NORTH-WEST UNIVERSITY ®
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

POTCHEFSTROOM CAMPUS

NATURAL SCIENCES

POSTGRADUATE PROGRAMMES

CALENDAR 2016

FACULTY OF NATURAL SCIENCES

POSTGRADUATE

Potchefstroom Campus

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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

Agricultural Economics
Dr PC Cloete, PhD (UFS)

Biochemistry
Prof AA van Dijk, DSc Biochemistry (NWU)

Botany
Dr S Janse van Vuuren, PhD (PU vir CHO)

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
Dr CGCE van Sittert, MSc (PU for CHE), PhD Chemistry (PU for CHE), DTE (PU for CHE), MSc Computational Chemistry (Cardiff University, UK)

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

Geography and Environmental Management
Prof LA Sandham, BSc Ed (RAU), PhD (RAU)

Geology and Soil Science
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 J van den Berg , PhD (UOVS)

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	Agricultural Economics Botany Microbiology Zoology
Physical and Chemical Sciences	Biochemistry Chemistry Physics
Geo- and Spatial Sciences	Geography and Environmental Studies Geology and Soil Science 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, Chemical Resource Beneficiation
g) Focus Area: 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 Degrees

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 / Curricula	Qualification/ Curriculum Codes
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Biochemistry**	**202156**
	Biochemistry	N650P
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

Qualification; Abbreviation	Programme / Curricula	Qualification/ Curriculum Codes
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
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Quantitative Risk Management**	**202127**
	Quantitative Risk Management (following on BSc N134P or N137P)	N610P
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Financial Mathematics**	**202128**
	Financial Mathematics (following on BSc N135P)	N611P
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Data Mining**	**202129**
	Data Mining (following on BSc N134P, N136P)	N612P
Honours Baccalaureus Scientiae; Hons BSc	**Programme: Environmental Sciences**	**202124**
	Geography and Environmental Management	N648P
	Ecological Remediation and Sustainable Management	N641P
	Biodiversity and Conservation Ecology	N642P
	Aquatic Ecosystem Health	N643P
	Plant Protection	N644P
	Environmental Geology	N646P
	Hydrology	N647P
	Waste Management	N649P
Honours Baccalaureus Commercii; Hons BCom	**Programme: Computer Science and Information Systems**	**504143**
	Computer Science-Information Systems	N658P

Qualification; Abbreviation	Programme / Curricula	Qualification/ Curriculum Codes
Magister Scientiae; MSc (following Hons BSc)	**Programme: Computer Science**	**203155**
	Computer Science	N861P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Statistics**	**203156**
	Statistics	N862P
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
Magister Scientiae; MSc (following Hons BSc)	**Programme: Space Physics**	**203128**
	Physics	N866P
	Astro Physics and Space Science	N867P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Chemistry**	**203123**
	Chemistry	N868P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Biochemistry**	**203132**
	Biochemistry	N869P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Environmental Sciences**	**203194**
	Environmental Sciences	N830P
	Chemistry	N831P
	Hydrology and Geohydrology	N832P

Magister Scientiae; MSc (following Hons BSc)	**Programme: Zoology**	**203190**
	Zoology	N826P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Microbiology**	**203191**
	Microbiology	N827P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Botany**	**203192**
	Botany	N828P
Magister Scientiae; MSc (following Hons BSc)	**Programme: Geography and Environmental management**	**203193**
	Geography and Environmental Management	N829P
Magister Scientiae; MSc	**Science Education**	**203134**
	Science education	N860P
Master's in Environmental Management (following on BSc (Hons))	**Programme: Environmental Management**	**218106**
	Environmental Management	N824P
Magister Commercii; MCom (following on BCom Hons))	**Programme: Computer Science and Information Systems**	**505138**
	Computer Science and Information Systems	N870P
Magister Artium et Scientiae (Planning); MArt et Scien	**Programme: Urban and Regional Planning**	**119102**
	Urban and Regional Planning	N825P
Magister Scientiae in Agriculture	**Programme: Agriculture in economics**	**277103**
	Agriculture in economics	N873P

Qualification; Abbreviation	Programme / Curricula	Qualification/ Curriculum Codes
Philosophiae Doctor; PhD	**Programme: Computer Science**	**204132**
	Computer Science	N901P
Philosophiae Doctor; PhD	**Programme: Statistics**	**204138**
	Statistics	N902P
Philosophiae Doctor; PhD	**Programme: Applied Mathematics**	**204139**
	Applied Mathematics	N903P
Philosophiae Doctor; PhD	**Programme: Mathematics**	**204140**
	Mathematics	N904P
Philosophiae Doctor; PhD	**Programme: Business Mathematics and Informatics**	**204111**
	Business Mathematics	N905P
Philosophiae Doctor; PhD	**Programme: Risk Analytics**	**204133**
	Risk Analysis	N915P
Philosophiae Doctor; PhD	**Programme: Space Physics**	**204112**
	Physics	N906P
Philosophiae Doctor; PhD	**Programme: Chemistry**	**204120**
	Chemistry	N907P
Philosophiae Doctor; PhD	**Programme: Environmental Sciences**	**204114**
	Environmental Sciences	N914P
	Chemistry	N916P
	Hydrology and Geohydrology	N917P
Philosophiae Doctor; PhD	**Programme: Zoology**	**204136**
	Zoology	N908P
Philosophiae Doctor; PhD	**Programme: Geography and Environmental Management**	**204137**
	Geography and Environmental Management	N909P
Philosophiae Doctor; PhD	**Programme: Microbiology**	**204113**
	Microbiology	N910P
Philosophiae Doctor; PhD	**Programme: Botany**	**204134**
	Botany	N911P
Philosophiae Doctor; PhD	**Programme: Urban and Regional Planning**	**204115**
	Urban and Regional Planning	N912P
Philosophiae Doctor; PhD	**Programme: Agriculture, Economics**	**204128**
	Agriculture, economics	N922P
Philosophiae Doctor; PhD	**Programme: Biochemistry**	**204116**
	Biochemistry	N913P
Philosophiae Doctor; PhD	**Science Education**	**204118**
	Science Education	N921P

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) A four year BSc or Hons BSc 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 HONOURS BACHELOR OF SCIENCE

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 is 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 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.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 N137P
N611P	N135P
N612P	N134P or N136P

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:

a) 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;

b) 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;

b) 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;

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

d) 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;

b) 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.

N.2.7 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.2.8 PROGRAMME: BIOCHEMISTRY

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202156

N.2.8.1 Curriculum N650P: Biochemistry

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	Bio-molecular Interactions	24
BCHN671	Project	32
	Total number of credits	**128**

N.2.9 PROGRAMME: CHEMISTRY

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202117

N.2.9.1 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 clarification	8
CHEM623	Environmental chemistry	8
CHEM624	Techniques for organic synthesis	8
CHEM626	Electrochemistry	8
	Total number of credits	**128**

N.2.10 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.**

N.2.10.1 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.2.11 PROGRAMME: COMPUTER SCIENCE AND INFORMATION SYSTEMS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202134

N.2.11.1 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.2.12 PROGRAMME: STATISTICS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202135

N.2.12.1 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.2.13 PROGRAMME: APPLIED MATHEMATICS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202136

N.2.13.1 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), financial sector, mining, engineering firms, programmers, business analysts, data analysts, weather and environmental modelling.

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 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 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.2.14 PROGRAMME: MATHEMATICS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES
Qualification code: 202137

N.2.14.1 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 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 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**

Please note: Students who fail year modules WISN672/673/674/675 in 2013, will enroll for both corresponding semester modules.

N.2.15 PROGRAMME: ACTUARIAL SCIENCES

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 202126

N.2.15.1 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.2.16 PROGRAMME: QUANTITATIVE RISK MANAGEMENT

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 202127

N.2.16.1 Curriculum N610P: Quantitative Risk Management (following on BSc N134P 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		
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 curriculum		**148**

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

N.2.17 PROGRAMME: FINANCIAL MATHEMATICS

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 202128

N.2.17.1 Curriculum N611P: Financial Mathematics (following on BSc N135P)

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		
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 curriculum		**144**

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

N.2.18 PROGRAMME: DATA-MINING

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

N.2.18.1 Qualification code: 202129: Curriculum N612P: Data Mining (following on BSc N134P or N136P)

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.2.19 PROGRAMME: ENVIRONMENTAL SCIENCES

SCHOOLS: BIOLOGICALSCIENCES AND GEO- AND SPATIAL SCIENCES

Qualification code: 202124

N.2.19.1 Curriculum N648P: Geography and Environmental Management

SCHOOL: GEO- AND SPATIAL SCIENCES

This curriculum 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
OMBE621	Hydrology (full-time only)	2	16
OMBO678	Environmental Management I	Year	20
OMBO679	Environmental Analysis I	Year	20
GGFS671	Introduction to Earth Observation	Year	20
GGFS672	Air pollution	Year	20
~~PUMA612*~~	~~Public Management and Leadership~~	~~1~~	~~16~~
~~PUMA623*~~	~~Municipal Management~~	~~2~~	~~16~~
		Total elective modules	**72**
Total Curriculum			**128**

*These modules will not be available as electives for 2016 registration.

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 1 but the credit load will be distributed over the whole year.

N.2.19.2 Curriculum N641P: Ecological Remediation and Sustainable Management

SCHOOL: BIOLOGICAL SCIENCES

a) Faculty specific rules for the curriculum

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 curriculum is compiled from the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMSE612	Introduction to Landscape Ecology	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**
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
OMSE621	Restoration of degraded ecosystems	2	16
OMSE622	Urban Ecology	2	16
OMSE623	Plant ecophysiology and stress physiology	2	16
OMSE624	Plant growth and -development	2	16
OMSE625	Advanced Ecotoxicology	2	16
OMSE626	Microbial Ecology	2	16
	Total elective modules		**64**
Total Curriculum			**128**

N.2.19.3 Curriculum N642P: Biodiversity and Conservation Ecology

SCHOOL: BIOLOGICAL SCIENCES

a) Faculty specific rules for the curriculum

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 curriculum is compiled from the following modules:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMWB611	Biodiversity: past, present and future tendencies	1	16
OMSB611	Conservation Ecology	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**
OMSB612	Systematics in practice	1	16
OMSE612	Introduction to Landscape Ecology	1	16
OMBO613	Introduction to GIS	1	16
OMSB621	Bio-informatics	2	16
OMSB622	Evolutionary Biology and Ethology	2	16
OMSB623	Biogeography	2	16
OMSB624	Biodiversity Planning	2	16
OMSB625	Biomonitoring and Risk Assessment	2	16
OMSE621	Restoration of degraded ecosystems	2	16
OMSP621*	Biodiversity and population dynamics in agricultural ecosystems	2	16
	Total elective modules		**48**
Total Curriculum			**128**

***** OMSP621 not available for selection in 2016.

N.2.19.4 Curriculum N643P: Aquatic Ecosystem Health

SCHOOL: BIOLOGICAL SCIENCES

a) Faculty specific rules for the curriculum

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 curriculum consists of the following modules divided into two semesters:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
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		**80**
Elective modules			
Student selects THREE of the following modules in consultation with programme manager, research mentor and School Director			
Module code		**Semester**	**Cr**
OMWW614*	Waterborne diseases*	1	16
OMWW616	Estuarine and near shore marine ecology	1	16
OMWW629	Water purification and treatment	2	16
OMSW622**	Phycology**	2	16
OMBE621	Hydrology (full-time only)	2	16
OMSW624	Environmental Hydrology (full-time only)	2	16
OMSB621	Bio-informatics	2	16
OMSE626	Microbial ecology	2	16
	Total elective modules		**48**
Total Curriculum			**128**

* Prior knowledge in parasitology and epidemiology is a prerequisite

** This module 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.2.19.5 Curriculum N644P: Plant Protection

SCHOOL: BIOLOGICAL SCIENCES

a) Faculty specific rules for the curriculum

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 curriculum consists of the following modules divided into two semesters:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMSP611	Principles of integrated pest management	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**
OMWP611*	Pest phenology and damage symptoms*	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
OMSP625	Nematode/plant interactions and control	2	16
OMSB621	Bio-informatics	2	16
OMSA622	Weeds: interactions and control	2	16
OMSA623	Plant pathology	2	16
	Total elective modules		**64**
Total Curriculum			**128**

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

N.2.19.6 Curriculum N646P: Environmental Geology

SCHOOL: GEO- AND SPATIAL SCIENCES

a) Faculty specific rules for the curriculum

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 curriculum consists of the following modules divided into two semesters:

Compulsory modules			
Module code	**Descriptive name**	**Semester**	**Cr**
OMBO611	Introduction to Environmental Management	1	16
OMSG611	Environmental geochemistry (full-time only, GLGN 112 is a pre-requisite 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		**80**
Elective modules			
Student selects THREE of the following modules in consultation with programme manager, research mentor and School Director			
Module code	**Module name**	**Semester**	**Cr**
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 is a pre-requisite for this module)	2	16
OMSG622	Applied environmental geology (GLGN 112 is a pre-requisite for this module)	2	16
OMSE621	Restoration of degraded ecosystems	2	16
	Total compulsory modules		**48**
Total Curriculum			**128**

N.2.19.7 Curriculum N647P: Hydrology

CENTRE: WATER SCIENCE AND MANAGEMENT

Qualification code: 202124

a) Faculty specific rules for the curriculum

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 curriculum 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 112is a pre-requisite for this module)	1	16
	Total compulsory modules in the first semester		**32**
Second Semester			
OMBE621	Hydrology	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 curriculum			**128**

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

N.2.19.8 Curriculum N649P: Waste Management

SCHOOL: GEO- AND SPATIAL SCIENCES

Qualification code: 202124

This curriculum 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 Curriculum			**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.2.20 EXAMINATION

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

N.2.20.1 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.2.20.2 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.2.20.3 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.2.20.4 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.2.20.5 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.2.20.6 Unsatisfactory academic performance

General Rule 2.4.7 and 2.4.8 is applicable here.

N.3 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.3.1 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.3.2 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.3.3 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.3.4 STUDY PROGRAMMES

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

N.3.5 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.3.6 PROGRAMME: COMPUTER SCIENCE-INFORMATION SYSTEMS

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 504143

N.3.6.1 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.3.7 EXAMINATION

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

See N2.20.

N.4 RULES FOR THE DEGREE MAGISTER SCIENTIAE

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.4.1 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
	Physics	Space Research
School of Biological Sciences	Agricultural Economics Botany Microbiology Zoology	Environmental Sciences and Management

SCHOOL/CENTRE	SUBJECT GROUP	RESEARCH ENTITY
School of Geo- and Spatial Sciences	Geography and Environmental Management Geology and Soil Science 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.4.2 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.4.3 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.4.4 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.4.5 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.4.6 ARTICULATION POSSIBILITIES

a) 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.

b) 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.

c) 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.

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

N.4.7 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.4.8 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.4.8.1 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.4.8.2 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.4.8.3 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.4.8.4 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.4.8.5 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.4.8.6 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.4.8.7 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.4.8.8 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.4.8.9 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.4.9 PROGRAMMES IN THE RESEARCH UNIT FOR BUSINESS MATHEMATICS AND INFORMATICS AND THE CENTRE FOR BUSINESS MATHEMATICS AND INFORMATICS

N.4.9.1 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.4.9.2 Programme-specific articulation possibilities

N.4.9.2.1 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.4.9.2.2 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.4.10 PROGRAMME: COMPUTER SCIENCE

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS
Qualification code: 203155

N.4.10.1 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.4.11 PROGRAMME: STATISTICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203156

N.4.11.1 Curriculum N862P: Statistics

This curriculum 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	**180**

N.4.12 PROGRAMME: APPLIED MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203157

N.4.12.1 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:		
~~TGWS874**~~	~~Numerical Analysis~~	~~32~~
~~TGWS875**~~	~~Modelling of Financial Systems~~	~~32~~
~~TGWS876**~~	~~Optimization of Financial Systems~~	~~32~~
~~TGWS877**~~	~~Advanced Optimization~~	~~32~~
~~TGWS878**~~	~~Control Theory of Mechanical Systems~~	~~32~~
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**

** Phasing out: From Jan 2016-Terminate Dec 2016. Pipeline students will be accommodated on an ad hoc basis.

N.4.13 PROGRAMME: MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203158

N.4.13.1 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:		
~~WISN874**~~	~~Operator theory~~	~~32~~
~~WISN875**~~	~~Functional analysis~~	~~32~~
~~WISN876**~~	~~Riesz space theory~~	~~32~~
~~WISN877**~~	~~Topological vector spaces~~	~~32~~
~~WISN878**~~	~~Advanced linear algebra~~	~~32~~
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**

** Phasing out: From Jan 2016-Terminate Dec 2016. Pipeline students will be accommodated on an ad hoc basis.

N.4.14 PROGRAMME: QUANTITATIVE RISK MANAGEMENT

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203181

N.4.14.1 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.4.15 PROGRAMME: FINANCIAL MATHEMATICS

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203182

N.4.15.1 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.4.16 PROGRAMME: BUSINESS MATHEMATICS AND INFORMATICS

(With Specialisation in Business Analytics)

CENTRE: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203183

N.4.16.1 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.4.17 PROGRAMME: BUSINESS MATHEMATICS AND INFORMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203127

N.4.17.1.1 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.4.18 PROGRAMME: SPACE PHYSICS

CENTRE: SPACE RESEARCH

Qualification code: 203128

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.

N.4.18.1 Curriculum N866P: Physics

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 school director one of the following: Space Physics or Nuclear Physics or Solid State Physics.

N.4.18.2 Curriculum N867P: Astrophysics and Space science

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 the 12 and 24 credit 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
FSKB876	Current topics in Cosmology	12
FSKB877	Cataclysmic variables	12
FSKB878	Extragalactic astronomy and galactic dynamics	12
FSKB879	Advanced General Relativity	12
FSKB880	High energy astrophysics and pulsars	12
FSKB881	General Astrophysics 1	24
FSKB882	Stellar structure and -evolution	12
FSKB883	Observation techniques	12
FSKB884	Space technology	24
FSKB885	Geomagnetism and Aeronomy	12
FSKB886	Computational Astrophysics	12
Elective modules		**60**
Compulsory module		
FSKS872	Dissertation	132
	Total number of credits	**192**

N.4.19 PROGRAMME: CHEMISTRY

FOCUS AREA: CHEMICAL RESOURCE BENEFICIATION

Qualification code: 203123

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

N.4.19.1 Curriculum N868P: 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.4.20 PROGRAMME: BIOCHEMISTRY

CENTRE: HUMAN METABOLOMICS

Qualification code: 203132

N.4.20.1 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 study

N.4.21 PROGRAMME: ENVIRONMENTAL SCIENCES

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203194

This curriculum 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) Environmental management: environmental analysis, environmental hydrology, determining environmental impact, environmental economy, geographic information systems, integrated environmental management; distance observation.

b) Ecological remediation and sustainable utilisation: Anthropogenetic environmental impacts, bio-remediation, sustainable utilisation; environmental remediation and restoration, ecophysiology, ecotoxicology; plant and animal parasitism, urban ecology.

c) Water sciences and management: Phycology, industrial microbiology and fermentation biotechnology, water health, paracitology and epidemiology; water management and water purification, water treatment, aquatic ecotoxicology, aquatic ecophysiology, microbic ecology, biodiversity and limnology.

d) Biodiversity and Conservation Biology: threatened species, conservation management, biodiversity studies, biodiversity collections, biogeography, demography, ecology, evolution, phylogenetics, behaviour ecology, genome analysis, monitoring and taxonomy.

e) Plant protection: pest phenology, damage symptoms, principles of integrated pest management, levels of harmfulness, threshold values, biodiversity, population ecology in agricultural systems, Insecta, Acari and Nematoda.

N.4.21.1 Curriculum N830P: Environmental Sciences (Full-time and Part-time)

This curriculum is composed of the following:

Module code	Descriptive name	Credits
OMWN871	Dissertation	180
	Total credits for the curriculum	**180**

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

N.4.21.2 Curriculum N831P: Chemistry

This curriculum is composed of the following:

Module code	Descriptive name	Credits
CHEM871	Dissertation	180
	Total credits for the curriculum	**180**

N.4.22 PROGRAMME: ENVIRONMENTAL SCIENCES

CENTRE: WATER SCIENCE AND MANAGEMENT

Qualification code: 203194

N.4.22.1 Curriculum N832P: Hydrology and Geohydrology (Full-time and Part-time)

In this programme research can be conducted on any area in Hydrology and Geohydrology, although the School retains the right not to accept a candidate in instances where there does not exist sufficient capacity in the School of Geo- and Spatial Sciences.

This curriculum is composed of the following:

Module code	Descriptive name	Credits
HDGH871	Dissertation	180
	Total credits for the curriculum	**180**

N.4.23 PROGRAMME: ZOOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203190

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

N.4.23.1 Curriculum N826P: Zoology (Full-time and Part-time)

This curriculum is composed of the following:

Module code	Descriptive name	Credits
DRKN871	Dissertation	180
	Total credits for the curriculum	**180**

N.4.24 PROGRAMME: GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203193

In this programme research can be conducted on any aspect of Geography and environmental management, although the School 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

N.4.24.1 Curriculum N829P: Geography and Environmental Management (Full-time and Part-time)

This curriculum is composed of the following:

Module code	Descriptive name	Credits
GGFN871	Dissertation	180
	Total credits for the curriculum	**180**

N.4.25 PROGRAMME: MICROBIOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203191

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

N.4.25.1 Curriculum N827P: Microbiology (Full-time and Part-time)

This curriculum is composed of the following:

Module code	Descriptive name	Credits
MKBN871	Dissertation	180
	Total credits for the curriculum	**180**

N.4.26 PROGRAMME: BOTANY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203192

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

N.4.26.1 Curriculum N828P: Botany (Full-time and Part-time)

This curriculum is composed of the following:

Module code	Descriptive name	Credits
PLKN871	Dissertation	180
	Total credits for the curriculum	**180**

N.4.27 PROGRAMME: SCIENCE EDUCATION

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 203134

N.4.27.1 Curriculum N860P: Science Education

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.4.28 EXAMINATION

N.4.28.1 Exams

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

N.4.28.2 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.4.28.3 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.4.28.4 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.4.28.5 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.4.28.6 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.5 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 English only.

N.5.1 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.5.2 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.5.3 ASSUMED PRIOR LEARNING

The student has already obtained an honours baccalaureus degree in Geography and Environmental 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.5.4 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.5.5 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.5.6 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.5.7 EXIT LEVEL OUTCOMES

N.5.7.1 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.5.7.2 Specific exit level outcomes

N.5.7.2.1 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.5.7.2.2 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.5.7.2.3 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.5.8 PROGRAMME: ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 218106

N.5.8.1 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 September of the previous year.

N.5.8.2 Curriculum N824P: Environmental Management (following on a relevant honours degree)

The curriculum consists of:

Module code	Descriptive name	Credits
Elective modules		
Select in consultation with the research director TWO of the following modules:		
OMBO878	Environmental Management 2	40
OMBO879	Environmental Analysis 2	40
OMBO880	Management of Ecological Drivers in Aquatic Systems	40
OMBO881	Management of Ecological Responders in Equatic Systems	40
Mini dissertation		
OMBO873	Mini dissertation	100
	Total of credits of the curriculum	**180**

N.5.9 EXAMINATION

N.5.9.1 Exams

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

N.5.9.2 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.5.9.3 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.5.9.4 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.5.9.5 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.5.9.6 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.6 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.6.1 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.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 Rules, a student may apply for an extension of the study period.

N.6.3 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.6.4 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.6.5 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.6.6 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.6.7 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.6.8 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.6.8.1 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.6.8.2 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.6.9 PROGRAMME: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 505138

N.6.9.1 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
ITRW879	Integer Programming	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.6.10 EXAMINATION

N.6.10.1 Exams

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

N.6.10.2 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.6.10.3 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.6.10.4 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.6.10.5 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.6.10.6 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.7 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.7.1 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.7.2 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.7.3 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.7.4 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.7.5 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.7.6 ARTICULATION POSSIBILITIES

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

N.7.7 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.7.8 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.

g) On completion of this degree the student may apply for membership of the professional association of planners in South Africa, viz. the South African Council for Town and Regional Planners.

N.7.9 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.

No article option will be considered due to the professional nature of the programme. 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.

N.7.10 PROGRAMME: URBAN AND REGIONAL PLANNING

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANGEMENT

Qualification code: 119102

N.7.10.1 Curriculum N825P: Urban and Regional Planning (Full-time or Part-time)

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

N.7.11 EXAMINATION

N.7.11.1 Exams

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

N.7.11.2 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.7.11.3 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.7.11.4 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.7.11.5 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.7.11.6 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.8 RULES FOR THE DEGREE MASTER OF SCIENCE IN AGRICULTURE IN 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.8.1 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.8.2 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.8.3 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.8.4 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.8.5 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.8.6 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.8.7 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.8.8 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.8.9 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.8.10 PROGRAMME: AGRICULTURE IN ECONOMICS

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 277103

N.8.10.1 Curriculum N873P: Agriculture in economics (Full-time or Part-time)

Module code	Descriptive name	Credits
ECOM871	Dissertation	240
	Total of credits for curriculum	**240**

N.8.11 EXAMINATION

N.8.11.1 Exams

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

N.8.11.2 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.8.11.3 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.8.11.4 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.8.11.5 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.8.11.6 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.9 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.9.1 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
	Physics	Space Research
School of Biological Sciences	Agricultural Economics Botany Microbiology Zoology	Environmental Sciences and Management
School of Geo- and Spatial Sciences	Geography and Environmental Management Geology and Soil Science 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.9.2 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.9.3 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.9.4 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.9.5 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.9.6 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.9.7 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.9.8 PROGRAMME: COMPUTER SCIENCE

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204132

N.9.8.1 Curriculum N901P: Computer Science

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
ITRW971	Thesis	360

N.9.9 PROGRAMME: STATISTICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204138

N.9.9.1 Curriculum N902P: Statistics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
STTK971	Thesis	360

N.9.10 PROGRAMME: APPLIED MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204139

N.9.10.1 Curriculum N903P: Applied Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
TGWS971	Thesis	360

N.9.11 PROGRAMME: MATHEMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS
Qualification code: 204140

N.9.11.1 Curriculum N904P: Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
WISK971	Thesis	360

N.9.12 PROGRAMME: BUSINESS MATHEMATICS AND INFORMATICS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204111

N.9.12.1 Curriculum N905P: Business Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BWIN971	Thesis	360

N.9.13 PROGRAMME: RISK ANALYSIS

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204133

N.9.13.1 Curriculum N915P: Risk Analysis

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BWIR971	Thesis	360

N.9.14 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) TeV-gamma ray astronomy
b) Radio 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.9.14.1 Curriculum N906P: Physics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
FSKN971	Thesis	360

N.9.15 PROGRAMME: CHEMISTRY

RESEARCH UNIT: CHEMICAL RESOURCE BENEFICIATION

Qualification code: 204120

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

N.9.15.1 Curriculum N907P: Chemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
CHEN971	Thesis	360

N.9.16 PROGRAMME: ENVIRONMENTAL SCIENCES

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204114

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) Environmental management: environmental analysis, environmental hydrology, determination of environmental impact, environmental economy, geographic information systems, integrated environmental management, distance observation.

b) Ecological remediation and sustainable utilisation: Anthropogenic environmental impacts, bioremediation, sustainable utilisation, environmental remediation and restoration, ecophysiology, ecotoxicology, plant and animal paracitism, urban ecology.

c) Water sciences and management: Psychology, industrial microbiology and fermentation-biotechnology, water health, paracitology and epidemiology, water management and water purification, water treatment, aquatic ecotoxicology, aquatic ecophysiology, microbic ecology, biodiversity and limnology.

d) Biodiversity and Conservation Biology: threatened species, conservation management, biodiversity studies, biodiversity collections, biogeography, demography, ecology, evolution, phylogenetics, behaviour ecology, genome analysis, monitoring and taxonomy.

e) Plant protection: pest phenology, damage symptoms, principles of integrated pest management, levels of harmfulness, threshold values, biodiversity, population ecology in agricultural systems, Insecta, Acari and Nematoda.

N.9.16.1 Curriculum N914P: Environmental sciences

Module code	Descriptive name	Credits
OMWN971	Thesis	360

N.9.16.2 Curriculum N916P: Chemistry

This curriculum is composed of the following:

Module code	Descriptive name	Credits
CHEM971	Thesis	360

PROGRAMME: ENVIRONMENTAL SCIENCES

CENTRE: WATER SCIENCE AND MANAGEMENT

Qualification code: 204114

N.9.16.3 Curriculum N917P: Hydrology and Geohydrology

This curriculum is composed of the following:

Module code	Descriptive name	Credits
HDGH971	Thesis	360

N.9.17 Programme: ZOOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204136

This curriculum 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 school retains the right not to accept a candidate in instances where there is not sufficient capacity in the School of Biological Sciences.

N.9.17.1 Curriculum N908P: Zoology

This curriculum is composed of the following:

Module code	Descriptive name	Credits
DRKN971	Thesis	360

N.9.18 PROGRAMME: GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204137

This curriculum 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 school 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

N.9.18.1 Curriculum N909P: Geography and Environmental Management

This curriculum is composed of the following:

Module code	Descriptive name	Credits
GGFN971	Thesis	360

N.9.19 PROGRAMME: MICROBIOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204135

This curriculum 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 school retains the right not to accept a candidate in instances where there is not sufficient capacity in the School of Biological Sciences.

N.9.19.1 Curriculum N910P: Microbiology

This curriculum is composed of the following:

Module code	Descriptive name	Credits
MKBN971	Thesis	360

N.9.20 PROGRAMME: BOTANY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204134

This curriculum 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 school retains the right not to accept a candidate in instances where there is not sufficient capacity in the School of Biological Sciences.

N.9.20.1 Curriculum N911P: Botany

This curriculum is composed of the following:

Module code	Descriptive name	Credits
PLKN971	Thesis	360

N.9.21 PROGRAMME: URBAN AND REGIONAL PLANNING

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204115

N.9.21.1 Curriculum N912P: Urban and Regional Planning

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
SBEL971	Thesis	360

N.9.21.2 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.9.22 PROGRAMME: AGRICULTURE, ECONOMICS

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT
Qualification code: 204128

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.

N.9.22.1 Curriculum N922P: Agriculture, Economics

Module Code	Descriptive Name	Credits
ECOM971	Thesis	360

N.9.23 PROGRAMME: BIOCHEMISTRY

CENTRE: HUMAN METABOLOMICS

Qualification Code: 204116

N.9.23.1 Curriculum N913P: Biochemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BCHN971	Thesis	360

N.9.24 PROGRAMME: SCIENCE EDUCATION

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204118

N.9.24.1 Curriculum N921P: Science Education

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.9.25 EXAMINATIONS

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.9.26 PASS REQUIREMENTS

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

N.10 MODULE LIST

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	Bio-molecular Interactions	24	8
BCHN671	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 I	16	8
BWIN621	Quantitative Risk Analysis	16	8
BWIN622	Pricing of Derivatives A	16	8
BWIN623	Financial Engineering II	16	8
BWIN625	Financial Modelling II	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	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
CHEN623	Membrane science and technology	8	8

Module code Honours	Descriptive name	Credits	NQF-level
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
OMBE621	Hydrology	16	8
OMBE622	Applied Hydrology	16	8
OMBE623	Groundwater Geology	16	8
OMBE624	Geohydrology	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
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
OMSB612	Systematics in practice	16	
OMSB621	Bio-informatics	16	8
OMSB622	Evolutionary Biology and Ethology	16	8
OMSB623	Biogeography	16	8
OMSB624	Biodiversity Planning	16	8
OMSB625	Biomonitoring and Risk Assessment	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
OMSE623	Plant ecophysiology and stress physiology	16	8

Module code Honours	Descriptive name	Credits	NQF-level
OMSE624	Plant growth and -development	16	8
OMSE625	Advanced Ecotoxicology	16	8
OMSE626	Microbial Ecology	16	8
OMSE674	Research Project	32	8
OMSG611	Environmental geochemistry (full-time only, GLGN 112 is a pre-requisite for this module)	16	8
OMSG621	Environmental Mineralogy (GLGN 112 is a pre-requisite for this module)	16	8
OMSG622	Applied environmental geology (GLGN 112 is a pre-requisite for this module)	16	8
OMSP611	Principles of integrated pest management	16	8
OMSP621	Biodiversity and population dynamics in agricultural ecosystems	16	8
OMSP622	GM crops and integrated pest management	16	8
OMSP623	Nematodes and crops	16	8
OMSP624	Arthropoda/plant interactions	16	8
OMSP625	Nematode/plant interactions and control	16	8
OMSW611	Aquatic Ecosystems: Pollution and Ecotoxicology	16	8
OMSW622	Phycology	16	8
OMSW624	Environmental Hydrology	16	8
OMWB611	Biodiversity: past, present and future tendencies	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	Waterborne diseases*	16	8
OMWW616	Estuarine and near shore marine ecology	16	8
OMWW629	Water purification and treatment	16	8

Module code Honours	Descriptive name	Credits	NQF-level
~~PUMA612~~	~~Public Management and Leadership~~	~~16~~	~~8~~
~~PUMA623~~	~~Municipal Management~~	~~16~~	~~8~~
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

Module code Honours	Descriptive name	Credits	NQF-level
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
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

Module code Magister Sc	Descriptive name	Credits	NQF-level
BCHN872	Dissertation	135	9
BCHN877	Advanced Biochemistry	45	9
BWIA811	Enterprise-wide Risk Management	16	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
BWIB826	Industry Directed Research Project	80	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
ECOM871	Dissertation	240	9

Module code Magister Sc	Descriptive name	Credits	NQF-level
FSKB874	Plasma Physics	12	9
FSKB875	Magnetohydrodynamics	12	9
FSKB876	Current topics in Cosmology	12	9
FSKB877	Cataclysmic variables	12	9
FSKB878	Extragalactic astronomy and galactic dynamics	12	9
FSKB879	Advanced General Relativity	12	9
FSKB880	High energy astrophysics and pulsars	12	9
FSKB881	General Astrophysics 1	24	9
FSKB882	Stellar structure and -evolution	12	9
FSKB883	Observation techniques	12	9
FSKB884	Space technology	24	9
FSKB885	Geomagnetism and Aeronomy	12	9
FSKB886	Computational Astrophysics	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
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
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
****Phased out Jan-Dec 2016**			
~~TGWS874**~~	~~Numerical Analysis~~	~~32~~	~~9~~
~~TGWS875**~~	~~Modelling of Financial Systems~~	~~32~~	~~9~~
~~TGWS876**~~	~~Optimization of Financial Systems~~	~~32~~	~~9~~
~~TGWS877**~~	~~Advanced Optimization~~	~~32~~	~~9~~
~~TGWS878**~~	~~Control Theory of Mechanical Systems~~	~~32~~	~~9~~

Module code Magister Sc	Descriptive name	Credits	NQF-level
TGWN872	Dissertation	100	9
TGWN881	Applicable Analysis I		
TGWN882	Applicable Analysis II		
TGWN883	Modelling I		
TGWN884	Modelling 2		
TGWN887	Principles and Paradigms:Applied Mathematics	32	9
****Phased out Jan-Dec 2016**			
~~WISN874**~~	~~Operator theory~~	~~32~~	~~9~~
~~WISN875**~~	~~Functional analysis~~	~~32~~	~~9~~
~~WISN876**~~	~~Riesz space theory~~	~~32~~	~~9~~
~~WISN877**~~	~~Topological vector spaces~~	~~32~~	~~9~~
~~WISN878**~~	~~Advanced linear algebra~~	~~32~~	~~9~~
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**
BCHN971	Thesis	360	10
BWIN971	Thesis	360	10
BWIR971	Thesis	360	10
CHEN971	Thesis	360	10
CHEM971	Thesis	360	10
DRKN971	Thesis	360	10
ECOM971	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.11 MODULE OUTCOMES

N.11.1 HONOURS

School: Biological Sciences	**Subject Group: Biochemistry**	
Module code: BCHN611	**Semester 1**	**NQF-Level: 8**
Title: **Analytical Biochemistry**		
Module-outcomes: (a) **Knowledge**: Basic knowledge of general laboratory practice, variety of available analytical techniques, the application of separation techniques such as chromatography and electrophoresis, and identification techniques such as a variety of ionisation possibilities in mass spectrometry. In addition, students should have a basic knowledge of relevant techniques in the field of immunology and cell biology and the use of radioactive isotopes. The basic techniques used in molecular biology such as cloning, plasmids, DNA sequencing, polymerisation chain reaction and mutation detection are also important. (b) **Skills**: Upon completion of this module students will be able to find relevant scientific literature on analytical techniques for biochemistry and be able to perform the basic techniques for biochemistry research. (c) **Values**: At the end of this module, the students will be familiar with the field of application of analytical biochemistry and informed about ethical issues in the selection and application of specific techniques. Integrity and reliability are especially important..		
Method of delivering: Full Time		
Assessment methods: Assignments, oral presentations, tests (100%).		
School: Biological Sciences	**Subject Group: Biochemistry**	
Module code: BCHN612	**Semester 1**	**NQF-Level: 8**
Title: **Advanced Metabolism**		
Module-outcomes: (a) **Knowledge**: Upon completion of this module, the student will have an in-depth knowledge of the basic and emerging themes in metabolism. (b) **Skills**: Upon completion of this module students will be able to find relevant scientific literature and utilize it in a literature study and the execution of an oral presentation. (c) **Values:** At the end of this course students will be able to identify ethical issues in metabolism (theory and applications) and communicate their own point of view as well as those of the scientific, medical and general communities.		
Method of delivering: Full Time		
Assessment methods: Werkopdragte, mondelinge aanbiedings & toetse 30% Eksamen 70% Die eksamen kan uit een of meer van die volgende bestaan: een vraestel; ‘n voorbereide en/of onvoorbereide wetenskaplike artikel; oopboek eksamen.		

School: Biological Sciences	Subject Group: Biochemistry	
Module code: BCHN621	**Semester 2**	**NQF-Level: 8**

Title: **Advanced Molecular Biology**

Module-outcomes:

(a) **Knowledge**: Upon completion of this module, the student will have an in-depth knowledge of the basic and modern/emerging themes in molecular biology.

(b) **Skills**: Upon completion of this module students will be able to find relevant scientific literature and utilize it in a literature study and the execution of an oral presentation.

(c) **Values:** At the end of this course students will be able to identify ethical issues in molecular biology (theory and applications) and communicate their own point of view as well as those of the scientific, medical and general communities.

Method of delivering: Full Time

Assessment methods:
Assignments, oral presentations & tests (30%)

Examination (70%)

The examination may consist of one or more of the following: paper; a prepared and/or unprepared scientific article; open book exam.

School: Biological Sciences	Subject Group: Biochemistry	
Module code: BCHN622	**Semester 2**	**NQF-Level: 8**

Title: **Bio-molecular Interactions**

Module-outcomes:

(a) **Knowledge**: Upon completion of this module, the student will have an in-depth knowledge of energy metabolism (bioenergetics), mitochondrial genetics, processes that initiate cell death and cell signal mechanisms.

(b) **Skills**: Upon completion of this module students will be able to find relevant scientific literature and utilize it in a literature study and the execution of an oral presentation.

(c) **Values:** At the end of this course students will be able to identify ethical issues in molecular biology (theory and applications) and communicate their own point of view as well as those of the scientific, medical and general communities.

Method of delivering: Full Time

Assessment methods:
Assignments, oral presentations & tests (30%)

Examination (70%)

The examination may consist of one or more of the following: paper; a prepared and/or unprepared scientific article; open book exam.

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

Title: **Project**

Module-outcomes:

(a) **Knowledge**: Upon completion of this module, the student should have sufficient knowledge to plan and conduct a basic empirical scientific research projects.

(b) **Skills**: Upon completion of this module students will be able to

- design project-oriented experiments;
- prepare elementary research proposals;
- singlehandedly perform experiments;
- present and interpret results of experiments in a scientific way;
- write a report on a practical project;
- explore current and emerging trends a field of research.

(c) **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.

Method of delivering: Full Time

Assessment methods:
Final module assessment:

Oral presentation, March: (30%)

Final Examination (70%) consists of a report mark as well as an oral presentation which each counts 50% of the final examination mark.

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:
Objectives
On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of:
(i)how to do a professional job.
(ii)stakeholders and their needs.
(iii)the general environment (risk environment, regulatory environment, external environment, investment environment and capital requirements).
(iv)specification of the problem (contract design, project planning and project management).
(v)data.
(vi)risk management.
(vii)producing the solution (modelling, assumption setting, expenses, developing the cost and price, investment management, provisioning and the relationship between assets and liabilities).
(viii)living with the solution (maintaining profitability, determining the expected results, reporting actual results, asset management, capital management, surplus management, insolvency and closure and options and guarantees).
(ix)monitoring the actual experience.
(x)the principal terms used in financial services and risk management.
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 using evidence-based solutions and theory-driven arguments
(b)use efficient and effective information retrieval and processing skills

(c)perform a critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data
(d)understand a range of research methods, techniques and technologies and an ability to select these appropriately
(e)present and communicate academic/professional work effectively, catering for a range of audiences by using a range of different genres appropriate to the context through integrated assessment of objectives (i) to (x) in the form of project(s).

Method of delivering: Full Time

Assessment methods:

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

Title: **Quantitative Risk Analysis I**

Module-outcomes:
Knowledge:
At the end of this course students should have knowledge and insight into the modelling and management of market risk, credit risk, liquidity risk and operational risk in financial institutions. An integrated value at risk framework will be studied as well as hedging strategies for reducing risk. The important problem of capital allocation in a financial institution will be analysed. The new Basle regulatory requirements for the banking industry will also be analysed.
Skills: Students should be able to have the skills necessary to critically evaluate financial risk management problems in financial institutions and provide solutions to these problems. Students will also be able to implement some of the risk models in SAS/IML or MS Excel.

Method of delivering: Full Time

Assessment methods:

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

Title: **Financial Engineering I**

Module-outcomes:
Knowledge: Knowledge and insight into the mathematical modelling of financial instruments, Derive and apply mathematical formulas to price and hedge linear claims such as futures contracts. Understand and formulate equilibrium and no-arbitrage models of the short (interest) rate like the Vasicek and Cox-Ingersoll-Ross models. Derive and apply the Black-Scholes pricing formulas. Derive and apply binomial and risk-neutral Monte Carlo pricing Understand and explain the “Greeks”: delta, theta, vega, rho and gamma.
Skills: Use the MS Excel software package (or SAS/IML) to implement the Black-Scholes formulas. Use the MS Excel software package (or SAS/IML) to implement basic numerical procedures to price vanilla options using binomial trees and Monte Carlo simulation. Plan and conduct research according to standard protocol and to employ appropriate processes, procedures and techniques. Operate co-operatively in groups. Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications. Act ethically sound in dealing with issues and people.

Method of delivering: Full Time

Assessment methods:

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

Title: **Investment Theory I**

Module-outcomes:

The student should be able to: Construct optimal portfolio's Calculate portfolio inputs Evaluate portfolio's Construct efficient frontiers Select instruments for inclusion in portfolio's

Knowledge: At the end of the course the student should obtain insight and knowledge about the following concepts: risk and return, risk aversion, utility, the selection of risky assets, the construction of optimal portfolios, single and multi-index models, active and passive management, equilibrium models and the efficient market hypothesis.

Skills: In this course the student acquires the skill to assemble optimal portfolios and to select securities in an optimal manner for inclusion in the portfolio.

Method of delivering: Full Time

Assessment methods:

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

Title: **Financial Modelling I**

Module-outcomes:

Knowledge: Knowledge and insight into numerical methods and techniques for solving problems encountered in the financial industry, as well as have a thorough understanding of the underlying theory that support these methods and techniques. The learners should have the knowledge to apply these methods and techniques as part of a creative problem solving approach, and should have acquired an understanding of the practical issues in developing financial models.

Skills: Ability to produce computer models, using several important techniques, including use of special functions, iterative methods, approximation, interpolation, simulation and optimisation. The learners should demonstrate an understanding of the pitfalls of numerical computation (e.g. numerical instability) that arise in practical financial applications and should demonstrate skills in applying SAS software to assist in the problem solving approach.

Method of delivering: Full Time

Assessment methods:

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

Title: **Quantitative Risk Analysis**

Module-outcomes:

The aim of this research module is to introduce the student to the scientific research process through practical assignments. Various topics in Operational Risk Management are studied. The topics include the following:

- Key challenges in modelling operational risk
- Frequency and severity distributions
- Loss distributions
- Alpha-stable distributions
- Extreme value theory
- Value-at-Risk
- Modelling dependence and robustness

The students are required to do weekly written assignments on research questions on the studied topics. A minor and a major article on the research topics must also be written.

Method of delivering: Full Time

Assessment methods:

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:

At the completion of the module, students would have acquired knowledge and insight about the following techniques:

- Variable Selection
- Linear Models for Regression
- Linear Models for Classifications
- Resampling Methods
- Model Assessment and Selection

Method of delivering:

Assessment methods:

Students will attain the outcomes of the module by proving that they can apply the following techniques:

- Variable Selection
- Linear Models for Regression
- Linear Models for Classifications
- Resampling Methods
- Model Assessment and Selection

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:

At the completion of the module, students would have acquired knowledge and insight about the following topics:

- Basic Data Warehouse Concepts
- Alternative DW Methodologies
- Dimensional Modelling
- OLAP Cubes
- MDX Queries
- BI Reporting
- MS Excel Pivot Tables

Method of delivering:

Assessment methods:

Students will attain the outcomes of the module by proving that they can implement, discuss and/or evaluate the following topics:

- Basic Data Warehouse Concepts
- Alternative DW Methodologies
- Dimensional Modelling
- OLAP Cubes
- MDX Queries
- BI Reporting
- MS Excel Pivot Tables

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:

At the completion of the module, students would have acquired knowledge and insight about the following techniques:

- Monte Carlo Simulation
- Resampling
- Discrete-Event Simulation
- Queuing Theory
- Markov Chains

Method of delivering:

Assessment methods:

Students will attain the outcomes of the module by proving that they can apply the following techniques:

- Monte Carlo Simulation
- Resampling
- Discrete-Event Simulation

- Queuing Theory
- Markov Chains

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:

At the completion of the module, students would have acquired knowledge and insight about the following techniques:

- Non-linear Methods
- Neural Networks
- Tree-based Methods
- Support Vector Machines
- Ensemble Learning

Method of delivering:

Assessment methods:

Students will attain the outcomes of the module by proving that they can apply the following techniques:

- Non-linear Methods
- Neural Networks
- Tree-based Methods
- Support Vector Machines
- Ensemble Learning

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:

At the completion of the module, students would have acquired knowledge and insight about the following topics:

- Applied Time Series Forecasting
- ARIMA Prosesses
- Model Identification
- Smoothing Methods
- Vector Autoregression
- Time-series Clustering
- Survival Analysis
- Exponential, Weibull, Lognormal Distributions
- Censoring
- Kaplan-Meier and Lifetable Methods
- Effect of Covariates
- Time-Dependent Covariates
- Continuous-Time Models: Parametric and Cox Proportional Hazard
- Discrete-Time Models
- Competing Risks in a Business Analytics Context

Method of delivering:

Assessment methods:

Students will attain the outcomes of the module by proving that they can implement, discuss and/or evaluate the following topics:

- Applied Time Series Forecasting
- ARIMA Prosesses
- Model Identification
- Smoothing Methods
- Vector Autoregression
- Time-series Clustering
- Survival Analysis
- Exponential, Weibull, Lognormal Distributions
- Censoring
- Kaplan-Meier and Lifetable Methods
- Effect of Covariates
- Time-Dependent Covariates
- Continuous-Time Models: Parametric and Cox Proportional Hazard
- Discrete-Time Models
- Competing Risks in a Business Analytics Context

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

Title: **Pricing of Derivatives A**

Module-outcomes:

The purpose of this module is to provide students with an understanding of both the discrete time and the continuous time mathematics involved in the field of Financial Derivatives.

The topics include:

Understand and explain single-period and multi-period discrete time financial market models. Formulate and apply Fundamental Theorem of Financial Mathematics, the Feynman-Kac Stochastic Representation Formula, the Martingale Representation Theorem, the Girsanov Theorem, and the Ito Formula. Understand and formulate stochastic processes such as Wiener processes.

The students are required to use the MS Excel software package (or SAS/IML) to implement basic numerical procedures to price exotic options and derive hedging strategies using binomial trees and Monte Carlo simulation. Apply Ito calculus at an introductory level. Formulate and apply continuous time arbitrage theorems in a variety of situations. Interpret and apply Girsanov's theorem in the pricing of derivatives. Derive continuous time hedging strategies. Solve simple stochastic differential equations analytically. Solve more complex stochastic differential equations using numerical methods. Plan and conduct research according to standard protocol and to employ appropriate processes, procedures and techniques. Operate co-operatively in groups. Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications. Act ethically sound in dealing with issues and people.

Method of delivering: Full Time

Assessment methods:

Centre: Business Mathematics and Informatics	Subject Group:	
Module code: BWIN623	**Semester 2**	**NQF-Level: 8**
Title: **Financial Engineering II**		
Module-outcomes: This module is an extension of the content presented to the student in BWIN613: Financial Engineering I. The purpose of this module is to provide students with a thorough understanding of further concepts involved in the field of Financial Engineering, and will have a stronger focus on interest rate derivatives. The topics include: Understand and explain the relationship between a volatility smile and the risk-neutral probability measure used in binomial pricing of options. Understand and formulate the short (interest) rate lattice models like the Black-Derman-Toy, Ho-Lee and Hul-White models. Derive and apply mathematical formulas to price interest rate derivatives by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way. Understand and explain numerical methods like Least Squares Monte Carlo and Finite Differences for pricing exotic options found in insurance. The students are required to use the MS Excel software package (or SAS/IML and SAS/ETS) to implement basic numerical procedures to price more general (including path-dependent) options using binomial trees, finite difference methods and Monte Carlo simulation. Use the MS Excel software package (or SAS/IML and SAS/ETS) to implement basic numerical procedures to estimate and forecast volatilities and correlations. Use the MS Excel software package (or SAS/IML and SAS/ETS) to implement basic numerical procedures to calculate Value-at-Risk (VaR) using Monte Carlo simulation. Plan and conduct research according to standard protocol and to employ appropriate processes, procedures and techniques. Operate co-operatively in groups. Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications. Act ethically sound in dealing with issues and people.		
Method of delivering: Full Time		
Assessment methods:		
Centre: Business Mathematics and Informatics	**Subject Group:**	
Module code: BWIN625	**Semester 2**	**NQF-Level: 8**
Title: **Financial Modelling II**		
Module-outcomes: Knowledge: Knowledge and insight into applying numerical methods and techniques to specific applications in quantitative finance. Emphasis is placed on advanced portfolio optimisation problems and pricing problems. Module-outcomes: Skills: Ability to apply numerical and simulation techniques for portfolio construction under a range of different risk measures, and to do pricing of different exotic option classes. The learners should demonstrate skills in applying SAS software to assist in doing a practical project that will integrate their knowledge obtained from different subjects.		
Method of delivering: Full Time		
Assessment methods:		

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:

Students will on successful completion of the module have to write up two research reports. The first research report will be on Financial Engineering and the second research report will be on the Pricing of Derivatives.

Pricing of Derivatives: On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of:

- single-period and multi-period discrete time financial market models.
- the fundamental theorem of Financial Mathematics
- the Feynman-Kac Stochastic Representation Formula
- the Martingale Representation Theorem
- the Girsanov Theorem
- the Ito Formula
- stochastic processes such as Wiener processes
- using the MS Excel software package (or SAS/IML) to implement basic numerical procedures to price exotic options and derive hedging strategies using binomial trees and Monte Carlo simulation
- the applying Ito calculus at an introductory level
- applying continuous time arbitrage theorems in a variety of situations
- how to interpret and apply Girsanov's theorem in the pricing of derivatives
- deriving continuous time hedging strategies
- solving simple stochastic differential equations analytically
- solving more complex stochastic differential equations using numerical methods.

The student will as an individual demonstrate the ability to:

(a) identify, analyse and deal with complex and/or real world problems and issues using e theory-driven arguments

(b) use efficient and effective information retrieval and processing skills

(c) perform a critical analysis, synthesis and independent evaluation of quantitative and/or

(d) understand a range of research methods, techniques and technologies and an ability to

(e) present and communicate academic/professional work effectively, catering for a range of different genres appropriate to the context

through integrated assessment of the objectives in the form of two research reports. The first research report will be on Financial Engineering and the second research report will be on Pricing of Derivatives.

Method of delivering: Full Time

Assessment methods:

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:

Financial Engineering: On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of:

• the relationship between a volatility smile and the risk-neutral probability measure used in binomial pricing of options.

• the short (interest) rate lattice models like the Black-Derman-Toy, Ho-Lee and Hul-White models.
• deriving and applying mathematical formulas to price interest rate derivatives by using previous knowledge in other disciplines like statistics, computer science and economics in an integrative way.
• numerical methods like Least Squares Monte Carlo and Finite Differences for pricing exotic options found in insurance
• using the MS Excel software package (or SAS/IML and SAS/ETS) to implement basic numerical procedures to price more general (including path-dependent) options using binomial trees, finite difference methods and Monte Carlo simulation.
• using the MS Excel software package (or SAS/IML and SAS/ETS) to implement basic numerical procedures to estimate and forecast volatilities and correlations.
• using the MS Excel software package (or SAS/IML and SAS/ETS) to implement basic numerical procedures to calculate Value-at-Risk (VaR) using Monte Carlo simulation. Financial Modeling: On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of:
• the use of numerical techniques for solving problems such as numerical integration, simultaneous system of equations, interpolation and approximation etc.
• following a problem solving methodology that includes understanding the problem requirements, formulating a mathematical model, applying a solution approach and validating model solutions.
• convex analysis and the characterization of optimization problems in terms of feasibility and optimality.
• the translation of financial optimization problems into mathematical programming formulations, e.g. mean-variance portfolio optimization, asset-liability management, revenue-price optimization, etc.
• the implementation of various optimization techniques for solving financial optimization problems, e.g. gradient descent, quasi-Newton, simplex and branch-and-bound methods etc.
Module-outcomes:
The student will as an individual demonstrate the ability to:
(a)identify, analyse and deal with complex and/or real world problems and issues using evidence-based solutions and theory-driven arguments
(b)use efficient and effective information retrieval and processing skills
(c)perform a critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data
(d)understand a range of research methods, techniques and technologies and an ability to select these appropriately
(e)present and communicate academic/professional work effectively, catering for a range of audiences by using a range of different genres appropriate to the context
through integrated assessment of the objectives in the form of two research reports. The first research report will be on Financial Engineering and the second research report will be on Financial Modeling.

Method of delivering: Full Time

Assessment methods:

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

Title: **Research Module: Financial Modelling**

Module-outcomes:
On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of:
• the use of numerical techniques for solving problems such as numerical integration, simultaneous system of equations, interpolation and approximation etc.
• following a problem solving methodology that includes understanding the problem

requirements, formulating a mathematical model, applying a solution approach and validating model solutions.
• convex analysis and the characterization of optimization problems in terms of feasibility and optimality.
• the translation of financial optimization problems into mathematical programming formulations, e.g. mean-variance portfolio optimization, asset-liability management, revenue-price optimization, etc.
• the implementation of various optimization techniques for solving financial optimization problems, e.g. gradient descent, quasi-Newton, simplex and branch-and-bound methods etc.
• the formulation of dynamic and stochastic programming models for solving financial optimization problems, e.g. stylized consumption and option pricing problems.
• the use of heuristic methods for solving financial optimization problems, e.g. genetic algorithms, tabu-search, particle swarm optimization etc.
• the use of decomposition techniques for solving large scale linear and stochastic programming problems

Module-outcomes:

The student will as an individual demonstrate the ability to:

- identify, analyse and deal with complex and/or real world problems and issues using evidence-based solutions and theory-driven arguments
- use efficient and effective information retrieval and processing skills
- perform a critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data
- understand a range of research methods, techniques and technologies and an ability to select these appropriately
- present and communicate academic/professional work effectively, catering for a range of audiences by using a range of different genres appropriate to the context through integrated assessment of the objectives in the form of a research report.

Method of delivering: Full Time

Assessment methods:

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;
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.

Sk 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:
  a) water chemistry and water pollution processes
  b) atmospheric chemistry and pollution processes
  c) 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.

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 them with the Euler-Lagrange equations
- Central force problems and rigid body problems
- Hamiltonian mechanics including Legendre transformations, canonical transformations and canonical invariants
- Noether 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.
- Give concise physical interpretations, and arguments for the validity of the mathematical solutions.
- Similarly, solve simple problems in two and three dimensions in various coordinate systems, e.g. by using separation of variables in the Schrödinger equation.
- 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.
- Learn 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

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: At 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
- The semi-classical description of the interaction between radiation and charged particles
- Application of time-dependent perturbation theory to radiative transitions
- Quantization of the electromagnetic field.

Apart from the formal aspect students will also apply their knowledge to solving relevant quantum mechanical problems.

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. Module-outcomes: Knowledge of Maxwell-Boltzmann, Fermi-Dirac, en 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.

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 you 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, ossilatory 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:		
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:		
Method of delivering:		
Assessment methods:		

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, practical evaluation).

School: Computer, Statistical and Mathematical Sciences	Subject Group: Computer Science and 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:	**Subject Group:**	
Module code: OMBE621	**Semester 2**	**NQF-Level: 8**

Title: **Hydrology**

Module-outcomes:

Method of delivering:

Assessment methods:

School: Geo and Spatial Sciences	**Subject Group: Hydrology/Geohydrology**	
Module code: OMBE622	**Semester 2**	**NQF-Level: 8**

Title: **Applied Hydrology**

Module-outcomes:
On completion of the module the student should be knowledgeable and demonstrate critical comprehension in the following:

- conceptual model translation into the equivalent numerical model
- apply appropriate interpolation techniques to field data
- statistical methods and fit probability distribution functions to field data for use in modelling
- hydrological and geohydrological risk assessments
- groundwater flow and mass transport models
- rainfall runoff models, flood peak simulations and flood line determinations
- surface water yield modelling
- water resource management

Method of delivering:

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: **The student has mastered the outcomes if he/she can:**

- use conceptual model information and field data to setup and calibrate the appropriate numerical model:
  - groundwater flow and mass transport
  - rainfall runoff model
  - surface water yield model
- perform statistical analysis on hydrological and geohydrological data
- use field data / modelling results to perform hydrological and/or geohydrological risk assessments
- setup an integrated water resource plan

School: Geo and Spatial Sciences	**Subject Group: Hydrology/Geohydrology**	
Module code: OMBE623	**Semester 2**	**NQF-Level: 8**

Title: **Groundwater Geology**

Module-outcomes: **On completion of the module the student should be knowledgeable and demonstrate critical comprehension in the following:**

- geodetic and cartesian coordinate systems
- basic GPS operation
- rock types and stratigraphy as related to aquifers
- geological borehole logging
- interpretation of geological maps
- introduction to the geology of South Africa
- theory and analysis of geophysical methods used in groundwater investigations:
  - Magnetometer
  - Electro-Magnetics
  - Resistivity
  - Gravity
  - Seismic
- theory and analysis of radiometric methods
- practical execution of geophysical surveys using the following methods:
  - Magnetometer
  - Electro-Magnetics
  - Resistivity
  - Gravity
  - Spectrometer

Method of delivering:
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: **The student has mastered the outcomes if he/she can:**

- plan a geophysical survey based on existing geological information and the target area with relation to identifying possible groundwater targets
- construct a geological log for a newly drilled borehole
- identify the various types of aquifers present in South Africa as well as know the basic characteristics of these aquifers
- interpret a geological map and construct a 2D cross section and a simplified 3D geological model
- analyse and interpret data from the following geophysical methods:
  - Magnetometer
  - Electro-Magnetics
  - Resistivity

- Gravity

o perform a physical survey using any of the following geophysical methods:
  - Magnetometer
  - Electro-Magnetics
  - Resistivity
  - Gravity
  - Spectrometer

School: Geo and Spatial Sciences	Subject Group: Hydrology/Geohydrology	
Module code: OMBE624	**Semester 2**	**NQF-Level: 8**

Title: **Geohydrology**

Module-outcomes:
On completion of the module the student should be knowledgeable and demonstrate critical comprehension in 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, groundwater reserve determinations and environmental management plans
- groundwater and the mining environment including dewatering, flooding and decanting
- applicable interpolation techniques for groundwater level maps
- development of conceptual models in the use groundwater modelling
- basic groundwater modelling concepts both on regional and local scale
- field work: groundwater level measurements, pump tests, tracer tests, slug tests, groundwater sampling, multi-parameter borehole profiling, EC profiling for fracture identification, visual fracture verification through borehole camera

Method of delivering:
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: **The student has mastered the outcomes if he/she can:**

o use step and multi-rate pump test data to recommend the appropriate pumping rate for the constant rate test
o analyse and interpret pump test data to determine applicable aquifer parameters
o identify groundwater flow regimes and fracture positions based on pump test data
o recommend the sustainable yield of a borehole based on the methods described in the pump test manual
o estimate recharge based on the following methods:
  - Chloride
  - EARTH
  - Saturated Flow Volume
  - Cumulative Rainfall Departure
  - Spring flow
  - Isotopes
o perform a groundwater assessment and a groundwater reserve determination
o construct a basic conceptual model used for groundwater modelling
o do basic groundwater modelling on aquifer scale as well as wellfield scale

o setup a basic numerical groundwater flow and mass transport model
o perform the following field procedures:
- slug test
- step, multi-rate and constant rate borehole pump test
- tracer test
- multi-parameter profiling
- groundwater sampling

School:	**Subject Group:**	
Module code: OMBE673	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Research Project**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	**Subject Group:**	
Module code: OMBO611	**Semester 1**	**NQF-Level: 8**
Title: **Introduction to Environmental Management**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	**Subject Group:**	
Module code: OMBO613	**Semester 1**	**NQF-Level: 8**
Title: **Introduction to GIS**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	**Subject Group:**	
Module code: OMBO614	**Semester 1**	**NQF-Level: 8**
Title: **GIS Applications**		
Module-outcomes: 1.To give you practical experience in the field of GIS. 2. To demonstrate basic GIS software skills in ArcGIS software, as well as basic scientific skills 3. To understand and be able to perform data analysis and spatial modeling in GIS		
Method of delivering:		
Assessment methods:		

School:	**Subject Group:**	
Module code: OMBO678	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Environmental Management I**		
Module-outcomes:		

Method of delivering:		
Assessment methods:		
School:	**Subject Group:**	
Module code: OMBO679	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Environmental Analysis I**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
School:	**Subject Group:**	
Module code: OMBW611	**Semester 1**	**NQF-Level: 8**
Title: **Fundamentals of Waste Management**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
School:	**Subject Group:**	
Module code: OMBW612	**Semester 1**	**NQF-Level: 8**
Title: **Waste Management Law and Governance**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
School:	**Subject Group:**	
Module code: OMBW621	**Semester 2**	**NQF-Level: 8**
Title: **New Waste Management Solutions**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
School:	**Subject Group:**	
Module code: OMSA622	**Semester 2**	**NQF-Level: 8**
Title: **Weeds: interactions and control**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSA623	**Semester 2**	**NQF-Level: 8**
Title: **Plant pathology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
School: Biological Sciences	**Subject Group: Zoology**	
Module code: OMSB611	**Semester 1**	**NQF-Level: 8**
Title: **Conservation Ecology**		
Module-outcomes:		
Method of delivering: Contact and Distance		
Assessment methods:		
chool: Biological Sciences	**Subject Group: Zoology / Botany**	
Module code: OMSB612	**Semester 1**	**NQF-Level: 8**
Title: **Systematics in practice**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Contact and Distance		
Assessment methods:		
School: Biological Sciences	**Subject Group:Botany / Microbiology**	
Module code: OMSB621	**Semester 2**	**NQF-Level: 8**
Title: **Bio-informatics**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Contact and Distance		
Assessment methods:		
School: Biological Sciences	**Subject Group: Zoology**	
Module code: OMSB622	**Semester 2**	**NQF-Level: 8**
Title:: **Evolutionary Biology and Ethology**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Contact and Distance		
Assessment methods:		

School: Biological Sciences	Subject Group: Zoology / Botany	
Module code: OMSB623	**Semester 2**	**NQF-Level: 8**
Title: **Biogeography**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Contact and Distance		
Assessment methods:		

School: Geo- and Space Sciences	Subject Group:	
Module code: OMSB624	**Semester 2**	**NQF-Level: 8**
Title: **Biodiversity Planning**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Contact and Distance		
Assessment methods:		

School: Biological Sciences	Subject Group: Zoology / Botany	
Module code: OMSB625	**Semester 2**	**NQF-Level: 8**
Title: **Biomonitoring and Risk Assessment**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Contact and Distance		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE611	**Semester 1**	**NQF-Level: 8**
Title: **Environmental Soil Science (full-time only, GDKN 122, GDKN 211 and GDKN 221 are pre-requisites for this module)**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE612	**Semester 1**	**NQF-Level: 8**
Title: **Introduction to Landscape Ecology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE621	**Semester 2**	**NQF-Level: 8**
Title: **Restoration of degraded ecosystems**		
Module-outcomes:		
Method of delivering::		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE622	**Semester 2**	**NQF-Level: 8**
Title: **Urban Ecology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE623	**Semester 2**	**NQF-Level: 8**
Title: **Plant ecophysiology and stress physiology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE624	**Semester 2**	**NQF-Level: 8**
Title: **Plant growth and -development**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE625	**Semester 2**	**NQF-Level: 8**
Title: **Advanced Ecotoxicology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSE626	**Semester 2**	**NQF-Level: 8**
Title: **Microbial Ecology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:Geo and Spatial Sciences	Subject Group:Hydrology & Geohydrology	
Module code: OMSE674	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Research Project**		
Module-outcomes: **On completion of the module the student should be knowledgeable and demonstrate critical comprehension in the following:** Under the guidance of a study leader, scientific research regarding a given subject should be completed and submitted in article format. The student must be capable to apply the research proses as well as the research method and results according to scientific methods.		
Method of delivering: Teaching and learning will take place on the basis of presentation techniques to be applied according to each subject's unique requirements and circumstances. Initially a formal lecture is presented by the lecturer, after which the focus will shift primarily to self-study. Other techniques that may be used include group work, simulations, modeling, lectures, literature studies, etc		
Assessment methods: **The student has mastered the outcomes if he/she can:** • Appropriate literature may undertake to interpret the contents, analyze, evaluate and use in an ethically responsible argumentative way regarding the proposed solutions to real life problems / case studies • report writing • oral presentation in an ethically responsible manner undertaken before an audience of peers and scientists		

School: Biological Sciences	Subject Group: Botany / Zoology / Microbiology	
Module code: OMSE674 N643P	**Semester 1 & 2**	**NQF-Level: 8**
Title: **Research Project**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Full Time or Part Time		
Assessment methods:		

School:	Subject Group:	
Module code: OMSG611	**Semester 1**	**NQF-Level: 8**
Title: **Environmental geochemistry (full-time only, GLGN 111 is a pre-requisite for this module)**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSG621	**Semester 2**	**NQF-Level: 8**
Title: **Environmental Mineralogy (GLGN 111 is a pre-requisite for this module)**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSG622	**Semester 2**	**NQF-Level: 8**
Title: **Applied environmental geology (GLGN 111 is a pre-requisite for this module)**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSP611	**Semester 1**	**NQF-Level: 8**
Title: **Principles of integrated pest management**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSP621	**Semester 2**	**NQF-Level: 8**
Title: **Biodiversity and population dynamics in agricultural ecosystems**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSP622	**Semester 2**	**NQF-Level: 8**
Title: **GM crops and integrated pest management**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSP623	**Semester 2**	**NQF-Level: 8**
Title: **Nematodes and crops**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSP624	**Semester 2**	**NQF-Level: 8**
Title: **Arthropoda/plant interactions**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School:	Subject Group:	
Module code: OMSP625	**Semester 2**	**NQF-Level: 8**
Title: **Nematode/plant interactions and control**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School: Biological Sciences	Subject Group: Zoology	
Module code: OMSW611	**Semester 1**	**NQF-Level: 8**
Title: **Aquatic Ecosystems: Pollution and Ecotoxicology**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Full Time or Part Time		
Assessment methods:		

School: Biological Sciences	Subject Group: Botany	
Module code: OMSW622	**Semester 2**	**NQF-Level: 8**
Title: **Phycology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

School: Biological Sciences	Subject Group: Zoology	
Module code: OMSW624	**Semester 2**	**NQF-Level: 8**
Title: **Environmental Hydrology**		
Module-outcomes: • On completing the module the student should be able to demonstrate a		

comprehensive, integrated and systematic knowledge base and critical understanding of the basic theoretical concepts of environmental hydrology with a view to apply these to the following general topics:

- Water availability at global, regional and local scale
- Hydrological processes (surface water and groundwater)
- The ecological process associated with surface and ground water systems
- Evaluate the relationship between abiotic drivers (hydrological processes) and ecological responders (ecological processes).
- Interpret the abiotic driver and biological responders in terms of the South African water resources management framework.

On completing the module the student should be able to demonstrate the ability to plan and conduct research projects regarding water-related problems such as altered flow regimes, impoundments and water quality issues with a view to provide practical solutions to these issues.

Method of delivering: Full Time

Assessment methods:

School: Biological Sciences	**Subject Group: Botany / Zoology**	
Module code: OMWB611	**Semester 1**	**NQF-Level: 8**

Title: **Biodiversity: past, present and future tendencies**

Module-outcomes:

See Afrikaans yearbook.

Method of delivering: Contact and Distance

Assessment methods:

School:	**Subject Group:**	
Module code: OMWE611	**Semester 1**	**NQF-Level: 8**

Title: **Rehabilitation of disturbed areas (full-time only, GDKN 122, GDKN 211 and GDKN 221 are pre-requisites for this module)**

Module-outcomes:

Method of delivering:

Assessment methods:

School:	**Subject Group:**	
Module code: OMWP611	**Semester 1**	**NQF-Level: 8**

Title: **Pest phenology and damage symptoms**

Module-outcomes:

Method of delivering:

Assessment methods:

School: Biological Sciences	Subject Group: Zoology / Botany	
Module code: OMWP613	**Semester 1**	**NQF-Level: 8**
Title: **Economic damage and threshold values**		
Module-outcomes:		
Method of delivering: Full Time or Part Time		
Assessment methods:		

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: **See Afrikaans yearbook.**		
Method of delivering: Full Time or Part Time		
Assessment methods:		

School: Biological Sciences	Subject Group: Zoology	
Module code: OMWW614	**Semester 1**	**NQF-Levelv: 8**
Title: **Waterborne diseases**		
Module-outcomes: **See Afrikaans yearbook.**		
Method of delivering: Full Time or Part Time		
Assessment methods:		

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 module OMWW615, the student will demonstrate: • That they are able to explain the function and structures of the near shore marine environment and estuaries. • That they are able to appraise the importance of estuaries		
Method of delivering: Full Time		
Assessment methods:		

School: Biological Siences	Subject Group: Microbiology	
Module code: OMWW629	**Semester 2**	**NQF-Level: 8**
Title: **Water purification and treatment**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

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 course 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 are taught, such as the way a written report, an oral report, or a paper on a finished statistics project must 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 then a professional report will be compiled and a professional presentation of the work will be given.		
Method of delivering:		
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: This course presents the student with the opportunity to learn about general statistical modelling using matrix notation and to be able to apply this to a wide range of models, namely the general linear models which include multiple regression models, analysis of variance and covariance models, and tree models. Model selection methods, robust regression and smoothing techniques are presented. After the successful completion of the module the student should have mastered the necessary theoretical concepts related to specific types of data collection required for the analysis of certain problems, to be able to apply sensible models for these problems and then to use appropriate inferences for the various models considered. Computer packages (such as S-PLUS, SAS, and Statistica) will need to be used to support the analytical procedures.		
Method of delivering:		
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 will be learned and applied where classical methods are not applicable. Students learn to derive bootstrap estimators by using standard errors of estimators, to compute bootstrap confidence intervals, to do hypothesis testing and other inference by using bootstrap methods for regression time series models. The programming language Fortran will be studied to do		

Monte Carlo simulation studies.

Having completed the course, the student will be able to identify which problems and inference tasks can be solved by applying the bootstrap method, will be able to use the Fortran programming environment, including the IMSL libraries, to perform statistical inference for certain problems which were previously not possible.

Method of delivering:

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:
This module will be presented on demand.

Method of delivering:

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 course 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 modeling and simulation of Markov processes.

Having completed the course, the learner will be able to identify stochastic processes and carry out the appropriate probability calculations.

Method of delivering:

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 course 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 course.

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:

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:
This module will be presented on demand.

Method of delivering:

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:
This module will be presented on demand.

Method of delivering:

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 course 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 derived from the practice. The contents of the manual for postgraduate students of the university must be studied. Methods of reporting as required by research journals or magazines 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:

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 course 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 such as computing parameters and making forecasts. The manner in which software packages like S-PLUS, SAS, STATISTICA and others handles time series will be learned and applied.

Having completed the course the student will be able to use time series data in practical situations, to identify the presence of time dependent relations, to compute relevant parameters and to do forecasting by using software packages such as S-PLUS, SAS, STATISTICA or other applicable packages.

Method of delivering:

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 course 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 S-PLUS, SAS and STATISTICA in the above-mentioned cases will be studied.

Having completed the course, 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 S-PLUS, SAS and STATISTICA are used.

Method of delivering:

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 course is to provide the learner with the ability to do inference by using categorical data constructively. Asymptotic methods, the 0- and o-notations, convergence of stochastic sequences, convergence of movements and the δ-method for determining asymptotic distributions form part of the course, as well as model differentiation, model fitting, determining parameters for log-linear models, logistic and logit models. The use of

SAS and S-PLUS to do computations will also be studied.

Having completed the course, the learner will be able to perform categorical data (discrete data), inference using log-linear models, logistic and logit models, apply model fitting criteria to do model selection, do parameter estimation and make practical interpretations.

Method of delivering:

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 course, 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:

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 will be presented on demand.

Method of delivering:

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:
This module will be presented on demand.

Method of delivering:

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-uitkomste: Module-outcomes: This module will be presented on demand.		
Method of delivering:		
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, 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 Making predictions from models; 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: 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 methode 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:
Upon completion of this module , the student should be able to do the following:

- Basic properties of the eigenvalue problem;
- Diagonalizing through similarity transformation;
- Functions of diagonalizable matrices;
- Systems of differential equations;
- Nilpotent matrices and Jordan structure;
- Jordan form;
- Functions of non-diagonalizable matrices;
- Difference 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:
Upon completion of this module the students should be able to do the following, with due consideration to previous studiesdemonstrate knowledge of and ability in applying the principles and applicable methods to solve problems with regard to the following topics:

o master introductory research techniques in the field of study; o read and understand literature in Mathematical journals; o handle references and sources; o undertake literature searches; o apply knowledge and skills of different sub disciplines in an integrated way to solve mathematical problems; o communicate the topic verbally and in writing and; o show use of scientific language and; o work together in a team on a topic.
Method of delivering: Full Time
Assessment methods: Dissertation and oral presentation

N.11.2 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:
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: BWIA821	**Semester 2**	**NQF-Level: 9**

Title: **Enterprise-wide Risk Management II**

Module-outcomes:
Understand the principal terms in Enterprise Risk Management (ERM).
Describe the concept of ERM
Discuss the framework for risk management and control within a company
Understand risk frameworks in regulatory environments
Describe the role of credit agencies in the evaluation of risk management functions, including the risk management grading criteria used, and discuss the relevance of these criteria.

ERM Process
Demonstrate an understanding of the relevance of ERM to all stakeholders
Describe how to determine a company's risk appetite, risk capacity and risk objectives
Describe and assess the elements and structure of a successful risk management function, including the ERM roles and responsibilities of the people within an organisation, and how the different groups should interact, and recommend a structure for an organisation's risk management function.
Describe how financial and other risks and opportunities influence the selection of strategy.
Discuss the application of the risk management control cycle, including the relevance of external influences and emerging risks.
Discuss how to identify risks and their causes and implications.
Demonstrate the application of ERM to real and hypothetical contexts

Risk Categories and Classification
Explain what is meant by risk and uncertainty, and discuss different definitions and concepts of risk.
Show an awareness and understanding of risk categories
Describe the relationship between systematic risk, non-systematic or specific risk, and concentration of risk.

Risk Modelling and Aggregation of Risks
Discuss the extent to which identified risks can be amenable to quantitative analysis.
Describe risk aggregation and correlation
Describe the use of scenario analysis and stress testing in the risk measurement process,

including the advantages and disadvantages of each.
Demonstrate understanding of the use of copulas as part of the process of modelling multivariate risks, including recommendation of an appropriate copula.
Explain the importance of the tails of distributions, tail correlations and low frequency / high severity events.
Demonstrate how extreme value theory can be used to help model risks that have a low probability.
Demonstrate an understanding of model and parameter risk.
Discuss the use of models in the overall ERM decision-making process.

Risk Measurement and Assessment
Describe the properties and limitations of common risk measures, including
Describe how to choose a suitable time horizon and risk discount rate
Analyse univariate and multivariate financial and insurance data (including asset prices, credit spreads and defaults, interest rates and insurance losses) using appropriate statistical methods.
Recommend a specific choice of model based on the results of both quantitative and qualitative analysis of financial or insurance data.
Discuss the assessment of different types of market risk.
Evaluate credit risk
Discuss the assessment of operational, liquidity and insurance risks.

Risk Management Tools and Techniques
Describe risk optimisation and responses to risk
Recommend approaches, which balance benefits against inherent costs, that can be used to manage an organisation's overall risk profile
Discuss the management of market risk
Discuss the tools and techniques for identifying and managing credit risk
Describe the management of operational, liquidity and insurance risks

Economic Capital
Demonstrate an understanding of economic capital calculations
Demonstrate an understanding of how to allocate capital across an organisation

Method of delivering:

Assessment methods:

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 will demonstrate an advanced and systematic knowledge and understanding of, and an ability to apply in various contexts:-Data Management, Databases, Datamarts & Data Warehouses -Relational Databases -Data Access -Data Cleaning and Preparation -Data Querying and Reporting -Statistical Analysis of Databases -Data Reporting -Data Mining Software Tools.		
Method of delivering: Full time (Contact)		
Assessment methods: Through integrated assessment of objectives in the form of project(s) and exams (written and computer-based).		
Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIB821	**Semester 2**	**NQF-Level: 9**
Title: **Data Mining Techniques**		
Module-outcomes: On completion of the module the student will demonstrate a comprehensive and systematic knowledge and coherent and critical understanding of: a) Data preparation for data mining b) Predictive modelling using • decision trees • linear and logistic regression • neural networks c) Pattern discovery using • cluster analysis • market basket analysis Module-outcomes: On completion of the module the student will have the necessary skills to: i) identify appropriate application of linear regression, logistic regression, neural networks, cluster analysis, association analysis and decision trees ii) apply SAS Enterprise Miner to develop and implement data mining projects following the SEMMA methodology iii) identify, analyse and deal with complex and/or real world problems and issues drawing systematically and creatively on the theory, research methods and literature around data mining problems iv) perform a critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data v) effectively present and communicate the results to specialist and non specialist audiences using the resources of an academic/professional discourse		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIB822	**Semester 2**	**NQF-Level:9**

Title: **Contemporary Issues in Business Analytics**

Module-outcomes:
At the end of the course the student will have obtained knowledge and insight in the application of:
a) Text Mining
b) Web Analytics
c) Geospatial Analytics
d) Customer Analytics
Module-outcomes:
On completion of the module the student will have the necessary skills to:
i) process and prepare textual data for analysis and do exploratory predictive modelling of the textual data
ii) process and prepare click stream data for analysis and apply web analytics to turn raw Web data into valuable business information
iii) process and prepare geospatial data in various formats for analysis and to explore methods for displaying geographic data analysis results for decision support and modelling
iv) process and prepare customer behaviour data for segmentation and predictive models needed for direct marketing and customer relationship management
v) perform a critical analysis, synthesis and independent evaluation of quantitative and/or qualitative data
vi) effectively present and communicate the results to specialist and non specialist audiences using the resources of an academic/professional discourse

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIB823	**Semester 2**	**NQF-Level: 9**

Title: **Multiple Criteria Decision Making**

Module-outcomes:
At the end of the course the student will have obtained advanced knowledge on:
a) modelling and mathematical programming
b) mastering the subject language
c) the solution techniques for multi criteria decision making problems
Module-outcomes:
On completion of the module the student will have the necessary skills to:
i) formulate and solve decision making problems using linear programming, mixed integer programming,
and nonlinear programming
ii) formulate and solve multi criteria decision making problems using linear programming, mixed integer
programming, and nonlinear programming
iii) effectively present and communicate the results to specialist and non specialist audiences using the
resources of an academic/professional discourse

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIB826(BWIB824)	**Semester 2**	**NQF-Level: 9**
Title**: Industry Directed Research Project**		
Module-outcomes: At the end of the course the student will have obtained advanced knowledge on: a) data driven decision making b) the analysis of large real world datasets c) teamwork and group dynamics d) state of the art visualization techniques Module-outcomes: On completion of the module the student, as part of a multi disciplinary team, will have the necessary skills to: (i) solve problems encountered in advanced analytics in a structured way (ii) apply sound project management principles in practice (iii) apply presentation, communication and technical writing skills in a professional manner		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN811	**Semester 1**	**NQF-Level: 9**
Title: **Practical Risk Management SAS RD**		
Module-outcomes: The student should be able to: 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 Knowledge: At the end of the course the student will have obtained knowledge and insight in the application of financial risk management techniques in a practical context. Module-outcomes: Skills: After successful completion of the course, the student will be able to create a risk analysis environment, of limited scope, in the SAS Institute's risk management solution, SAS Risk Dimensions. The student will also be able to do a number of risk analyses.		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN812	**Semester 1**	**NQF-Level: 9**
Title: **Pricing of Derivatives B**		
Module-outcomes: Knowledge: Understand and explain short rate models such as the Vasicek model, the Ho-Lee model, the Hull-Whites model, etc., and forward rate models such as the Heath-Jarrow-Morton model. Students should also know the difference between the LIBOR and the Swap Market models. Skills: Use the MS Excel software package (or SAS/IML) to implement basic numerical procedures to model an arbitrage-free family of zero-coupon bond price processes (the term-structure). Students should be able to use different short rate models to invert the yield curve. Plan and conduct research according to standard protocol and to employ appropriate		

processes, procedures and techniques. Operate co-operatively in groups. Communicate effectively, orally and in writing and to make use of appropriate technologies in all communications. Act ethically sound in dealing with issues and people.

Method of delivering:

Assessment methods:

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:
The student will be exposed to a practical problem that will have to be taken through its complete life cycle. This entails 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.
Knowledge and Skills:
The course has a few sub goals, such as practical English, problem solving techniques and mental skills. Professional communication and presentations in a team environment will form an integral part of the general procedure.

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN816	**Semester 1**	**NQF-Level: 9**

Title: **Modern Portfolio Theory**

Module-outcomes:
Manage a portfolio with a quantitative approach - applying rigorous analysis and a rigorous process to beat the market in investment management. Develop/propose a structured approach for active investment management. This includes constructing as well as analysing a portfolio. Apply investment management methodologies and models to practical problems. Use the BARRA software package to analyse, construct and evaluate portfolios.

Knowledge:
At the end of this course the student should obtain knowledge and insight about the following concepts: exceptional returns, forecasting exceptional returns, benchmark portfolios, the information ration, value added, the fundamental law of active management, structural risk models, the objective of the active manager, portfolio construction and performance analysis. Practical work will be done with the BARRA system.
Module-outcomes:
Skills: In this course the student acquires the skill to do active portfolio management by using the BARRA system. This system is used worldwide for portfolio management.

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for BMI		
Module code: BWIN817	**Semester 1**	**NQF-Level: 9**

Title: **Retail Credit Risk**

Module-outcomes:
The student should be able to: Describe the principles and practice of consumer credit risk management Build Scorecards Build Logistic Regression models Apply the data analysis methodology Develop SAS programmes to implement above
Knowledge: After completion of the course, the student would have gained knowledge of and insight into what Retail Credit is.
Skills: The student will be able to build Scorecards as well as Logistic Regression models.

Method of delivering:

Assessment methods:

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:
Knowledge and Skills:
This course occupies the last semester of the M.Sc. programme and is similar to the Business Integration Project (BWIN815), apart from the fact that the student now has to formulate and solve the problem on his own. In the process he/she will still receive academic support from his/her study leader at the Centre, but a greater degree of independence will be expected from the student. The student team will be expected to conduct the project in accordance to the

guidelines specified in the procedure that has been developed to manage such projects. The study is concluded with the formal documentation of the problem, together with the solution as a report (paper), which will also be considered for inclusion in the BMI Centre's publication series.		
Method of delivering:		
Assessment methods:		
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:		
Module code: CHEM871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: CHEN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: CHEN874	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced Chemistry**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: DRKN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ECOM871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB874	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Plasma Physics**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB875	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Magnetohydrodynamics**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB876	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Current topics in Cosmology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: FSKB877	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Cataclysmic variables**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: FSKB878	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Extragalactic astronomy and galactic dynamics**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: FSKB879	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced General Relativity**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: FSKB880	**Semester 1 & 2**	**NQF-Level: 9**
Title: **High energy astrophysics and pulsars**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: FSKB881	**Semester 1 & 2**	**NQF-Level: 9**
Title: **General Astrophysics 1**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: FSKB882	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Stellar structure and -evolution**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB883	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Observation techniques**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB884	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Space technology**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB885	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Geomagnetism and Aeronomy**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: FSKB886	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Computational Astrophysics**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area: Centre for Space Research		
Module code: FSKM811	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Astrophysics I**

Module-outcomes:
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.

Method of delivering:

Assessment methods:
Homework assignments, class participation, tests and final exam

Unit/Centre/Focus Area: Centre for 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:

- 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.

Unit/Centre/Focus Area: Centre for Space Research		
Module code: FSKM813	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Astrophysics II**

Module-outcomes:
Knowledge: 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

Skills: 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 delivering:

Assessment methods:
Assessment is a formal examination at the end of the module, plus homework assignments which include problem solving

The student has to indicate 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: Centre for 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, 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 delivering: 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:
Knowledge: 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.

Skills: 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: Full Time

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 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: Centre for 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 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 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:		
Module code: GGFN871	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

Module-outcomes:

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Centre for Water Science and Management (Hydrology & Geohydrology)		
Module code: HDGH871	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Dissertation**

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 paper

Method of delivering: Not applicable – research project

Assessment methods:

- The NWU and Faculty policies for external moderation of research dissertations has relevance

Unit/Centre/Focus Area:		
Module code: ITRN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ITRW876	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Databases**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ITRW877	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Decision Support Systems**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ITRW878	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Artificial Intelligence**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ITRW883	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Image Processing**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: ITRW884	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Information Systems Engineering**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ITRW885	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Computer Security**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ITRW886	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Data Warehouses**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: MKBN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
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:		
Module code: OMBO873	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Mini dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: OMBO878	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Environmental Management 2**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: OMBO879	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Environmental Analysis 2**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
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:		
Method of delivering: Part Time		
Assessment methods:		
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:		
Method of delivering: Part Time		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: OMWN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: PLKN871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: RSWW811	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Research Method**		
Module-uitkomste: Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: RSWW821	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Research Communication**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: SBEL871	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

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:		
Assessment methods:		

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:		
Assessment methods:		

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:		
Assessment methods:		
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:		
Assessment methods:		
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:		
Assessment methods:		

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:		
Assessment methods:		

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:		
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.
Module-outcomes:
Method of delivering:
Assessment methods:

Unit/Centre/Focus Area:		
Module code: TGWN872	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Dissertation**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

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:		
Module code: TGWS874 **	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Numerical Analysis: **Phasing out**

Module-outcomes:

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area:

Module code: TGWS875**	Semester 1 & 2	NQF-Level: 9
Title: **Modelling of Financial Systems: **Phasing out**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: TGWS876**	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Optimization of Financial Systems: **Phasing out**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: TGWS877**	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced Optimization: **Phasing out**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: TGWS878**	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Control Theory of Mechanical Systems: **Phasing out**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
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.

Unit/Centre/Focus Area: Unit for BMI		
Module code: WISN874	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Operator theory : **Phasing out**

Module-outcomes:
After completion of this module the student will - in consideration of previous studies - be able to demonstrate fundamental knowledge of and skills in the principles underlying the methods, abstract argumentation, application of core theorems in argumentation and further theoretical development in the field of the following topics: general spectral theory; a few important classes of compact and Fredholm operators; Riesz projections and functional calculus; linear operator bundles; singular values of compact operators; Hilbert-Schmidt operators and Fredholm operators; applications with regard to operator equations, operator differential equations and homogeneous difference equations.

Method of delivering: Full Time (sceduled classes)

Assessment methods:
Through homework, tests and projects a participation mark will be established. A final examination will take place and the final mark will be calculated in the relation: participation mark : examination mark = 50 : 50. This module will contribute 32/180 to the final mark for the M-programme.

Unit/Centre/Focus Area: Unit for BMI		
Module code: WISN875	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Functional analysis : **Phasing out**

Module-outcomes:
After completion of this module the student will - in consideration of previous studies - be able to demonstrate fundamental knowledge of and skills in the principles underlying the methods, abstract argumentation, application of core theorems in argumentation and further theoretical development in the field of the following topics: compact operators on Hilbert and Banach spaces and spectral theory; duality theory and the dual spaces of quotient spaces and subspaces of normed spaces and locally convex spaces; basic theory of locally convex spaces, weak and weak* topologies, Alaoglu's theorem and the characterisation of reflexive Banach spaces; separability and metrisability of topological vector spaces; weak compactness and characteristics of weak compact operators; basic theory of p-summable operators, characterisations of such operators (in terms of the Pietsch Dominating Theorem and Pietsch Factorisation Theorem) and the study of these operators on classical Banach spaces; operator ideals and the ideal characteristics of compact, weakly compact, completely continuous and p-summable operators.

Method of delivering: Full Time (scheduled classes)

Assessment methods:
Through homework, tests and projects a participation mark will be established. A final examination will take place and the final mark will be calculated in the relation: participation mark : examination mark = 50 : 50. This module will contribute 32/180 to the final mark for the M-programme.

Unit/Centre/Focus Area:		
Module code: WISN876	**Semester 1 & 2**	**NQF-Level: 9**

Title: **Riesz space theory: **Phasing out**

Module-outcomes:

Method of delivering:

Assessment methods:

Unit/Centre/Focus Area: Unit for BMI		
Module code: WISN877	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Topological vector spaces: **Phasing out**		
Module-outcomes: After completion of this module the student will - in consideration of previous studies - be able to demonstrate fundamental knowledge of and skills in the principles underlying the methods, abstract argumentation, application of core theorems in argumentation and further theoretical development in the field of the following topics: paranorms, semi-norms and semi-normed spaces; filters and filter bases; topological vector spaces and the closed graph theorem for Fréchet spaces; FH spaces; nets in topological spaces and completeness; locally convex spaces; duality and compatible topologies; equicontinuity and the Mackey-Arens theorem; barreled spaces; the strong topology and reflexivity of locally convex spaces; dual operators and the Hellinger-Toeplitz theorem; inductive limits.		
Method of delivering: Full Time (scheduled classes)		
Assessment methods: Through homework, tests and projects a participation mark will be established. A final examination will take place and the final mark will be calculated in the relation: participation mark : examination mark = 50 : 50. This module will contribute 32/180 to the final mark for the M-programme.		
Unit/Centre/Focus Area: Unit for BMI		
Module code: WISN878	**Semester 1 & 2**	**NQF-Level: 9**
Title: **Advanced linear algebra: **Phasing out**		
Module-outcomes: After completion of this module the student will - in consideration of previous studies - be able to demonstrate fundamental knowledge of and skills in the principles underlying the methods, abstract argumentation, application of core theorems in argumentation and further theoretical development in the field of the following topics: tests for positive definite matrices; sngular value decomposition; the finite-element method; intersection, sum and product of vector spaces; Jordan normal forms; Pagerank, parameters in the Pagerank Model, sensitivity of the Pagerank Model, Pagerank as a linear system; non-negative matrices, the Perron-Frobenius Theorem (I) and (II).		
Method of delivering: Full Time (scheduled classes)		
Assessment methods: Through homework, tests and projects a participation mark will be established. A final examination will take place and the final mark will be calculated in the relation: participation mark : examination mark = 50 : 50. This module will contribute 32/180 to the final mark for the M-programme.		
School: Computer, Statistical and Mathematical 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 Mathematical Sciences	**Subject Group: Mathematics and Applied 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.11.3 PHILOSOPHIA DOCTOR

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:		
Module code: CHEN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: CHEM971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: DRKN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-uitkomste: Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: ECOM971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
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:

Module code: GGFN971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:

Metode van aflewering:

Assessment methods:

Unit/Centre/Focus Area: Centre for Water Science and Management (Hydrology and Geohydrology)

Module code: HDGH971	**Semester 1 & 2**	**NQF-Level: 10**

Title: **Thesis**

Module-outcomes:
- Conduct innovative research in the study field
- 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 scientific papers

Method of delivering: Not applicable – research project

Assessment methods:
- The NWU and Faculty policies for external moderation of research dissertations has relevance

Unit/Centre/Focus Area:		
Module code: ITRW971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: MKBN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
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:		
Module code: OMWN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: PLKN971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

Unit/Centre/Focus Area:		
Module code: SBEL971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: STTK971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: TGWS971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		
Unit/Centre/Focus Area:		
Module code: WISK971	**Semester 1 & 2**	**NQF-Level: 10**
Title: **Thesis**		
Module-outcomes:		
Method of delivering:		
Assessment methods:		

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