately deal with the principles and practice of consumer credit risk management in scenarios and cases.
- An ability to conceptually design and develop scorecards to solve problems in the field of retail credit risk.
- Plan and conduct research according to standard protocol and employ appropriate protocols, conventions, processes, procedures and techniques to solve problems in the field of credit risk.
- Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications to lay and professional audiences.
- Demonstrate the ability to take full responsibility of his/her own work and practices.

Method of delivering:

Assessment methods:

The student has reached the outcome if he/she has the ability to:

- Analyse and critically evaluate the development of predictive models.
- Develop logistic regression models correctly to address the problems identified in the field of retail credit risk.
- Critique the current principles and practice of consumer credit risk management in a specific scenarios.
- Develop (build) scorecards using the applicable statistical modelling technique and implement it in the applicable software package.
- Construct and write a technical report that contains the results of a research study to solve problems in the broad field of retail credit risk.
- Present information in a professional and ethically sound manner.
- Track own learning progress and manage all resources successfully to realise all outcomes of the module.

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIN818	**Semester 1**	**NQF-Level: 9**

Title: **Topical Research issues in Risk Analysis**

Module-outcomes:

Knowledge: At the end of this course, students should have knowledge and insight into the most recent research trends and technological breakthroughs in the area of financial risk management. Aspects that will be studied include: market risk, credit risk, liquidity risk, operational risk and model risk. The important problem of the allocation of risk capital for financial institutions will also be studied. The relationship between financial risk and insurance risk will be analysed.

Skills: Students should be able to have the skills necessary to critically evaluate cutting edge risk issues and research breakthroughs for possible practical application.

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for BMI

Module code: BWIR826	**Semester 2**	**NQF-Level:9**

Title: **Industry directed research project**

Module-outcomes:

On completion of the module, the student should be able to demonstrate:

- Integrated knowledge and understanding of practical project management including the formulation of the user requirement, the planning, scheduling and costing of the project, the determination of a base line, the execution and monitoring of the project, documentation and the presentation of the results.

- The the ability to identify, formulate and solve business/ decision making problems using appropriate qualitative and quantitative tools.

- The ability to effectively present and communicate, orally and in writing, relevant academic and professional information – including creative insight, rigorous interpretations, and solutions to problems – to a range of audiences with the use of appropriate technologies.

- The ability to operate independently and take full responsibility for his or her own work, and, where appropriate, to account for leading and initiating processes and implementing systems, ensuring good resource management and governance practices.

Method of delivering:

Assessment methods:
Students have mastered the outcomes if they are able to:

- Formulate, plan, schedule and cost a industry directed research problem.
- Demonstrate technical writing skills through writing a project proposal document
- Demonstrate oral communication skills by presentations during the formal project meeting (Business Case, Project Proposal, Project Review, Project Close-out)
- Demonstrate the ability to individually manage a project from conception to execution, by conducting a real-world industry project, monitored on a hands-on way
- Ability to effectively manage meetings through tools such as meeting agendas, minutes and meeting document packs.
- Demonstrate high levels of autonomy and initiative in research and professional activities.
- Take responsibility for his/her own work.

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: CHEM871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		

Module-outcomes:
1. Specialist knowledge and understanding to engage with and critique research and practices within the field of Atmospheric Chemistry; and to contribute to disciplined thinking about relevant matters with particular reference to their area(s) of specialisation.
2. The ability to evaluate current processes of knowledge production in the field of Atmospheric Chemistry and to choose appropriate processes of enquiry for the area of specialisation.
3. A command of relevant methods and procedures required to solve practical and theoretical problems in the field of Atmospheric Chemistry.
4. The ability to address complex and challenging problems in a specialised field of Atmospheric Chemistry and to understand and contextualise their findings.
5. Demonstrate the ability to make ethical decisions which affect knowledge production, or complex organisational or professional issues. Critically contribute to the development of ethical standards specifically in atmospheric chemistry studies.
6. Demonstrate the ability to access, process and manage information and to communicate their findings in academically appropriate ways.
7. An understanding of the context of their research and associated consequences thereof to influence the field of Atmospheric Chemistry.
8. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility

Method of delivering: Full-time or part-time

Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners

Unit/Centre/Focus Area: Chemical Resource Beneficiation		
Module code: CHEN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: Upon completion of this module the student should demonstrate profound knowledge of and be familiar with the development of new knowledge and skills in one of the following research fields: Chromium Technology, Catalysis and Synthesis, Membrane Technology, Electrochemistry for Energy and Environment, and Coal Chemistry, and to demonstrate systematic knowledge of the specific research methodology of this field(s), that include: • the identification and scientific formulation of a problem statement; • a thorough investigation of existing knowledge as reflected by the applicable literature; • a critical analysis of existing knowledge in the field; • the execution of applicable research to solve the problem; • the scientific evaluation of the results in context with the problem statement; the scientific communication of the results in the form of a dissertation.		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners		
Unit/Centre/Focus Area: Chemical Resource Beneficiation		
Module code: CHEN874	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced Chemistry**		
Module-outcomes: At the end of the module the student should, in one of the following research fields: Chromium Technology, Catalysis and Synthesis, Membrane Technology, Electrochemistry for Energy and Environment, and Coal Chemistry, • demonstrate knowledge of fundamental concepts of a topic(s) of interest; • show extensive and systematic knowledge of a topic(s) of interest; • analyse, evaluate and solve abstract and unfamiliar related industrial problems and to communicate, individually or in groups, these solutions in a responsible manner both orally and in writing in a prescribed format.		
Method of delivering: Full-time or part-time		
Assessment methods: Assignment(s) and/or oral examination(s) and/or written examination(s).		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: DRKN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: 1. Plan, and execute new or existing research initiatives, and to create and present new knowledge and questions, based on demonstrated, integrated, and contextualised knowledge of the relevant scientific literature. 2. Contribute towards scholarly debate concerning the practice and possible implementation of the new knowledge generated. 3. Apply existing methods towards new research questions in original, creative and innovative ways to address the chosen research topic. 4. Apply and/or develop problem solving skills by using knowledge, advice, and theory in reflexive ways to address any practical and/or interpretive situations foreseen or that may arise during the study. 5. Apply all relevant ethical requirements as set out by the relevant ethical committees,		

procedures, and regulations
6. Collect, process, analyse, and interpret new data, findings, and information in the context of existing knowledge.
7. Produce and communicate new data, findings, analyses, and insights as presentable and potentially publishable work
8. Be held accountable for scientific integrity.

Method of delivering: Full-time or part-time

Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners

Unit/Centre/Focus Area: Environmental Sciences and Management

Module code: DRRS871	**Semester 1 & 2**	**NQF-Level: 9**

Title: Dissertation

Module-outcomes:
1. Specialist knowledge and understanding to engage with and critique disaster risk science multidiciplinary research and practices within the field of disaster risk studies; and to contribute to disciplined thinking about relevant matters with particular reference to their area(s) of specialisation.
2. The ability to evaluate current processes of knowledge production in the area of disaster risk studies and to choose appropriate processes of enquiry for the area of disaster risk studies.
3. The ability to use a wide range of specialised skills and relevant methods in identifying, conceptualising, designing and implementing methods of enquiry to address complex and challenfging disaster risk problems.
4. Demonstrate the ability to make autonomous ethical decisions which affect knowledge production, or complex organisational or professional issues, an ability to critically contribute to the development of ethical standards specifically in disaster risk studies.
5. Demonstrate the ability to access, process and manage resources of academic/ professional/ or occupational discourses to communicate and defend substantial ideas that are the products of their findings in academically appropriate ways in an area of specialisastion.
6. Demonstrate the ability to use a wide range of advanced and specialised skills and discources appropriate to disaster risk studies, to communicate to a multidisciplinary environment with different levels of knowledge or expertise.
7. Provide an understanding of the context of their research and associated consequences thereof to influence the field of Disaster Risk Studies.
8. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.

Method of delivering: Full-time or part-time

Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners

Unit/Centre/Focus Area: Environmental Sciences and Management

Module code: ECOM871	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:
1. Specialist knowledge and understanding to engage with and critique research and practices within the field of Agricultural Economics; and to contribute to disciplined thinking about relevant matters with particular reference to their area(s) of specialisation; increases knowledge of a specific field within the discipline concerned.
2. The ability to evaluate current processes of knowledge production in the field of Agricultural Economics and to choose appropriate processes of enquiry for the area of specialisation; The ability to evaluate, plan and execute a research programme in the field of Agricultural Economics.
3. A command of relevant methods and procedures required to solve practical and theoretical problems in the field of Agricultural Economics; The ability to choose appropriate methods of analysis for the area of specialisation.

4. The ability to address complex and challenging problems in a specialised field of Agricultural Economics and to understand and contextualise their finding; 5. Demonstrate the ability to access, process and manage information and to communicate their findings in academically appropriate ways; To collect and interpret research results and writing of scientific papers; To conduct independent research and communicate research results effectively. 6. An understanding of the context of their research and associated consequences thereof to influence the field of Agricultural Economics 7. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB874	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Plasma Physics**		
Module-outcomes: After completion of this module the student should have advanced knowledge of plasmas relevant for space science		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB875	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Magnetohydrodynamics**		
Module-outcomes: After completion of this module the student should have advanced knowledge of Magnetohydrodynamics relevant for Space Physics.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB877	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Cataclysmic variables**		
Module-outcomes: After completion of this module the student should have advanced knowledge of Cataclysmic Variable Stars, including the Novae.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB878	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Extragalactic astronomy**		
Module-outcomes: After completion of this module the student should have advanced knowledge of Extragalactic Astronomy.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, project.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB879	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced General Relativity**		
Module-outcomes: After completion of this module the student should have advanced knowledge of General Relativity.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		

Unit/Centre/Focus Area: Space Research		
Module code: FSKB880	**Semester 1 & 2**	**NQF-Level: 9**
Title: **High Energy Astrophysics and Pulsars**		
Module-outcomes: After completion of this module the student should have advanced knowledge of high-energy Astrophysics, neutron stars and pulsars.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB882	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Stellar structure and -evolution**		
Module-outcomes: After completion of this module the student should have advanced knowledge of stellar structure and evolution.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB885	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Geomagnetism and Aeronomy**		
Module-outcomes: After completion of this module the student should have advanced knowledge of Geomagnetism and aspects of the Earth's upper atmosphere.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB886	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Computational Astrophysics**		
Module-outcomes: After completion of this module the student should have advanced knowledge of computational techniques in modern Astrophysics.		
Method of delivering: Contact		
Assessment methods: Homework assignments, class participation, tests, projects.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB887	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Radio Interferometry**		
Module-outcomes: After completion of this module the student should have advanced knowledge of radio interferometry.		
Method of delivering: Contact		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB888	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Time Series and Data Analysis**		
Module outcomes: After completion of this module the student should have advanced knowledge of time series and data analysis.		
Method of delivery: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		

Unit/Centre/Focus Area: Space Research		
Module code: FSKB889	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Space Weather**		
Module outcomes: After completion of this module the student should have advanced knowledge of the drivers of- and the effects on the space environment affecting mankind and its modern technological necessities.		
Method of delivery: Contact		
Assessment methods: Homework assignments, class participation, tests, final examination.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB890	**Semester 1 & 2**	**NQF-Level: 9**
Title**: Observational Cosmology**		
Module outcomes: After completion of this module the student should have advanced knowledge of Observational Cosmology and the testing of theoretical models of the early and late universe.		
Method of delivery: Contact		
Assessment methods: Homework assignments, class participation, tests, project.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKB891	**Semester 1 & 2**	**NQF-Level: 9**
Title: Theoretical Cosmology		
Module outcomes: After completion of this module the student should have advanced knowledge of the theory of modern Cosmology.		
Method of delivery: Contact		
Assessment methods: Homework assignments, class participation, tests, project.		
Unit/Centre/Focus Area: Space Research		
Module code: FSKM811	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Astrophysics I**		
Module outcomes: Upon completion of this module, students should have high-level knowledge regarding various high-energy astrophysics topics, including: - multi-wavelength and multi-messenger astronomy; - relevant astrophysical radiation mechanisms and radiative transfer; - the physics of shocks; - supernovae, gamma-ray bursts, and supernova remnants; - compact objects (white dwarfs, neutron stars, and black holes); - active galactic nuclei.		
Method of delivering: Contact (lectures)		
Assessment methods: Homework assignments, class participation, tests and final exam		

Unit/Centre/Focus Area Space Research		
Module code: FSKM812	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Transport Theory**

Module-outcomes:
Upon completion of this course the student should be able to derive, understand and be able to apply the following by identifying problems and solving them creatively:

- The Boltzmann equation for a dilute gas that is not in equilibrium;
- The Maxwellian equilibrium distribution from the Boltzmann equation;
- The conservation equations for mass, momentum and energy from the Boltzmann equation and from macroscopic considerations, for non-viscous and viscous incompressible or barotropic flows;
- Sound-, shock- and blast waves in a compressible gas;

The kinematics of homogenous and isotropic turbulence, the theory for turbulence in equilibrium and turbulent diffusion.

Method of delivering: Contact- lecturers

Assessment methods:

- Class tests, discussions, assignments, exam

Unit/Centre/Focus Area: Space Research		
Module code: FSKM813	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Astrophysics II**

Module-outcomes:
Upon completion of this module the student should demonstrate advanced knowledge and understanding of the characteristics of and the physical processes which occur in the diffuse interstellar medium (ISM).

The following aspects are emphasised:

- The structure of the Milky Way
- Cooling of gas because of emission of line radiation
- Heating of the ISM
- HII areas
- Phases of the ISM
- Molecular clouds
- Gravitational collapse and star formation
- Masers and other line radiation processes associated with molecular clouds

Upon completion of this module the student should be able to interpret photon spectra of the ISM over a wide wavelength range in terms of the dominant physical processes, and successfully do practical calculations pertaining to various relevant problems regarding the ISM.

Method of delivery: : Contact (lectures)

Assessment methods:
Assessment include a formal examination at the end of the module, plus homework assignments which include problem solving

The student has to demonstrate that he/she understands the Physics of, and the physical processes which occur in, the ISM, and be able to independently do appropriate calculations in order to solve problems.

Unit/Centre/Focus Area: Space Research		
Module code: FSKM814	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Heliospheric Physics**		
Module-outcomes: : Advanced theoretical study of heliospheric physics based on plasmatic phenomena that originate on the Sun and propagate throughout the heliosphere, specifically what consequences they have concerning the solar wind, heliospheric magnetic field, corotating interaction and merged interaction regions, modulation of cosmic rays, acceleration of charged particles, (e.g. the anomalous component), heliospheric structures such as the heliosheath, the termination shock and heliopause, local interstellar region and spectra. This module is designed to support research in this field.		
Method of delivery: Semester module with five fixed assignments and three varying options from the topics listed above. Assignments are discussed every week followed up by submissions every second week		
Assessment methods: Eight assignments are handled as exam papers for which at least 50% each is required. If this is not done, an oral exam on all eight assignments is compulsory within the allocated period of semester examinations.		
Unit/Centre/Focus Area:		
Module code: FSKM815	**Semester 1 & 2**	**NQF-Level: 9**
Title: Capita Selecta I		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area: Centre for Space Research		
Module code: FSKM821	**Semester 1 & 2**	**NQF-Level: 9**
Title: **General Relativity**		
Module-outcomes: Upon completion of this module, the student should demonstrate in-depth knowledge and understanding, as well as be able to apply this knowledge when solving problems, regarding the following topics: • The scientific (experimental and scientific) and historical reasons why the General Theory of Relativity came into being as a generalisation of the Special Relativity Theory. • The criticisms against Newtonian gravity, as well as the changed concept of gravity from being a force in 3D space plus time, to a property of the geometry of 4D spacetime. • The fundamental assumptions of General Relativity, as well as the role played by the Equivalence Principle and the equality of inertial and gravitational mass. • Description of the orbits of photons and particles in a particular gravitational field using a spacetime metric and the geodesic equation. • Studying the implications of the spherically symmetric-Schwarzschild geometry which is a solution to Einstein's field equation. • Description of several applications of General Relativity, including black holes and cosmological models. Upon completion of this module, the student should be able to: • Use basic tensor notation. • Solve problems using basic mathematical techniques, including integration, differentiation, and vector analysis. • Present results graphically. • Communicate research assignments orally and in writing.		
Method of delivering: Contact (lectures		

Assessment methods:
The student will be assessed as to his / her ability to:

- Describe the development of General Relativity, as well as the fundamental reasons for this development, and the conceptual revolution of space, time, and gravitation which resulted from this process.
- Discuss the shortcomings of Newtonian gravity and Special Relativity.
- Demonstrate a deep understanding of the fundamental assumptions of General Relativity, as well as the implications of these assumptions regarding the definition of local inertial frames and freely falling frames.
- Describe curved-spacetime geometries mathematically, including the derivation (motivation) of the geodesic equation, and solving for the equations of motion of photons and particles moving close to a spherical massive object.
- Qualitatively and mathematically discuss various applications specific to General Relativity, including gravitational redshift, precession of the perihelion of Mercury, bending of light orbits in a gravitational field, and black holes.
- Phenomenologically and qualitatively discuss cosmological models as well as cosmological experimental measurements with the necessary understanding.
- Approach and solve mathematical problems creatively and represent the solutions graphically, using newly-acquired / revised mathematical skills.
- Successfully present oral research assignments.

Unit/Centre/Focus Area: Space Research

Module code: FSKS872	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:
Upon completion of this module the student should be familiar with the particular research methodology of one or a combination of Physics, Astronomy and Astrophysics, Space Physics and Applications in Physics, which includes:

- identification and scientific formulation of a problem statement, with guidance
- a thorough investigation of existing advanced knowledge as reflected by appropriate scientific literature
- conducting appropriate research towards solving the problem
- scientific evaluation of the results in context of the problem statement
- scientific communication of the results in a dissertation

Method of delivery: Full-time

Assessment methods:
Student will be assessed in an integrated manner on:

- indentification of a problem in one or a combination of Physics, Astronomy and Astrophysics, Space Physics and Applications in Physics, and the scientific formulation of such problem
- a thorough scientific literature study
- conducting appropriate research by means of suitable methodology to solve the problem
- scientific evaluation of the results in the context of the problem statement
- scientific communication of results in a dissertation/thesis

Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: GGFN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: 1. Specialist knowledge and understanding to engage with and critique research and practices within the field of Geography and Environmental Management; and to contribute to disciplined thinking about relevant matters with particular reference to their area(s) of specialisation. 2. The ability to evaluate current processes of knowledge production in the field of Geography and Environmental Management and to choose appropriate processes of enquiry for the area of specialisation. 3. A command of relevant methods and procedures required to solve practical and theoretical problems in the field of Geography and Environmental Management. 4. The ability to address complex and challenging problems in a specialised field of Geography and Environmental Management and to understand and contextualise their findings. 5. The ability to make autonomous ethical decisions which affect knowledge production, or complex organisational or professional issues, an ability to critically contribute to the development of ethical standards specifically in Geography and Environmental Management. 6. The ability to access, process and manage information and to communicate their findings in academically appropriate ways 7. An ability to effectively present and communicate the results of research to specialist and non-specialist audiences using the resources of an academic-professional discourse. 8. An understanding of the context of their research and associated consequences thereof to influence the field of Geography and Environmental Management. 9. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners		
Unit/Centre/Focus Area: Water Science and Management (Hydrology & Geohydrology)		
Module code: HDGH871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: 1. To have advanced specialist knowledge to enable engagement with and critique of current research or practices in the field of Hydrology and Geohydrology 2. The ability to conduct a relevant in-depth literature review and evaluate and critically manage current knowledge in the field of Hydrology and Geohydrology 3. The ability to select appropriate research methodologies and plan an appropriate research design in order to execute a research project with a view to solve challenging and relevant research problems in the field of Hydrology and Geohydrology 4. The ability to correctly interpret research results and to effectively communicate such results in the form of scientific papers 5. The ability to make autonomous ethical decisions during the process of knowledge production, thereby making a critical contribution to the development of ethical standards in the context of research within the field of Hydrology and Geohydrology. 6. Demonstrate an ability to use the resources of academic and professional discourses to communicate and defend substantial ideas that are the products of research.		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.		

Unit/Centre/Focus Area: Water Science and Management (Hydrology & Geohydrology)		
Module code: HDMG871	**Semester 1 & 2**	**NQF-Level: 9**
Title: Dissertation		
Module-outcomes: 1. To have advanced specialist knowledge to enable engagement with and critique of current research or practices in the field of Mining Hydrology 2. The ability to conduct a relevant in-depth literature review and evaluate and critically manage current knowledge in the field of Mining Hydrology 3. The ability to select appropriate research methodologies and plan an appropriate research design in order to execute a research project with a view to solve challenging and relevant research problems in the field of Mining Hydrology 4. The ability to correctly interpret research results and to effectively communicate such results in the form of scientific papers 5. The ability to make autonomous ethical decisions during the process of knowledge production, thereby making a critical contribution to the development of ethical standards in the context of research within the field of Mining Hydrology 6. Demonstrate an ability to use the resources of academic and professional discourses to communicate and defend substantial ideas that are the products of research		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: IPMM871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: 1. The ability to identify a relevant research problem in the field of pest and /or disease or weed management by integrating the above-mentioned skills and by thoroughly investigating existent knowledge as reflected in appropriate scientific literature. 2. Command of an applied competency in research methodology and in scientific penmanship. 3. The Ability to carry out the desired research in view of solving the problem 4. The Ability to evaluate the results scientifically in the context of the problem statement. 5. The Ability to communicate the results scientifically.		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.		
Unit/Centre/Focus Area:		
Module code: ITRN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: The student is equipped to master and apply research methodologies and techniques, which implies that he or she acquires the necessary expertise to identify within his or her subject field a suitable research topic, acquires theoretical background knowledge, submits relevant solution theories, formulates and proves theorems if necessary, and furnishes practical proof of the meaningfulness, implementability and accuracy of the new solution theory. Methods for committing the above process to paper in a scientific manner are acquired. The student's thorough fundamental training acquired beforehand in selected, advanced theoretical subjects is embodied in the dissertation. After the successful completion of the module the student will be able to master subject-matter and methods on his/her own, as well as to control modern techniques, apparatus and software. He/She will be able to function efficiently and independently in doing research in his/her subject and/or to solve practical problems of a standard magnitude. The student will therefore be able to act as a self-reliant scientist and take charge in dealing with not only standard problems and projects, but also problems and		

projects of an advanced nature, and also to undertake research projects in actual practice.

Method of delivering: Dissertation

Assessment methods: Assessment regulations of the faculty for Master dissertations apply.

Unit/Centre/Focus Area:

Module code: ITRW876	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Databases**

Module-outcomes:

After completion of the module the student will be able to show that he/she:

- is conversant with the Oracle structures and processes involved in back-up and repair; is conversant with the various methods used for back-up and repair in an Oracle database; can prevent and identify certain database problems that may occur, and know possible solutions to such problems;
- can repair possible failures in Oracle databases;
- can describe the most important steps that are part of an adjustment methodology;
- can use Oracle aids for diagnosing problems with performance;
- can configure memory structures for optimising the operation of the cache;
- can configure file structures in order to improve performance;
- can identify and solve problems with importing/exporting, storage and database configuration;
- can identify and solve problems with competing at final usage;
- can configure memory and disc sources in order to optimise sorting;
- can do research in order to keep abreast of new developments and findings

Method of delivering: Full time / Part time

Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).

Unit/Centre/Focus Area:

Module code: ITRW877	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Decision Support Systems**

Module-outcomes:

After completing the module the student will be able to indicate that he/she:

has mastered the theory and practice of various modelling problems of especially mathematical models; has mastered the technical language so that communication with colleagues can take place with ease; can proceed in a problem-solving manner; display a love for the study field and show an understanding of the relationship between reality, abstraction, model and solution and master more specialised examples and problems if the module is taken as an M-module.

Method of delivering: Full time / Part time

Assessment methods:

Formative and summative assessment (Tests, exams, practical evaluation).

Unit/Centre/Focus Area:

Module code: ITRW878	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Artificial Intelligence**

Module-outcomes:

At the end of the module the student must be able to do the following:

- Define artificial Intelligence and critically evaluate a definition;
- describe the historical principles and history of the subject;
- discuss logical agents and the environments in which they operate;
- define the concept of rationality and apply it to intelligent agents;
- solve problems by making use of various informed and uninformed search methods;
- describe the history and applications of neural networks;
- explain the biological inspiration for neural networks;

- discuss and use various neural network models and architectures for solving practical problems;
- describe the principles of knowledge-based agents;
- define proposition logic (both syntax and semantics);
- make inferences in proposition logic;
- define predicate logic (both syntax and semantics);
- make inferences in predicate logic;
- translate problem descriptions in predicate logic;
- construct proof of resolution;
- build a simple furnisher of proof for predicate logic;
- work together in groups;
- communicate effectively, orally as well as in writing, by making use of appropriate technology;
- integrate and apply information from various modules in the solving of practical problems (the outcomes will be achieved with the aid of one or more integrated evaluations);

act in an ethical manner with regard to all aspects of artificial intelligence.

Method of delivering: Full time / Part time

Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).

Unit/Centre/Focus Area:

Module code: ITRW883	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Image Processing**

Module-outcomes:

Context:

On theoretical level, the student should have insight and a basic knowledge of concepts and mathematical background of image processing. From a practical perspective students should demonstrate the ability to apply this knowledge to solve image processing problems.

Module-outcomes:

Upon successful completion of the module the students will be able to:

- Discuss basic concepts of image processing with reference to examples of the use of image processing, different imaging modalities, human visual perception, image acquisition, sampling and quantization, representation of digital images and relationships between pixels;
- Discuss and practically implement image enhancement in the spatial domain with reference to grey level transforms as well as spatial filters for smoothing and sharpening of images;
- Discuss and practically implement image enhancement in the frequency domain with reference to the Fourier transform and its properties as well as smoothing, sharpening and homomorphic filters;
- Discuss and practically implement colour image processing with reference to the different colour models and both pseudo-colour and full-colour processing;
- Discuss and practically implement different image compression algorithms.
- Discuss the use of mathematical morphology in image processing.
- Discuss different image segmentation techniques with reference to edge detection and linking as well as thresholding of images.
- Discuss the representation and description of images with reference to the description of boundaries and regions as well as the use of principal component analysis.
- Discuss the practical use of image processing.
- Discuss the application of the basic image processing techniques listed above in the fields of document image processing and video processing.

Method of delivering: Full time / Part time

Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).

Unit/Centre/Focus Area:		
Module code: ITRW884	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Information Systems Engineering**		
Module-outcomes: After the completion of this module students should be able to: understand and apply project management in the IT context; understand and manage project management process groups; understand and apply project integration management; understand and apply scope management; understand and apply time management; understand and apply cost management; understand and apply quality management; understand and apply human resource management; understand and apply communication management; understand and apply risk management; understand and apply purchasing management. At the end of the study the students will have a sound knowledge of different system development methodologies. These include system development methods, underlying approaches upon which system development methods are based, development process models followed in system development methods, development techniques and aids used in system development methods. After the completion of this module students should be able to: define and explain information system engineering; define and explain system development methodology; explain acceptance of system development methodology in practice; understand and apply STRADIS (Structured analysis, design, and implementation of information systems); understand and apply IE (Information Engineering); understand and apply RUP (Rational Unified Process); understand and apply XP (Extreme Programming); understand and apply SSM (Soft Systems Methodology); understand and apply ETHICS (Effective technical and human implementation of computer-based systems); understand and apply MULTIVIEW 1 en 2; do a critical evaluation and comparison of system development methodologies. Students will be able to critically evaluate system development methodologies, and be able to recommend a suitable methodology for a specific project. Students will be able to apply system development methodologies and develop a large project by means of it		
Method of delivering: Full time / Part time		
Assessment methods: Formative and summative assessment (Tests, exams practical evaluation).		
Unit/Centre/Focus Area:		
Module code: ITRW885	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Computer Security**		
Module-outcomes: • CONTEXT On theoretical level the learner should have insight and basic knowledge of main concepts of computer and information security. The learner is sensitised to security problems in the world we live in and should be able to recognise appropriate controls for the threats in computing areas including databases and networks. Upon successful completion of the module the learners will be able to: • Discuss concepts of computer and information security and weaknesses in computerised environments and understand how the threats can be controlled. • Know basic encryption and decryption schemes as well as the most important encryption systems generally used. • Understand operating system controls, and reliable operating systems. • Identify security problems in computer systems, programs and information in businesses and recommend measures to address these. • Discuss database concepts regarding information security and understand how threats can be controlled. • Discuss network security threats and possible countermeasures. • Discuss administrative security within an IT environment and its economic aspects. • Identify and discuss privacy and legal issues within computer security. • Understand that security systems should be completed meticulously and in the		

agreed manner and that confidential information should be handled as such.
- Understand that computer resources should be used ethically and responsibly. The students should know social and ethical issues within computer and information security.
- Study and discuss other relevant computer and information security topics.

Method of delivering: Full time / Part time

Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).

Unit/Centre/Focus Area:

Module code: ITRW886	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Data Warehouses**

Module-outcomes:
At the end of the module the student will be able to: understand and discuss the basic principles of data warehouses, and must write down explanations and elucidate these explanations by means of own examples;
understand the life cycle of a data warehouse and discuss and apply each of the phases in detail; set up a dimensional model for a case study; discuss different software aids for data warehouses.

Method of delivering: Full time / Part time

Assessment methods: Formative and summative assessment (Tests, exams, practical evaluation).

Unit/Centre/Focus Area: Environmental Sciences and Management

Module code: MKBN871	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:
1. Demonstrate specialist knowledge and understanding to engage with and critique research and practices within the field of Microbiology.
2. Demonstrate a command of relevant methods and procedures required to solve practical and theoretical problems in the field of Microbiology.
3. Demonstrate the ability to address complex and challenging problems in a specialised field of Microbiology and to understand and contextualise their findings.
4. Demonstrate the ability to access, process and manage information and to communicate their own findings in academically appropriate ways.
5. Demonstrate an understanding of the context of their research and associated consequences thereof to influence the field of Microbiology.
6. Demonstrate self-regulated learning and responsibility for academic and professional development; knowledge of the ethics of research and practice in Microbiology.

Method of delivering: Full-time/part-time

Assessment methods:
Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area:

Module code: NWON871	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: OMBO873	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Mini dissertation**		
Module-outcomes: 1. Specialist knowledge and understanding to engage with and critique research and practices within the field of environmental management; and to contribute to disciplined thinking about relevant matters with particular reference to their area(s) of specialisation. 2. The ability to evaluate current processes of knowledge production in the field of environmental management and to choose appropriate processes of enquiry for the area of specialisation. 3. A command of relevant methods and procedures required to solve practical and theoretical problems in the field of environmental management. 4. The ability to address complex and challenging problems in a specialised field of environmental management and to understand and contextualise their findings. 5. Demonstrate the ability to make autonomous ethical decisions which affect knowledge production, or complex organisational or professional issues, an ability to critically contribute to the development of ethical standards specifically in environmental management. 6. Demonstrate the ability to access, process and manage information and to communicate their findings in academically appropriate ways (f and g) 7. An ability to effectively present and communicate the results of research to specialist and non-specialist audiences using the resources of an academic-professional discourse. 8. An understanding of the context of their research and associated consequences thereof to influence the field of environmental management. 9. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.		
Method of delivering: Part-time		
Assessment methods: Assessment mark after examination and moderation of dissertation : 100 % of the final mark.		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: OMBO878	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Environmental Management**		
Module-outcomes: 1. Demonstrate specialist knowledge and understanding to engage with and critique research and practices relating to global and national perspectives on environmental and sustainability challenges; including all relevant environmental management and governance instruments. 2. The ability to evaluate current processes of knowledge production in the field of environmental management and governance and to choose appropriate processes of enquiry for the area of specialisation. 3. A command of relevant methods and procedures required to solve practical and theoretical problems in environmental management and governance instruments and approaches. 4. The ability to address complex and challenging problems in a specialised field of environmental management and governance and to understand and contextualise their findings. 5. Demonstrate the ability to operate within the ethical requirements of environmental management and governance. 6. Demonstrate the ability to access, process and manage information related environmental management and governance and to communicate their findings in academically appropriate ways. 7. Candidates exhibit the potential to act as leaders and experts in the field of environmental management and governance. 8. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.		

Method of delivering: Part-time

Assessment methods: Assignments, practical reports, presentations and examination

Unit/Centre/Focus Area: Environmental Sciences and Management

Module code: OMBO879	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Environmental Assessment**

Module-outcomes:

1. Demonstrate specialist knowledge and understanding to engage with and critique research and practices relating to global and national perspectives on environmental and sustainability challenges; including all relevant environmental assessment and governance instruments.
2. The ability to evaluate current processes of knowledge production in the field of environmental assessment and governance and to choose appropriate processes of enquiry for the area of specialisation.
3. A command of relevant methods and procedures required to solve practical and theoretical problems in environmental assessment and governance instruments and approaches.
4. The ability to address complex and challenging problems in a specialised field of environmental assessment and governance and to understand and contextualise their findings.
5. Demonstrate the ability to operate within the ethical requirements of environmental assessment and governance.
6. Demonstrate the ability to access, process and manage information related environmental assessment and governance and to communicate their findings in academically appropriate ways.
7. Candidates exhibit the potential to act as leaders and experts in the field of environmental assessment and governance.
8. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.

Method of delivering: Part-time

Assessment methods: Assignments, practical reports, presentations and examination

Unit/Centre/Focus Area: Environmental Sciences and Management

Module code: OMBO880	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Management of Ecological Drivers in Aquatic Systems**

Module-outcomes:

1. Demonstrate specialist knowledge and understanding to engage with and critique research and practices relating to global and national perspectives on environmental and sustainability challenges; including all relevant environmental management and governance instruments.
2. The ability to evaluate current processes of knowledge production in relation to ecological water requirements and to choose appropriate processes of enquiry for the area of specialisation.
3. A command of relevant methods and procedures required to solve practical and theoretical problems related to ecological water requirements and specifically ecological drivers in aquatic systems.
4. The ability to address complex and challenging problems in relation to ecological water requirements and ecological drivers in equatic systems, and to understand and contextualise their findings.
5. Demonstrate the ability to operate within the ethical requirements of water management and governance.
6. Demonstrate the ability to access, process and manage information related to ecological water requirements and to communicate their findings in academically appropriate ways.
7. Candidates exhibit the potential to act as leaders and experts in the field of water management and governance.
8. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.

Method of delivering: Part Time

Assessment methods: Assignments, practical reports, presentations and examination

Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: OMBO881	**Semester 1 & 2**	**NQF-Level: 9**
Title**: Management of Ecological Responders in Equatic Systems**		
Module-outcomes: 1. Demonstrate specialist knowledge and understanding to engage with and critique research and practices relating to global and national perspectives on environmental and sustainability challenges; including all relevant environmental management and governance instruments. 2. The ability to evaluate current processes of knowledge production in relation to ecological water requirements and to choose appropriate processes of enquiry for the area of specialisation. 3. A command of relevant methods and procedures required to solve practical and theoretical problems related to ecological water requirements and specifically ecological responders in aquatic systems. 4. The ability to address complex and challenging problems in relation to ecological water requirements and ecological responders in equatic systems, and to understand and contextualise their findings. 5. Demonstrate the ability to operate within the ethical requirements of water management and governance. 6. Demonstrate the ability to access, process and manage information related to ecological water requirements and to communicate their findings in academically appropriate ways. 7. Candidates exhibit the potential to act as leaders and experts in the field of water management and governance. 8. Self-regulated learning and responsibility for academic and professional development with cognisance of their ethical responsibility.		
Method of delivering: Part Time		
Assessment methods: Assignments, practical reports, presentations and examination		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: OMBO882	**Semester 1 & 2**	**NQF-Level: 9**
Title**: Integrated Waste Management**		
Module-outcomes: 1. An integrated knowledge of and engagement in integrated waste management and of theories, techniques and requirements relevant to waste management as well as the ability to critically evaluate and apply these concepts. 2. The ability to gather multiple sources of knowledge and information within the field of integrated waste management, and critically evaluate, review and apply this knowledge. 3. Contextualize and critically comment on the complex nature of integrated waste management and how it relates to unfamiliar contexts and other fields of environmental management. 4. The ability to select, critically evaluate and apply a range of different but appropriate tools, techniques, requirements and best practices related to integrated waste management, and to reflect on and propose suggestions to effectively manage waste throughout the entire waste management life cycle.		
Method of delivering: Part Time		
Assessment methods: Assignments, practical reports, presentations and examination		

Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: OMBO883	**Semester 1 & 2**	**NQF-Level: 9**
Title**: Waste Management Law And Governance**		
Module-outcomes: 1. An integrated knowledge of and engagement in integrated waste management legislation and governance (including international obligations, policies, laws, regulations, norms and standards, etc.) relevant to waste management as well as the ability to critically evaluate and apply these concepts. 2. The ability to gather multiple sources of knowledge and information applicable to waste management legislation and governance, and evaluate, review and apply this knowledge; 3. Contextualize and critically comment on the complex nature of waste management legislation and governance, and how it relates to unfamiliar contexts and other fields of environmental management. 4. The ability to select, review, evaluate and apply a range of different but appropriate legislative requirements related to integrated waste management, and to reflect on and propose suggestions to effectively manage waste within the South African legal framework.		
Method of delivering: Part Time		
Assessment methods: Assignments, practical reports, presentations and examination		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: OMWN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: 1. Demonstrate specialist knowledge and knowledge literacy regarding the field of environmental sciences. 2. Demonstrate a command of, design, and select appropriate methods, techniques and processes in the research of environmental sciences. 3. Use wide range of specialised skills in identifying, and conceptualising methods of enquiry to address complex and challenging problems within the field of environmental sciences. 4. Access, process and manage information in order to conduct a review on the current research in the area of environmental sciences. 5. Produce and communicate information regarding his/her research in the field of environmental sciences. 6. Place his/her research findings in context within the prevailing understanding of the research problem within environmental sciences and suggest solutions/intervention. 7. Make autonomous ethical decisions, to operate independently and take full responsibility for his/her own work.		
Method of delivering: Full-time or part-time		
Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: PLKN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: 1. Knowledge of the botanical field of specialisation (ecology, molecular biology, physiology or taxonomy) of terrestrial or aquatic environments. 2. Ability to evaluate relevant literature in the field of specialisation. 3. Ability to address complex problems within the field of specialisation by applying skills to identify, conceptualise and design relevant research questions. 4. Application of appropriate and creative methods, techniques, processes or technologies to address practical or theoretical problems in the field of specialisation. 5. Adoption of appropriate, responsible and approved ethical decisions for knowledge production in the field of specialisation.		

6. Ability to implement appropriate procedures to collect, process and analyse data in the field of specialisation, and the initiation and implementation of good management practices to meet the goals of the study.
7. Independent thought and responsibility for the research in the field of specialisation, and to communicate and defend findings in academically appropriate ways.

Method of delivering: Full-time or part-time

Assessment methods: Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area:

Module code: RSWW811	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Research Method**

Module-uitkomste: Module-outcomes:
On completing this module the student will be able to demonstrate that he/she is ready for undertaking the literature study with a view to a dissertation in his/her subject field (which may include that the student should be able to present the literature study in the form of an article); that he/she knows how to consult and correctly quote sources without committing plagiarism. The student will demonstrate that he/she is conversant with the contents of the "guide to postgraduate study", and that he/she is able to choose and apply an appropriate research method, for example that he/she (where applicable) is able to prepare suitable questionnaires and can do suitable statistic processing of data; that he/she is able to work with questionnaires and results in an ethically correct manner. On completing this module the student will be able to write a research proposal.

Method of delivering: Full time / Part time (Scheduled lectures)

Assessment methods: Formative and summative assessment: Assignments and exam.

Unit/Centre/Focus Area:

Module code: RSWW821	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Research Communication**

Module-outcomes:
On completion of this module the student would have shown that he/she is capable of communicating research results in writing and verbally according to the standard practices in the subject field. The student will be able to present a lecture on research results that will include the necessary skills in making use of modern aids (such as the data projector), and he/she must submit a typed article from the work in his/her dissertation for examination. The student must have the skills to use the generally accepted word processing package of his/her subject field and prepare the article by means of that.

Method of delivering: Full time / Part time (Scheduled lectures)

Assessment methods: Summative assessment: Assignments.

Unit/Centre/Focus Area: Environmental Sciences and Management

Module code: SBEL871	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:
1. Illustrate the ability to independently conduct research under guidance, and collect, process, analyse, evaluate and interpret data and to document these findings meaningfully in a dissertation.
2. Illustrate the ability to apply advanced subject-specific and integrated planning knowledge and skills in addressing planning issues and in identifying, analysing and solving complex and abstract problems.
3. Illustrate sufficient knowledge of related literature, mastery of appropriate techniques and analytical methods, and the ability to remain at the forefront of the latest policy and practices in planning;
4. Illustrate the ability to apply the knowledge and skills acquired in these studies meaningfully in order to reflect significant insight.

5. Demonstrate advanced and specialised skills, appropriate to the Urban and Regional Planning discipline, to communicate research findings to a range of audiences with different levels of knowledge or expertise.

Method of delivering: : Full time or part-time

Assessment methods:
Dissertation (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area:

Module code: STTK874	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Resampling Methods**

Module-outcomes:
The student will be able to demonstrate that he / she is capable of applying a wide range of advanced inferential techniques to which classical analytical methods cannot be applied due to unpredictability and when conventional bootstrap methods do not give satisfactory answers. He/she will master diagnostic methods to ensure the safe use of bootstrap methods. The student will demonstrate advanced methods concerning complex regression situations like generalized linear models, certain non-linear models, master semi- and nonparametric regression models and survival models, as well as new inference concerning time series and point processes. The student will be able to identify which problems and inference tasks can be tackled with the bootstrap method, he / she will be able to program in both SPLUS and FORTRAN, and will also be able to link to the IMSL libraries in applications so that statistical inference can be conducted non-parametrically. It gives the student the tools to solve many complex problems that were previously left untouched in pre-graduate courses due to complexity, by applying advanced techniques and computational methods.

Method of delivering:Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area:

Module code: STTK875	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Statistical Models**

Module-outcomes:
he students be able to demonstrate that he / she has mastered the statistical aspects of non-parametric regression smoothing equations methods, both theoretically and practically. The student will be able to demonstrate that he / she understands the basic underlying ideas regarding smoothing, as well as master specific smoothing techniques (including kernel-smoothing methods regarding functions as well as derivatives of functions, k-adjacent smoothing methods, orthogonal series estimators, and the so-called "Spline" smoothers). The accuracy of the smoothing methods depends, inter alia, on the choice of the kernel functions and the smoothing parameters. The student will have the means to choose between the kernel functions and the smoothing parameter, apply the nonparametric regression with regard to certain criteria successfully. The student will, after completion of the course, be able to apply the regression approach to situations where it was previously impossible, due to the invalidity of conditions required by conventional parametric methods.

Method of delivering:Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area:

Module code: STTK876	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Multivariate Statistics**

Module-outcomes:
The student will be equipped with both a sound theoretical background and a practical skill to manipulating and conduct inference in a wide range of topics in Multivariate Statistics, such as the geometric representation of data, the comparison of multivariate mean vectors, multivariate linear models, detailed studies on the determination of principal components, performing canonical correlation analysis, discrimination analysis, classification analysis and

application of cluster analysis. He / she will be able to make use of available software packages, e.g., S-PLUS, SAS and STATISTICA, and other computer-related websites such as those of the package R. The student will be able to work out and reflect on multivariable problems and come up with analytical solutions where possible and appropriate. This will be done in terms of the theoretical problems concerning the topics mentioned above, and in practical situations where inference can be applied.

Method of delivering: Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area:

Module code: STTK877	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Probability Theory**

Module-outcomes:
The student will understand the measure theoretical basis of Probability and the theorems and laws that flow from it, especially with respect to the developments of the past few decades. The student will also learn about the concepts of independence, Interchangeability, and martingales. The student will master concepts such as sigma-algebras, measurable and product spaces, measurable transformations, limit probabilities of events, and understand other related concepts as applied in formulations and proofs of fundamental theorems of probability theory. The student should be well versed in topics such as integration in a probability space, stopping times, customized theoretical statements applied to the probability measure, martingale and limit theorems for independent random variables. After successful completion of the course the student will have the necessary skills to tackle theoretical and practical problems concerning these issues with a view towards basic statistical research and research on advanced statistical-financial issues and related problems in other application areas.

Method of delivering:Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area:

Module code: STTK878	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Time Series Models**

Module-outcomes:
he course in advanced time series models offer students the opportunity to get acquainted with advanced models in time series analysis. Standard concepts which are used in the course include topics such as linear time series models, Stationary and non-Stationary ARIMA models, model identification, prediction, testing for the existence of unit roots and, finally, an introduction to multivariate time series models such as vector autoregressive models. The advanced module enables students to study time series from the perspective of the so-called frequency domain approach instead of the usual time domain approach. The focus is on spectral theory of Stationary processes and estimation of the spectrum. Further, more advanced topics are dealt with in: multivariate time series, transfer function models, state space models, and Kalman filters. Long memory and non-linear processes are discussed along with the influence of the combination of time series data and systematic sampling of data on the distribution of test statistics and significance levels.

Method of delivering:Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area:

Module code: STTK879	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Stochastic Processes**

Module-outcomes:
his course offers the student the opportunity to build a custom theoretical view of important facets of financial mathematics, and is presented in terms of risk parameters. The student is equipped with background knowledge on financial derivatives as well as an overview of the fundamental mathematics of discrete-time stochastic processes. This knowledge is applied to

discrete-time financial mathematics and extended to continuous time situations. Incomplete markets and interest rate models are included in the course.

Method of delivering:Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area:

Module code: STTN872	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:
Students will be able to master and apply statistical research methodologies and techniques. This means that the student will acquire the necessary expertise in the field to identify a suitable research topic, to gain theoretical background knowledge of the topics, to suggest appropriate theoretical solutions to problems, to formulate and (if necessary) prove statements related to these problems, and provide practical proof of the significance, feasibility and accuracy of newly proposed solution strategies. Methods to scientifically document the above process is also acquired. The student's in-depth, fundamental insight in selected advanced theoretical topics will be embodied in the thesis. Upon successful completion of this module, students will have become a *statistical thinker*. He / She will be able to master certain materials and methods, as well as the use of modern theoretical techniques and its application on modern computer software. He / She will be able to effectively and independently execute (and solve) standard theoretical research problems and/or practically-oriented problems related to their subject field. The student will thus be able to operate as an independent and self-sufficient scientist to tackle standard (or even advanced) problems and projects in practice.

Method of delivering:Full time

Assessment methods:
According to the faculty's given rules for the examination of dissertations. Ultimately, the dissertation will count 100/180 of the final mark..

Unit/Centre/Focus Area:

Module code: STTN874	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Advanced Survival Models**

Module-outcomes:
The content of the course will equip students to deal with the complexity of censored and truncated data sets as they typically occur in a wide range of fields; from biological fields, public health fields, epidemiological and medical studies, as well as in engineering and economics. Included in the courses are the topics of estimation of the survival function, estimation of the cumulative hazard rate and estimation of measures of centrality (this estimation is also presented in in the presence of more complex censored data structures), smoothing techniques, hypothesis testing and Bayesian survival methods. After successful completion of the course students should be able to deal with censored and truncated data sets and perform inference on the topics mentioned above. Specifically, the student will have the skills to critically evaluate survival models and effectively and practically implement them in the field of insurance. Appropriate estimation methods can be used for mortality and other parameters such as transition intensities. Statistical models can be built for, among others, the transition between multiple states and mortality, the census approach to estimate will be applied, tests for consistency of estimators will be implemented, as well as simple assurance and annuity contracts and the application of survival models to this. S-PLUS, SAS and Statistica will be used for these calculations.

Method of delivering:Full time

Assessment methods: Class tests, assignments, exam

Unit/Centre/Focus Area: Business Mathematics and Informatics		
Module code: TGWN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module outcomes: ***Knowledge:*** The student is equipped to master and apply Applied Mathematics and Mathematics research methodologies and techniques, which implies that he or she acquires the necessary expertise to identify within his or her subject field a suitable research topic, acquire theoretical background knowledge, submit relevant solution theories, formulate and prove theorems if necessary, and furnish practical proof of the meaningfulness, implementability and accuracy of the new solution theory. Methods for committing the above process to paper in a scientific manner are acquired. The student's thorough fundamental training acquired beforehand in selected, advanced theoretical subjects is embodied in the dissertation. ***Skills:*** After the successful completion of the module the student will have mastered the Applied Mathematics way of thinking. He or she will be able to master subject-matter and methods on his/her own, as well as to control modern techniques, apparatus and software. He or she will be able to function efficiently and independently in doing research in his/her subject and/or to solve practical problems of a standard magnitude. The student will therefore be able to act as a self-reliant scientist and take charge in dealing with not only standard problems and projects, but also problems and projects of an advanced nature, and also to undertake research projects in actual practice.		
Method of delivery: Not applicable – research project:		
Assessment methods: The candidate submits a dissertation on a suitable research topic		
School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: TGWN881	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Applicable Analysis I**		
Module-outcomes: Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of and skill in * the deeper principles, * the methods, * the application of the theory regarding selected aspects of the one or more of the following topics: Solvability of finite dimensional integral-, differential- and operator equations; the contraction mapping principle; applications of the theory of integration, applications of complete spaces with Hilbertian and Normed structures; the Calculus of Variations		
Method of delivering: Full Time/Part Time (scheduled classes)		
Assessment methods: *Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.*		

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: TGWN882	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Applicable Analysis II**

Module-outcomes:
This module complements and extends the material covered in TGWN881 (Applicable Analysis I). Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected advanced aspects of the one or more of the following topics:

Advanced aspects of the solvability of finite dimensional integral-, differential- and operator equations; the contraction mapping principle; applications of the theory of integration, applications of complete spaces with Hilbertian and Normed structures; the Calculus of Variations.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: TGWN883	**Semester 1& 2**	**NQF-Level: 9**

Title: **Modelling I**

Module-outcomes:
Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected aspects of one or more of the following topics:

The study of the various ways in which phenomena may be modelled by means of mathematics, namely linear vs nonlinear models, static vs dynamic models, explicit vs implicit models, discrete vs continuous models, deterministic vs stochastic models, deductive, inductive or floating models.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: TGWN884	**Semester & 2**	**NQF-Level: 9**

Title: **Modelling 2**

Module-outcomes:
This module complements and extends the material covered in TGWN883 (Modelling I). Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected advanced aspects of one or more of the following topics:

The study of the various ways in which phenomena may be modelled by means of mathematics, namely linear vs nonlinear models, static vs dynamic models, explicit vs implicit models, discrete vs continuous models, deterministic vs stochastic models, deductive, inductive or floating models.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences	Subject Group: Mathematics and Applied Mathematics	
Module code: TGWN887	**Semester 1& 2**	**NQF-Level:9**

Title: **Principles and Paradigms:Applied Mathematics**

Module-outcomes:
Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of and skill in
* the deeper principles,
* the methods,
* the application of the theory
of selected topics in Advanced Applied Mathematics not covered by the other Masters level module modules. Such topics shall be jointly determined by the supervisor of the affected student, and the chairperson of the subject group Applied Mathematics, and shall be directly related to the chosen research topic of the student.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

Unit/Centre/Focus Area: Unit for BMI		
Module code: WISK872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes: The student is equipped to master and apply research methodologies and techniques, which implies that he or she acquires the necessary expertise to identify within his or her subject field a suitable research topic, acquire theoretical background knowledge, submit relevant solution theories, formulate and prove theorems if necessary, and furnish practical proof of the meaningfulness, implementability and accuracy of the new solution theory. Methods for committing the above process to paper in a scientific manner are acquired. The student's thorough fundamental training acquired beforehand in selected, advanced theoretical subjects is embodied in the dissertation. After the successful completion of the module the student will have mastered the mathematical way of thinking. He/she will be able to master learning matter and methods independently. He/she will be able to function efficiently and independently in doing research in his/her subject and/or to solve research problems of a standard magnitude. The student will therefore be able to act as a self-reliant scientist and take charge in dealing with not only standard problems and projects, but also problems and projects of an advanced nature.		
Method of delivering: Dissertation		
Assessment methods: Assessment methods: According to the faculty rules for the examination of dissertations. The dissertation will contribute 100/180 of the final mark for the M-programme.		
School: Computer, Statistical and Matheatical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN881	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Abstract Analysis I**		
Module-outcomes: Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of, and skill in * the deeper principles, * the methods, * the application of the theory regarding selected aspects of the one or more of the following topics: Regular Borel- and Radon measures, Fourier and Harmonic analysis, Banach function spaces, Hilbert spaces, Operator theory, Locally Convex spaces, C*- and von Neumann algebras.		
Method of delivering: Full Time/Part Time (scheduled classes)		
Assessment methods: Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.		

School: Computer, Statistical and Mathematical Sciences		Subject Group: Mathematics and Applied Mathematics
Module code: WISN882	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Abstract Analysis II**

Module-outcomes:
This module complements and extends the material covered in WISN881 (Abstract Analysis I). Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of, and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected advanced aspects of the one or more of the following topics: Regular Borel- and Radon measures, Fourier and Harmonic analysis, Banach function spaces, Hilbert spaces, Operator theory, Locally Convex spaces, C*- and von Neumann algebras.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences		Subject Group: Mathematics and Applied Mathematics
Module code: WISN883	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Algebra I**

Module-outcomes:
Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of, and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected advanced aspects of the one or more of the following topics:

- Structures described by one or two binary operations on one set (for example groups, rings and lattices), and/or
- Structures described by one or two binary operations on a set, together with an action of a second set on the first (for example vector spaces, modules, algebras and co-algebras).
- The interface of algebraic structures with non-algebraic structures (Lie groups, ordered rings, ordered groups, ordered fields, etc.).
- The interface of algebraic structures with other study fields, including, but not limited to algebraic topology, algebraic homology, algebraic graph theory or matrix theory.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and	Subject Group: Mathematics and Applied

Mathematical Sciences		Mathematics
Module code: WISN884	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Algebra II**

Module-outcomes:
This module complements and extends the material covered in WISN883 (Algebra I). Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected advanced aspects of the one or more of the following topics:

- structures described by one or two binary operations on one set (for example groups, rings and lattices), and/or
- Structures described by one or two binary operations on a set, together with an action of a second set on the first (for example vector spaces, modules, algebras and co-algebras).
- The interface of algebraic structures with non-algebraic structures (Lie groups, ordered rings, ordered groups, ordered fields, etc.).
- •The interface of algebraic structures with other study fields, including, but not limited to algebraic topology, algebraic homology, algebraic graph theory or matrix theory

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN885	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Discrete Structures 1**

Module-outcomes:
Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of, and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected aspects of the one or more of the following topics:

Theoretical Computer Science, Logic and Set Theory, Combinatorics, Graph Theory, Discrete Probability, Number Theory, Geometry, Game Theory, Complexity Theory.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN886	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Discrete Structures 2**

Module-outcomes:
This module complements and extends the material covered in WISN885 (Discrete Structures I). Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of, and skill in
* the deeper principles,
* the methods,
* the application of the theory
regarding selected advanced aspects of the one or more of the following topics:

Theoretical Computer Science, Logic and Set Theory, Combinatorics, Graph Theory, Discrete Probability, Number Theory, Geometry, Game Theory, Complexity Theory.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

School: Computer, Statistical and Mathematical Sciences	**Subject Group: Mathematics and Applied Mathematics**	
Module code: WISN887	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Principles and Paradigms: Pure Mathematics**

Module-outcomes:
Building on prior knowledge, the student should upon completion of this module demonstrate a thorough and advanced knowledge of, and skill in

* the deeper principles,
* the methods,
* the application of the theory
regarding selected topics in Advanced Mathematics not covered by the other Masters level module modules. Such topics shall be jointly determined by the supervisor of the affected student, and the chairperson of the subject group Mathematics, and shall be directly related to the chosen research topic of the student.

Method of delivering: Full Time/Part Time (scheduled classes)

Assessment methods:
Formative assessment in the form of practical assignments / homework and/or projects that integrate the various outcomes of the module, and summative assesment in the form of either a written examination or an in-depth essay about a selected topic wherein the extent to which students have attained the outcomes of the module will be assessed by means of applied and theoretical questions.

N.29.3 PHILOSOPHIA DOCTOR

Unit/Centre/Focus Area:		
Module code: AECM971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes: The learner in this programme will attain the following specific outcomes: The candidate will write a thesis of high technical quality (with reference to language usage, illustrations, tables, graphic representations, etc.) that will demonstrate: His/her command of an applied competency in an applicable quantitative and qualitative research methodology and in scientific penmanship; The ability to identify a relevant research problem in a natural science or agricultural science discipline by integrating the above-mentioned skills and by thoroughly investigating existent knowledge as reflected in appropriate scientific literature; The ability to carry out the desired research in view of solving the problem; The ability to evaluate the results scientifically in the context of the problem statement; The ability to communicate the results scientifically. The learner will demonstrate by means of a literature investigation that he/she has a thorough and in-depth knowledge of related scientific literature; has the ability to interpret and debate different viewpoints and theories on a scientific basis; has looked up a large enough quantity of recent and appropriate historic primary and secondary sources in the speciality area. The learner will provide proof by means of problem identification that he/she has a sound insight into the nature and aim of the research; has the ability to circumscribe the research topic properly at the level of a doctorate. Apart from the literature investigation the student will demonstrate that the research method is appropriate to the speciality area in view of handling the problem identified and that the research method has been selected in a reflexive and responsible manner. By scientific evaluation and communication of the results the student will demonstrate the following: scientific processing of the thesis, with reference to the handling of appropriate quantitative or qualitative research methods and/or techniques, such as modeling, mathematical techniques of proof, experiments, observations, systematisation, founding of scientific statements, etc., as may be relevant to the problem investigated; the ability to formulate clearly; the ability to present a logical structure; a critical attitude and personal insight; the ability to formulate scientifically justified recommendations.		
Method of delivering: Distance		
Assessment methods: Internal and external evaluation/examination of thesis		

Unit/Centre/Focus Area:		
Module code: BCHN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		

Module-outcomes:
Knowledge: Upon completion of this module, the student should have complete knowledge of the relevant scientific literature and be able to plan and conduct advanced empirical scientific research, to such a level that he/she is considered an expert in the field of study

Skills: Upon completion of this module students will be able to

- Formulate a scientific question
- Design project-oriented experiments;
- Singlehandedly perform experiments using advanced analytical procedures;
- Present and interpret results of experiments in a scientific manner;
- Write a thesis and publish in scientific literature
- Explore current and emerging trends a field of research.

Values: At the end of this course students will be able to identify ethical issues in biological research (theory and applications) and communicate their own point of view as well as those of the scientific, medical and general community. Furthermore, students will have developed a skills pertaining to using advanced analytical apparatus, experimentation, and higher interpretive thinking and scientific writing, to the extent that they are considered experts in the field of study.

Method of delivering:

Assessment methods:
Thesis examination: 100% of marking allocation

Unit/Centre/Focus Area:

Module code: BWIN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area:

Module code: BWIR971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Chemical Resource Beneficiation

Module code: CHEN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:
Upon completion of this module the student should make a determined contribution to the development of new knowledge and skills in one of the following research fields: Chromium Technology, Catalysis and Synthesis, Membrane Technology, Electrochemistry for Energy and Environment, and Coal Chemistry, and to be acquainted with the specific research methodology of this field(s), that include:

- the identification and scientific formulation of a problem statement;
- a thorough investigation of existing knowledge as reflected by the applicable literature;
- a critical analysis of existing knowledge in the field;
- the execution of applicable research to solve the problem;
- the scientific evaluation of the results in context with the problem statement;
- • the scientific communication of the results in the form of a thesis.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area: Environmental Science and Management

Module code: CHEM971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:
1. Demonstrate expertise and critical knowledge of a specialised area in Atmospheric Chemistry and/or across specialised or applied areas.
2. Demonstrate an ability to develop new methods, techniques or approaches in original, creative and innovative ways appropriate to specialised and complex contexts.
3. Demonstrate the ability to apply specialist knowledge and theory in critically reflexive, creative and novel ways to address complex and unfamiliar problems in a specialised field of Atmospheric Chemistry and/or across applied areas.
4. Demonstrate the ability to make independent judgements about managing incomplete or inconsistent information or data in an iterative process of analysis and synthesis.

5. Demonstrate the ability to produce and communicate the findings of their research in academically appropriate ways.
6. Demonstrate the ability to identify, address and manage emerging ethical issues and advance processes of ethical decision-making; take full responsibility for own work and operate independently.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area: Environmental Science and Management

Module code: DRKN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-uitkomste:
1. Conceptualise, plan, and execute new research initiatives, and to create and present new knowledge and questions, based on demonstrated, integrated, and contextualised knowledge of the relevant scientific literature and theory.
2. Contribute towards the scholarly debate concerning the theory, practice and possible implementation of the new knowledge generated.
3. Develop new methods and/or apply existing methods towards new research questions in original, creative and innovative ways to address the chosen research topic.
4. Apply and/or develop problem solving skills by using specialist knowledge and theory in critically reflexive, creative, and novel ways to address any practical, interpretive, and/or theoretical situations foreseen or that may arise during the study.
5. Apply all relevant ethical requirements as set out by the relevant ethical committees, procedures, and regulations
6. Collect, process, analyse, judge, and interpret new data, findings, information, and theory in the context of existing knowledge, discourse, and theory
7. Produce, communicate, and defend new data, findings, analyses, insights, and theoretical and practical discourse as presentable and publishable work
8. Be held accountable for scientific integrity.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area: Environmental Science and Management

Module code: DRRS971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-uitkomste: Module-outcomes:
1. Demonstrate advanced and integrated knowledge with regard to disaster risk studies to specifically enable engagement with and critique of multidisciplinary research practices and the ability to evaluate current processes of knowledge production in disaster risk studies and then to select appropriate processes of enquiry into disaster risk in various sectors.
2. Demonstrate the ability to use a wide range of specialised skills in identifying, conceptualising, designing and implementing methods of enquiry to address complex and challenging problems within disaster risk studies and the ability to make autonomous ethical decisions which affect knowledge production, or complex organisational or professional issues, an ability to critically contribute to the development of ethical standards specifically in disaster risk studies.
3. Demonstrate the ability to use the resources of academic/ professional/or occupational discourses to communicate and defend substantial ideas that are the products of research or development in disaster risk studies; and use a range of advanced and specialised skills and discourses appropriate to disaster risk studies, to communicate to a multidisciplinary environment with different levels of knowledge or expertise.
4. Demonstrate the ability to make strategic interventions at an appropriate level within a system, based on an understanding of hierarchical relations within the system, and the ability to address the intended and unintended consequences of interventions.

5. Demonstrate an ability to operate independently and take full responsibility for own work, and, where appropriate, to account for leading and initiating processes and implementing systems, ensuring good resource management and governance practices.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area: Space Research

Module code: FSKN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:

Upon completion of this module. the students should make a specific contribution towards the development of new knowledge and skills in one of or a combination of, Physics, Astronomy and Astrophysics, Space Physics and Applications in Physics, and be familiar with the particular research methodology of the field(s), which includes:

- identification and scientific formulation of a problem statement;
- a thorough investigation of existing advanced knowledge as reflected by appropriate scientific literature;
- critical analysis of existing knowledge in the field;
- conducting appropriate research by means of suitable methodology to solve the problem;
- scientific evaluation of the results in the context of the problem statement;
- scientific communication of results in a dissertation.

Method of delivering:

Assessment methods:
Student will be assessed in an integrated manner on:

- indentification of a problem in one or a combination of Physics, Astronomy and Astrophysics, Space Physics and Applications in Physics, and the scientific formulation of such problem;
- a thorough investigation of existing knowledge as reflected in appropriate scientific literature;
- critical analysis of existing knowledge in the field;
- conducting appropriate research to solve the problem;
- scientific evaluation of the results in the context of the problem statement;
- the contribution towards furthering new knowledge and skills;
- scientific communication of results in a dissertation/thesis.

Unit/Centre/Focus Area: Environmental Science and Management

Module code: GGFN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:
1. Depth of critical knowledge and high levels of theoretical understanding in a complex and specialised area within the field of Geography and Environmental Management and /or across specialised or applied areas and expand or redefine existing knowledge in the field of Geography and Environmental Management.
2. Intellectual independence and advanced research skills through the ability to apply sophisticated knowledge and research methodologies to the solution of complex, unfamiliar problems in the field of Geography and Environmental Management and the competence to integrate and apply theoretical knowledge and research findings within local and global contexts.
3. The ability to question existing knowledge boundaries and practices in the field of Geography and Environmental Management; and to deal with complexity, and contradictions

in the knowledge base of the field of Geography and Environmental Management.
4. The ability to make autonomous, independent judgements about information and concepts at highly abstract levels and make evaluations on the basis of independently generated criteria. Show mastery of the literature and state of research in Geography and Environmental Management, with specific reference to their chosen are of specialisation; and to defend and communicate the findings of their own research.
5. Research leadership within the field of Geography and Environmental Management or across disciplines to optimise all aspects of research processes within complex and unpredictable contexts.
6. High levels of responsibility, self-reflexivity and adaptability, with respect to the ethical implications of research, the determination of socially relevant l issues and research needs in South Africa, and the ability to relate these issues to international contexts.

Metode van aflewering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners

Unit/Centre/Focus Area: Water Science and Management (Hydrology and Geohydrology)

Module code: HDGH971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:
1. To have advanced specialist knowledge to enable engagement with and critique of current research or practices in the field of hydrology and geohydrology
2. To develop new methods/techniques/processes/systems in original, creative and innovative ways appropriate to the complex context of hydrology and geohydrology
3. The ability to select appropriate research methodologies and plan an appropriate research design in order to execute a complex research project with a view to obtaining novel solutions to challenging and relevant research problems in the field of hydrology and geohydrology
4. The ability to correctly interpret research results and to effectively communicate such results in the form of scientific papers
5. The ability to produce substantial publishable work that meets international standards because it is considered to be new/innovative
6. The ability to make autonomous ethical decisions during the process of knowledge production, thereby making a critical contribution to the development of ethical standards in the context of research within the field of hydrology and geohydrology.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area:

Module code: ITRW971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:
The student will be able to demonstrate his/her ability to make a definite contribution towards the development of new knowledge and skills in Computer Science and Information Systems by proving mastered knowledge of the theory and principles of the field; the integration of theory and practice in the field; critical analysis of existing knowledge in the field; the undertaking of research according to the accepted methodology in the field; the analysis and interpretation of research data and results; and the reporting of his/her research results in a scientifically acceptable format.

Method of delivering: : Full-time/part-time

Assessment methods:
The student shall submit a thesis on a suitable research topic. Examination of the thesis will take place according to the A rules and the particular faculty rules. The evaluation of the thesis will be determined by the findings of the examiners with regard to: the question whether the

work meets the expectations set in the criteria of scientific contribution to the subject field, originality of content, technical finishing of the thesis, acceptable research methodology and scientific presentation.		
Unit/Centre/Focus Area: Environmental Sciences and Management		
Module code: MKBN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes: 1. Demonstrate expertise and critical knowledge of a specialised area in Microbiology and/or across specialised or applied areas. 2. Demonstrate an ability to develop new methods, techniques or approaches in original, creative and innovative ways appropriate to specialised and complex contexts. 3. Demonstrate the ability to apply specialist knowledge and theory in critically reflexive, creative and novel ways to address complex and unfamiliar problems in a specialised field of Microbiology and/or across applied areas. 4. Demonstrate the ability to make independent judgements about managing incomplete or inconsistent information or data in an iterative process of analysis and synthesis. 5. Demonstrate the ability to produce and communicate the findings of their research in academically appropriate ways. 6. Demonstrate the ability to identify, address and manage emerging ethical issues and advance processes of ethical decision-making; take full responsibility for own work and operate independently.		
Method of delivering: Full-time/part-time		
Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.		
Unit/Centre/Focus Area:		
Module code: NWON971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area: Environmental Science and Management		
Module code: OMWN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes: 1. Demonstrate expertise and critical knowledge in an area at the forefront of environmental sciences and to contribute to scholarly debates around theories and processes of knowledge production in environmental sciences. 2. Demonstrate an ability to develop new methods/techniques/processes/systems to specialised and complex areas of environmental science. 3. Demonstrate an ability to apply specialist knowledge and theory to address complex problems in environmental science. 4. Demonstrate an ability to make independent judgements about managing incomplete/inconsistent information/data in the field of environmental science in an iterative process of analysis and synthesis. 5. Demonstrate an ability to produce substantial, independent, in-depth and publishable work in environmental science. 6. Demonstrate an understanding of theoretical underpinnings in the management of complex environmental scientific systems. 7. Demonstrate an ability to identify, and address emerging ethical issues, to advance processes of ethical decision-making, and to operate independently and responsibly within the context of research in environmental science.		
Method of delivering: Full-time or part-time		
Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by		

internal and external examiners.

Unit/Centre/Focus Area: Environmental Science and Management

Module code: PLKN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:

1. Display expertise and broad knowledge of the botanical field of specialisation (ecology, molecular biology, physiology or taxonomy) in terrestrial or aquatic environments to formulate conduct fundamental research of significance in the primary area of study.
2. Exhibit a critical and advanced understanding of the theoretical underpinnings of research in the field of specialisation to identify, demarcate and critically analyse complex research problems, and to conceptualise and formulate appropriate research questions.
3. Initiate, develop and implement appropriate procedures to collect, process, analyse and manage data to independently address the goals of the study through the application of creative skills (techniques, processes or technologies) and suitable analytical methods to test a research hypothesis.
4. Adopt appropriate, responsible and approved processes of ethical decision-making for knowledge production in the field of specialisation and to monitor and evaluate the consequences of these decisions where appropriate.
5. Produce substantial, in-depth and publishable research that meets international standards, which is considered to be new or innovative by peers, and makes a significant contribution to the discipline and field of specialisation.
6. Demonstrate intellectual independence, research leadership and management of research development in the field of specialisation, and to initiate communication strategies to defend and promote the value of the research.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area: Environmental Science and Management

Module code: SBEL971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:

1. Illustrate an original contribution to knowledge creation within the field of Urban and Regional Planning, by applying advanced subject-specific and integrated planning knowledge and skills in addressing planning issues and in identifying, analysing and solving relevant problems.
2. Illustrate expertise and insight into the nature and objectives of the study, as well as the theoretical and scientific principles that form the basis of the study, in order to conceptualise new research initiatives, and create new knowledge.
3. Illustrate the ability to contribute to scholarly debates around theories and knowledge production within the field of Urban and Regional Planning
4. Illustrate the ability to develop new techniques and analytical methods appropriate to complex planning problems, and the ability to retrieve new knowledge appropriate to specialised and complex Urban and Regional Planning contexts.
5. Illustrate thorough, logical and coherent assessment of the significance of the research findings, including the ability to produce significant insights, apply specialist knowledge and skills acquired in these studies, meaningfully.
6. Illustrate critical and independent thought, demonstrating insight into the challenges and multi-dimensional considerations within the field of Urban and Regional Planning, which makes a significant, publishable contribution to the Urban and Regional Planning discipline.

Method of delivering: Full-time or part-time

Assessment methods: Thesis (100%) will be examined according to the Faculty guidelines by internal and external examiners.

Unit/Centre/Focus Area:		
Module code: STTK971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
• Module-outcomes: • Increased knowledge in the study field of pertaining to the research conducted • Perform relevant literature study through the review of related research • Proper execution and planning of the research program • Conduct independent research • Interpret research results • Communicate research results in the form of a scientific dissertation / article the contribution towards furthering new knowledge and be up to dat eon the latest technology and research methods in planning		
Method of delivering: Full-time or part-time		
Assessment methods: The NWU and Faculty policies for external moderation of research theses has relevance		
Unit/Centre/Focus Area: Unit for Business Mathematics and Informatics		
Module code: TGWS971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module outcomes: Students will have to demonstrate their ability to make a definite contribution towards the development of new knowledge and skills in Applied Mathematics by proving mastered knowledge of the theory and principles of the field; the integration of theory and practice in the field; critical analysis of existing knowledge in the field; the undertaking of research according to the accepted methodology in the field; the analysis and interpretation of research data and results; and the reporting of their research results in a scientifically acceptable format.		
Method of delivering: Not applicable – research project		
Assessment methods: The student shall submit a thesis on a suitable research topic.		
Unit/Centre/Focus Area: Business Mathematics and Informatics		
Module code: WISK971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes: Students will have to demonstrate their ability to make a definite contribution towards the development of new knowledge and skills in Mathematics by proving mastered knowledge of the theory and principles of the field; the integration of theory and practice in the field; critical analysis of existing knowledge in the field; the undertaking of research according to the accepted methodology in the field; the analysis and interpretation of research data and results; and the reporting of their research results in a scientifically acceptable format.		
Method of delivering: Not applicable – research project		
Assessment methods: The student shall submit a thesis on a suitable research topic.		

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