

CALENDAR 2009

FACULTY OF NATURAL SCIENCES

POSTGRADUATE STUDIES

Potchefstroom Campus

This Calendar was originally published in Afrikaans.

Correspondence may be conducted in either Afrikaans or English.

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PLEASE MENTION YOUR UNIVERSITY NUMBER IN ALL CORRESPONDENCE

The General Academic Rules of the University, to which all learners 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.

Selection: Please take cognisance of the fact that, owing to specific capacity constraints, the University reserves the right to select candidates for admission to certain fields of study. This means that prospective students who comply with the minimum requirements may not necessarily be admitted to the relevant courses.

Warning against plagiarism: Assignments are individual tasks and not group activities (unless explicitly indicated as group activities). For further details see: http://www.nwu.ac.za/beheer-bestuur/beleid-reels/index_e.html

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 learners finally decide on the selection of modules, they must consult the class timetable. If a clash occurs in the planned selection of a learner, the relevant module combination is not permitted.

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Compiled by Mrs. L. Grimbeek, M.A. (NWU)
Administrative Manager, Faculty of Natural Sciences
August 2008

FACULTY OF NATURAL SCIENCES

OFFICIALS

DEAN

Prof. J.J. Pienaar, D.Sc. (PU for CHE)

ADMINISTRATIVE MANAGER

Mrs. L. Grimbeek, M.A. (NWU)

SCHOOL DIRECTORS

School of Physical and Chemical Sciences

Prof. C.A. Strydom, Pr.Sci.Nat., Ph.D. (UP).

School of Environmental Sciences and Development

Prof. H. van Hamburg, Pr.Sci.Nat., M.Sc.(Agric.) (UP), D.Sc. (UP)

School of Computer, Statistical and Mathematical Sciences (Acting)

Prof. G.J. Groenewald, Hons.B.Sc. (UWK), M.Sc. (Univ. van Illinois te Urbana-Champaign), M.Sc. (UK), Ph.D. (Vrije Univ. te Amsterdam).

RESEARCH DIRECTORS

Business Mathematics and Informatics (Acting)

Prof. J.H. Fourie, D.Sc. (PU for CHE), THOD (POK).

Environmental Sciences and Management

Prof. L. van Rensburg, Ph.D. (PU for CHE), HED (POK).

Space Physics

Prof. R.A. Burger, D.Sc. (PU for CHE)

Focus Area for Chemical Resource Benefication

Prof. H.C.M. Vosloo, Ph.D. (PU for CHE).

CENTRE DIRECTORS

Centre for Business Mathematics and Informatics

Prof. P.J. de Jongh, B.Comm. (US), M.Sc. (UNISA), Ph.D. (UCT)

Centre for Human Metabonomics

Prof. C.J. Reinecke, Ph.D. (Rijksuniversiteit, Leiden).

Centre for Environmental Management

Prof. JG Nel, B.A. (Ed), Hons.B.A. (UPE), M.A. (UPE).

SUBJECT CHAIRPERSONS

Biochemistry

Mr. E. Erasmus, M.Sc. (PU for CHE)

Chemistry

Prof. E.L.J. Breet, Pr.Sci.Nat., D.Sc. (PU for CHE)

Zoology

Prof. P.D. Theron, Pr.Sci.Nat., D.Sc. (PU for CHE)

Physics

Prof. H. Moraal, Pr.Sci.Nat., MSAIP, D.Sc. (PU for CHE).

Geography and Environmental Studies

Dr. L.A. Sandham, B.Sc.Ed. (RAU), Ph.D. (RAU)

Geology

Prof. M.S. Coetzee, Pr.Sci.Nat., M.Sc. (PU for CHE), Ph.D. (UFS)

Microbiology

Prof. C.C. Bezuidenhout, Pr. Sci. Nat., Ph.D (Rhodes)

Botany

Prof. K. Kellner, Ph.D. (PU for CHE)

Computer Sciences and Information Systems

Prof. H.M. Huisman, Ph.D. (PU for CHE)

Urban and Regional Planning

Prof. C.B. Schoeman, D.Sc. (Eng.) (Century University, VSA), D.Phil. (PU for CHE)

Statistics and Operational Research

Prof. F.C. van Graan, Ph.D. (PU for CHE)

Mathematics and Applied Mathematics

Dr. M. Hitge , Ph.D. (PU for CHE).

N.1 RULES: FACULTY OF NATURAL SCIENCES

N.1.1 INTRODUCTION

N.1.1.1 Authority of the 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)).

The *General Academic Rules* is found at "General"/"General Calendar"/"Rules" in the WebPages of the University at <http://www.nwu.ac.za>. Printed copies of the rules may be consulted in the Ferdinand Postma Library and at the Director: Academic Administration.

N.1.2 SCHOOLS AND FOCUS AREAS IN THE FACULTY

The Faculty of Natural Sciences consists of five schools, 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 as well as the subjects groups that make up each school are represented in the following table:

SCHOOL/CENTRE	SUBJECT GROUP
School of Physical and Chemical Sciences	Biochemistry Chemistry Physics Natural Science, Mathematics and Technology Education
School of Environmental Science and Development	Zoology Geography and Environmental Studies Geology Microbiology Botany Urban and Regional Planning
School of 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 Business Mathematics

Research in the Faculty is managed in research units and a research focus area. The research units and focus area are further responsible for the master's (M.Sc.) and doctorate (Ph.D.) training programmes, i.e. programmes that contain a significant research component. At the moment there are three research units, each of them connected to a programme, viz. Business

Mathematics and Informatics, Environmental Sciences and Management, Space Physics, and the focus area, Chemical Resource Benefication.

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.

N.B.: 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
Honneurs Baccalaureus Scientiae; Hons.B.Sc.	Program: Chemistry and Biochemistry	20120
	Biochemistry	N601P
	Chemistry	N602P
Honneurs Baccalaureus Scientiae; Hons.B.Sc.	Program: Physics	202121
	Physics	N618P
Honneurs Baccalaureus Scientiae; Hons.B.Sc.	Program: Computer, Statistical and Mathematical Sciences	202122
	Computer Science and Information Systems	N604P
	Statistics	N605P
	Applied Mathematics	N606P
	Mathematics	N607P
	Mathematics Education	N608P
Honneurs Baccalaureus Scientiae; Hons.B.Sc.	Program: Business Mathematics and Informatics	202123
	Actuarial Science (following on B.Sc. N137P)	N609P
	Quantitative Risk Management (following on B.Sc. N134P, N135P, N136P)	N610P
	Financial Mathematics (following on B.Sc. N135P)	N611P
	Data Mining (following on B.Sc. N134P, N136P)	N612P
Honneurs Baccalaureus Scientiae; Hons.B.Sc.	Program: Environmental Sciences	202124
	Geography and Environmental Management	N613P
	Ecological Remediation and Sustainable Utilisation	N614P
	Biodiversity and Conservation Biology	N615P
	Water Sciences	N616P
	Plant Protection	N617P
Honneurs Baccalaureus Commercii; Hons.B.Com.	Program: Computer, Statistical and Mathematical Sciences	504140
	Computer Science-Information Systems	N620P
	Statistics	N621P
	Mathematics	N622P
	Mathematics Education	N623P

Qualification; Abbreviation	Programme / Curricula	Qualification/ Curriculum Codes
Honneurs Baccalaureus Artium; Hons.B.A.	Program: Environmental Sciences	102170
	Geography and Environmental Management	N631P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Computer, Statistical and Mathematical Sciences	203125
	Computer Science	N801P
	Computer Science	N802P
	Statistics	N803P
	Statistics	N804P
	Applied Mathematics	N805P
	Applied Mathematics	N806P
	Mathematics	N807P
	Mathematics	N808P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Mathematics and Informatics	203126
	BMI [Specialisation Quantitative Risk Management] (following on Hons.B.Sc. N610P)	N809P
	BMI [Specialisation Financial Mathematics] (following on Hons.B.Sc. N611P)	N810P
	BMI [Specialisation Data Mining] (following on Hons.B.Sc. N612P)	N811P

Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Business Mathematics and informatics	203127
	Risk Analysis	N830P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Space Physics	203128
	Physics	N818P
	Astro Physics and Space Science	N840P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Reactor Science	203130
	Reactor Science	N814P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Chemical Resource Benefication	203131
	Chemistry	N815P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Biochemistry	203132
	Biochemistry	N816P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Environmental Sciences	203194
	Environmental Sciences	N830P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Chemistry	203133
	Chemistry	N815P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Zoology	203190
	Zoology	N826P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Microbiology	203191
	Microbiology	N827P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Botany	203192
	Botany	N828P
Magister Scientiae; M.Sc. (following on Hons.B.Sc.)	Program: Geography and Environmental management	203193
	Geography and environmental management	N829P
Magister Scientiae; M.Sc.	Science Education	203134
	Science education	N831P
Master's in Environmental Sciences (following on B.Sc.)	Program: Environmental Sciences	217104
	Ecological Remediation and Sustainable Utilisation	N820P
	Biodiversity and Conservation Biology	N821P
	Water Sciences	N822P
	Plant Protection	N823P

	Environmental Analysis and Management	N825P
Master's in Environmental Management (following on B.Sc. (Hons.))	Program: Environmental Management	218106
	Environmental Management	N824P
Magister Commercii; M.Com. (following on B.Com. (Hons.))	Program: Computer, Statistical and Mathematical Sciences	505 110
	Computer Science and Information Systems	N850P
	Statistics	N851P
	Mathematics	N852P
Magister Artium et Scientiae (Planning); M.Art. et Scien.	Program: Urban and Regional Planning	119102
	Urban and Regional Planning	N825P
Philosophiae Doctor; Ph.D.	Program: Computer, Statistical and Mathematical Sciences	204110
	Computer Science	N901P
	Statistics	N902P
	Applied Mathematics	N903P
	Mathematics	N904P
Philosophiae Doctor; Ph.D.	Program: Business Mathematics and Informatics	204111
	Business Mathematics and Informatics	N905P
Philosophiae Doctor; Ph.D.	Program: Business Mathematics and Informatics	204133
	Risk Analysis	N915P
Philosophiae Doctor; Ph.D.	Program: Space Physics	204112
	Physics	N906P
Philosophiae Doctor; Ph.D.	Program: Chemical Resource Benefication	204113
	Chemistry	N907P
Philosophiae Doctor; Ph.D.	Program: Environmental Sciences	204114
	Environmental Sciences	N914P
Philosophiae Doctor; Ph.D.	Program: Chemistry	204120
	Chemistry	N907P
Philosophiae Doctor; Ph.D.	Program: Zoology	204136
	Zoology	N908P
Philosophiae Doctor; Ph.D.	Program: Geography and Environmental Management	204137
	Geography and Environmental Management	N909P
Philosophiae Doctor; Ph.D.	Program: Microbiology	204113
	Microbiology	N910P

Philosophiae Doctor; Ph.D.	Program: Botany	204134
	Botany	N911P
Philosophiae Doctor; Ph.D.	Program: Urban and Regional Planning	204115
	Urban and Regional Planning	N912P
Philosophiae Doctor; Ph.D.	Program: Biochemistry	204116
	Biochemistry	N913P
Philosophiae Doctor; Ph.D.	Reactor Physics	204117
	Reactor Science	N920P
Philosophiae Doctor; Ph.D.	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 (general rule A.1.29).

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 rule A.1.38.

In the description of each qualification and programme a number of possible curricula, from which the learner 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 or three years, as applicable to the relevant qualification. A learner 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 learner 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-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 learners, 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 learner.

N.1.6 ADMISSION AND REGISTRATION

On taking an appropriate baccalaureus degree learners are not automatically admitted to the postgraduate programmes of the Faculty. Admission and registration for postgraduate programmes take place in accordance with general rules A.12.1, A.12.3, A.13.1, A.13.2 and A.14.1, A.14.2.

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

N.1.7 APPROVAL OF STUDY PROGRAMMES

Approval of study programmes for master's (M.Sc.) and doctorate (Ph.D.) degrees is given in accordance with general rules A.13.2 and A.14.2. **Prospective postgraduate learners are advised to study these rules carefully beforehand.**

N.1.8 EXAMINATIONS

Admission to examinations, the number of examination opportunities, pass requirements of modules and curricula, repetition of endorsed modules and the requirements that minidissertations, dissertations and theses must conform to are extensively discussed in general rules A.8, A.12, A.13 and A.14. **Prospective postgraduate learners 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 Ph.D. curricula that contain endorsed modules each endorsed module must be passed individually before the degree will be conferred on the learner.

N.1.8.1 Deadlines

Learners must beforehand make sure of the official deadlines for submitting examination documents, i.e. minidissertations, dissertations and theses. These dates are determined annually. A learner 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 learner will have to register and pay class fees for another year.

N.1.9 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 learner having failed one or more modules in preceding semesters will probably not be adequately equipped to take the modules of the following semester. Such learners 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.1.10 TERMINATION OF STUDIES

The studies of learners who fail to keep scheduled appointments for their studies or do not progress satisfactorily may be terminated in terms of general rule A.9.

N.1.11 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.Sci.Nat.) at the South African Council for Natural Scientific Professions:

- a) A four year B.Sc. or Hons.B.Sc. plus three years of experience in a natural science profession;
- b) M.Sc. plus two years of experience in a natural science profession;
- c) D.Sc. or Ph.D. plus one year of experience in a natural science profession.

A Masters degree complying with the requirements as set out by the South African Medical and Dental Council is the minimum qualification for registering as a Medical Scientist in terms of items 32(1) and 61(4) of the *Act on Physicians, Dentists and Additional Health Services*. In the case of clinical biochemistry a B.Sc. degree is required for registration.

Learners who took the B.Art. 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 a baccalaureus degree (see N.2.3). The studies may be taken full-time or part-time.

Prospective learners 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 (general rule A.12.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

N.2.1 DURATION OF STUDIES

The minimum duration of the studies is one year full-time and two 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.2.4. Apart from the provisions in A.4.1 and A.12 the additional requirements set out in the relevant curricula in N.2.7 have to be complied with.

N.2.3 ASSUMED PRIOR LEARNING

- a) The learner has already obtained an appropriate baccalaureus degree of which he has taken at least 96 module credits at NQR level 6 in the core subject of the relevant honours programme for which he intends to register.
- b) If the learner 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.B.Sc. 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 learner must have taken the B.Sc. qualification in Business Mathematics and Informatics or the B.Com. qualification in Quantitative Risk Management, subject to the following prerequisites:

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

- d) Learners qualifying for a specific honours BMI curriculum according to the table in (c) may switch to another honours BMI curriculum according to the following table:

Switch to	Graduate qualification obtained		
	N134P	N135P	N136P
N610P	--	--	--
N611P	A	--	A
N612P	NM	NM	--

A = Learner may register provisionally for N611P on condition that WISK 311 and WISK321 be taken together with the other prescribed modules in the honours year.

NM = Changing to another curriculum is not possible unless certain first, second and third year modules are taken.

- e) A minimum prerequisite for registration for the postgraduate BMI qualifications N610P, N611P and N612P is that learners 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 directors of the Centre for Business Mathematics and Informatics and the Research Unit for Business Mathematics and Informatics.
- f) Students in Actuarial Science who passed the curriculum N137P and obtained an average of at least 60% in the core modules in the third year may be admitted to the curriculum N609P.
- g) Prospective learners in Actuarial Science must make certain of the provisions that apply to studies in Actuarial Science and are obtainable from the director of the Unit for Business Mathematics and Informatics.

N.2.4 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 Environmental Sciences and Development and School of Physical and Chemical Sciences).

N.2.5 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 learner has acquired will be further rounded off, with more emphasis on accompanying research skills.

N.2.5.1 Natural science (including mathematical and computer) and technology problem solving

At the end of the studies the learner 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.2.5.2 Applying fundamental and expert knowledge

At the end of the studies the learner 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 -
 - i) formal analysis and modelling of human activities and natural phenomena, systems and problems;
 - ii) communication of theories, concepts and ideas;
 - iii) discussions and conceptualisation of human activities and natural phenomena, systems and problems;
 - iv) management of uncertainties and risks by utilising statistical principles and methods;
 - v) 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 -
 - i) identify and solve open business and community problems;
 - ii) identify and utilise applications;
 - iii) make use of common fundamental expertise across the boundaries of disciplines.

N.2.5.3 Investigations, experimenting and data analysis

At the end of the studies the learner 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 learner will have a limited knowledge of the fundamental research methodology of the specific discipline.

N.2.5.4 Scientific methods, skills and information technology

At the end of the studies the learner 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 -
 - i) the evaluation of the appropriateness and limitations of software;
 - ii) the correct application and functioning of software;
 - iii) 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.2.5.5 Professional and general communication

At the end of the studies the learner 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.2.5.6 Impact of natural science activities on the community and environment

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

N.2.5.7 Team and multidisciplinary work

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

N.2.5.8 Lifelong learning

The learner 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.2.5.9 Professional ethics and practice

The learner 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.2.6 ARTICULATION POSSIBILITIES

- a) On successfully completing the Hons.B.Sc. programme the learner may be admitted to further learning for the M.Sc. 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 learner 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.2.7 PROGRAM: CHEMISTRY AND BIOCHEMISTRY

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202120

N.2.7.1 Curriculum N601P: Biochemistry

This curriculum is compiled from the modules in the table below. It is designed in view of training biochemists as natural scientists. However, the curriculum has also been approved with the aim that a learner who has completed it successfully may apply to be registered as a Medical Scientist. For this purpose the contents of sections of the modules below are modified to comply with the requirements of the registration.

To register the learner must on completion of the honours degree of curriculum N601P do two years of practical work in an approved pathology laboratory. A selected number of learners are admitted to this curriculum (maximum 14). Learners in this group wishing to become Medical Scientist are selected by pathologists for the practical work. In all instances regulations apply as determined from time to time by the Medical Council.

Module code	Descriptive name	Credits
BCHN611	Analytical Biochemistry	24
BCHN612	Advanced Metabolism	24
BCHN621	Advanced Molecular Biology	24
BCHN622	Bio-molecular Interactions	24
BCHN671	Project	32
Total number of credits		128

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202120

N.2.7.2 Curriculum N602P: Chemistry

This curriculum is compiled of the following modules:

Module code	Descriptive name	Credits
The following are compulsory modules:		
CHEN611	Advanced organic Chemistry	16
CHEN612	Advanced physical Chemistry	16
CHEN613	Advanced inorganic Chemistry	16
CHEN671	Project	48
Select FOUR of the following optional modules in consultation with the school director:		

CHEN621	Homogeneous catalysis	8
CHEN622	Coal chemistry	8
CHEN623	Membrane science and technology	8
CHEN624	Molecular modelling	8
CHEN625	Reactions under non-classical conditions	8
CHEN626	Femtochemistry	8
CHEM621	Polymer chemistry	8
CHEM622	Advanced structural clarification	8
CHEM623	Environmental chemistry	8
CHEM624	Techniques for organic synthesis	8
CHEM625	Platinum group metal chemistry	8
Total number of credits		128

N.2.8 PROGRAM: PHYSICS

SCHOOL: PHYSICAL AND CHEMICAL SCIENCES

Qualification code: 202121

N.2.8.1 Curriculum N618P: Physics

This curriculum is compiled from nine of the following modules. Capita Selecta may only be taken in consultation with the school director.

Module code	Descriptive name	Credits
FSKH611	Classical Mechanics	16
FSKH612	Quantum Mechanics I	16
FSKH613	Electrodynamics	16
FSKH614	Plasma Physics	16
FSKH615	Project I	8
FSKH621	Quantum Mechanics II	16
FSKH622	Statistical Mechanics	16
FSKH623	Computer Physics	16
FSKH624	Project II	8
FSKH625	Capita Selecta I [#]	16
In consultation with the school director an honours module from the mathematical sciences may be selected.		16
Total number of credits		128

[#] Select in consultation with the school director one of the following: Space Physics or Nuclear Physics or Solid State Physics.

N.2.9 PROGRAM: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 202122

N.2.9.1 Specific articulation possibilities

- a) On completion of this degree graduates will have access to the M.Sc. degree in the core subject(s) in which the degree has been taken:
- b) curriculum N604P grants admission to M.Sc. studies in Computer Science and Information Systems;
- c) curriculum N605P grants admission to M.Sc. studies in Statistics;
- d) curriculum N606P grants admission to M.Sc. studies in Applied Mathematics;
- e) curriculum N607P grants admission to M.Sc. studies in Mathematics (if a learner has already achieved a minimum of 96 credits in Statistics courses at level 6 this direction may also grant admission to M.Sc. studies in Statistics);
- f) curriculum N608P (in combination with a postgraduate teaching qualification) grants admission to the M.Sc. in Natural Science Education.

N.2.9.2 Curricula

Not all of the modules in the curricula below are presented every year.

N.2.9.2.1 Curriculum N604P: Computer Science and Information Systems

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

Module code	Descriptive name	Credits
First semester		
ITRW671	Project I	8
AND FOUR of the following modules in consultation with the school director:		
ITRW611	Data Warehouses I	16
ITRW612	Linear Programming I	16
ITRW613	Databases I	16
ITRW614	Information Systems Engineering I	16
ITRW615	Computer Security I	16
ITRW616	Artificial Intelligence I	16
ITRW617	Image Processing I	16
ITRW618	Decision Support Systems I	16
	Elective module*	16
Modules from curricula N605P, N606P and N607P.		

Second semester		
ITRW672	Project II	8
AND FOUR of the following modules in consultation with the school director:		
ITRW621	Data Warehouses II	16
ITRW622	Linear Programming II	16
ITRW623	Databases II	16
ITRW624	Information Systems Engineering II	16
ITRW625	Computer Security II	16
ITRW626	Artificial Intelligence II	16
ITRW627	Image Processing II	16
ITRW628	Decision Support Systems II	16
	Elective module*	16
Modules from curricula N605P, N606P and N607P.		
Total number of credits of this curriculum		144

*Select in consultation with the school director an honours module from one of the following subjects: Statistics, Applied Mathematics, Mathematics.

N.2.9.2.2 Curriculum N605P: Statistics

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

Module code	Descriptive name	Credits
First semester		
STTK611	Project I	8
STTK612	Statistical Data-analysis I: Advanced Models	16
STTK613	Resampling Methods	16
AND two modules from the following list in consultation with the school director:		
STTK614	Statistical Inference	16
STTK615	Stochastic Processes I	16
STTK616	Survival Analysis	16
STTK617	Capita Selecta*	16
STTK618	Capita Selecta*	16
Modules from curricula N604P, N606P and N607P and from the M.Sc. Business Mathematics curriculum.		
Second semester		
STTK621	Project II	8
STTK622	Statistical Data-analysis II: Time Series Analysis	16
STTK623	Multivariate Statistics	16
AND two modules from the following list in consultation with the school director:		
BWIN626	Contingencies (CT5)	16
STTK624	Discrete Data-analysis	16

STTK625	Stochastic Processes II	16
STTK627	Capita Selecta*	16
STTK628	Capita Selecta*	16
STTK633	Probability Theory	16
Modules from curricula N604P, N606P and N607P and from the M.Sc. Business Mathematics curriculum.		
Total number of credits of this curriculum		144

*Select in consultation with the school director an honours module from one of the following subjects: Robust Statistics, Monte Carlo Methods, Non-parametric methods.

N.2.9.2.3 Curriculum N606P: Applied Mathematics

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

Module code	Descriptive name	Credits
First semester		
TGWS611	Numerical Analysis I	16
TGWS612	Differential Equations II	16
AND elective modules to the value of 32 credits from the following list in consultation with the school director:		
WISK612	Functional Analysis I	8
WISK613	Topology of Metric and Normed Spaces	8
TGWS671	Fluid Dynamics	16
TGWS613	Control Theory	16
TGWS614	Capita Selecta	16
TGWS615	Capita Selecta	16
Modules from curricula N604P, N605P and N607P.		
Second semester		
TGWS621	Numerical Analysis II	16
TGWS622	Differential Equations III	16
TGWS674	Project	16
AND two modules from the following list in consultation with the school director:		
TGWS672	Optimisation	16
TGWS673	Approximation Theory	16
TGWS623	Optimal Control	16
TGWS624	Capita Selecta	16
TGWS625	Capita Selecta	16
Modules from curricula N604P, N605P and N607P.		
Total number of credits of this curriculum		144

*Select in consultation with the school director an honours module from one of the following subjects: Control of mechanical systems, Optimization of mechanical systems, Numerical analysis III.

N.2.9.2.4 Curriculum N607P: Mathematics

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

Module code	Descriptive name	Credits
WISK611	Algebra I	16
WISK612	Functional Analysis I	8
WISK613	Topology of Metric and Normed Spaces	8
WISK614	Measure and Integration Theory I	8
WISK616	General Topology	8
WISK673	Project	16
WISK625	Complex Function Theory	16
AND four modules from the following list in consultation with the school director:		
WISK615	Differential Equations I	16
TGWS612	Differential Equations II	16
TGWS611	Numerical Analysis I	16
WISK621	Algebra II	16
WISK622	Functional Analysis II	16
WISK624	Measure and Integration Theory II	16
TGWS622	Differential Equations III	16
TGWS621	Numerical Analysis II	16
TGWS673	Approximation Theory	16
WISK676	Capita Selecta*	16
WISK677	Capita Selecta*	16
Modules from curricula N604P, N605P and N606P.		
Total number of credits of this curriculum		144

* Select in consultation with the school director an honours module from one of the following subjects: Operator theory I, Operator theory II; General topology II, Complex analysis II, Linear algebra, Discrete mathematics.

N.2.9.2.5 Curriculum N608P: Mathematics Education

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

Module code	Descriptive name	Credits
WISK611	Algebra I	16
WISK612	Functional Analysis I	8
WISK613	Topology of Metric and Normed Spaces	8
WISK616	General Topology	8
WSKO672	Sets and the Number Systems	16
WSKO673	History of Mathematics	16
WSKO675	Project	16
AND elective modules to the value of 56 credits of which at least two must be chosen from the following list in consultation with the school director:		
WISK614	Measure and Integration Theory I	8
WISK615	Differential Equations I	16
WISK621	Algebra II	16
WISK622	Functional Analysis II	16
WISK624	Measure and Integration Theory II	16
WISK625	Complex Function Theory	16
WSKO674	Capita Selecta	16
If fewer than three modules have been selected from the list of elective modules the rest may be taken in the following manner: not more than two other modules from curricula N604P, N605P, N606P and N607P; not more than two B.Ed. modules (if a postgraduate education qualification has already been taken and the school director is consulted).		
Total number of credits of this curriculum		144

* Select in consultation with the school director an honours module from one of the following subjects: Operator theory I, Operator theory II; General topology II, Complex analysis II, Linear algebra, Discrete mathematics.

**N.2.10 PROGRAM: BUSINESS MATHEMATICS AND INFORMATICS
CENTRE FOR BUSINESS MATHEMATICS AND INFORMATICS**

Qualification code: 202123

N.2.10.1 Curriculum N609P: Actuarial Science (following on B.Sc. N137P)

This curriculum is compiled from the following modules:

Module code	Descriptive name	Credits
First semester		
BWIN613	Financial Engineering I	16
BWIN614	Investment Theory I	16
STTK612	Statistical Data-analysis I: Advanced Models	16
STTK615	Stochastic Processes I	16
STTK616	Survival theory	16
Second semester		
BWIN623	Financial Engineering II	16
BWIN626	Contingencies (CT5)	16
STTK622	Statistical Data-analysis II: Time Series Analysis	16
	Elective Module [#]	16
	Elective Module [#]	16
Total number of credits of this curriculum		160

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

Module code	Descriptive name	Credits
BWIN627	Core Applications part I	16
BWIN628	Financial and Investment ST5	16
BWIN629	Core Applications part II	16
BWIN622	Pricing of Derivatives A	16
STTK624	Discrete Data Analysis	16

The integrated assessment of this curriculum takes place during the assessment of the modules BWIN623.

N.2.10.2

Curriculum N610P: Quantitative Risk Management (following on B.Sc. N134P, N135P, N136P)

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

Module code	Descriptive name	Credits
First semester		
BWIN613	Financial Engineering I	16
BWIN614	Investment Theory I	16
EKNP617	Econometrics	16
STTK612	Statistical Data-analysis I	16
BWIN611	Quantitative Risk Analysis I	16
Second semester		
BWIN623	Financial Engineering II	16
EKNP623	Bank Risk Management	16
STTK622	Statistical Data-analysis II	16
STTK623	Multivariate Statistics	16
	Elective Module [#]	16
Total number of credits		160

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

Module code	Discriptive name	Credits
BWIN627	Core Applications part I	16
BWIN628	Finance and investment ST5	16
BWIN629	Core Applications part II	16
EKNP622	Fiscal and monetary policy	16
STTK624	Discrete Data analysis	16
BWIN621	Quantitative Risk Analysis	16

The integrated assessment of this curriculum takes lace during the assessment of the modules BWIN623 and EKNP623.

Curriculum N611P: Financial Mathematics (following on B.Sc. N135P)

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

Module code	Descriptive name	Credits
First semester		
BWIN613	Financial Engineering I	16
STTK612	Statistical Data-analysis I	16
STTK615	Stochastic Processes I	16
WISK613	Topology of Metric and Normed Spaces	8
WISK614	Measure and Integration Theory I	8
WISK615	Differential Equations	16
Second semester		
BWIN622	Pricing of Derivatives A	16
BWIN623	Financial Engineering II	16

STTK622	Statistical Data-analysis II	16
STTK625	Stochastic Processes II	16
WISK624	Measure and Integration Theory II	16
Total number of credits		160

The integrated assessment of this curriculum takes place during the assessment of the modules BWIN623.

N.2.10.3 Curriculum N612P: Data Mining (following on B.Sc. N134P, N136P)

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

Module code	Descriptive name	Credits
First semester		
EKNP617	Econometrics	16
ITRW616	Artificial Intelligence I	16
STTK612	Statistical Data-analysis I	16
ITRW613	Databases I	16
	Elective Module	16
Second semester		
ITRW626	Artificial Intelligence II	16
STTK622	Statistical Data-analysis II	16
STTK623	Multivariate Statistics	16
ITRW623	Databases II	16
	Elective Module	16
Total number of credits		160

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

Module code	Discriptive name	Credits
ITRW611	Data Warehousing I	16
BWIN614	Investment Theory I	16
BWIN613	Financial Engineering I	16
ITRW614	Information System Engineering	16
STTK613	Re-sampling Methods	16

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

Module code	Discriptive name	Credits
ITRW621	Data Warehousing II	16
BWIN623	Financial Engineering II	16
ITRW624	Information System Engineering	16
STTK624	Discrete Data Analysis	16

The integrated assessment of this curriculum takes place during the assessment of the modules ITRW626.

N.2.11 PROGRAM: ENVIRONMENTAL SCIENCES
SCHOOL: ENVIRONMENTAL SCIENCES AND DEVELOPMENT
Qualification code: 202124

N.2.11.1 Curriculum N613P : Geography and Environmental Management

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

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMBO672	Research project	24
OMBO874	Environmental Management I	24
OMBO875	Environmental Analysis I	16
Elective modules (select modules for at least 40 credits)		
OMBO613	Introduction to GIS	16
OMBO614	Applied GIS	16
OMBO622	Theoretical Hydrology	8
OMBO623	Applied Hydrology	8
SBEL421	Planning Management	16
The learner selects one module for 8 credits in consultation with the school director from any curriculum in this program or from any other relevant modules on honours level.		8
Total of credits of the curriculum		128

N.2.11.2

Curriculum N614P : Ecological Remediation and Sustainable Utilisation

The learner selects four of the elective modules in consultation with the school director.

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMWE611	Rehabilitation of Disturbed Areas	16
OMWE612	Introductory Environmental Soil Science	16
OMEW621	Sustainable Ecosystem Utilisation and Restoration	16
OMWE615	Conservation Biology	16
OMWE674	Practical Work/Project	24
Elective modules (learner selects four)		
OMWE614	Applied Soil Science	8
OMWE621	Urban Ecology	8
OMWE622	Plant Physiology and Stress-physiology	8
OMWE623	Plant Growth and Development	8
OMWE624	Animal Ecophysiology	8
OMWE627	Advanced Ecotoxicology	8
OMWE628	Capita Selecta	8
	The learner selects one module for 8 credits in consultation with the school director from any curriculum in this program or from any other relevant modules on honours level.	8
Total of credits of the curriculum		136

N.2.11.3**Curriculum N615P : Biodiversity and Conservation Biology**

The learner selects four of the elective modules in consultation with the school director.

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMWB611	Biodiversity: Past, Present and Future Tendencies	16
OMWB613	Systematics in Practice	16
OMWE615	Sustainable Ecosystem Utilisation and Restoration	16
OMWE615	Conservation Biology	16
OMWE674	Practical Work/Project	24
Elective modules (learner selects four)		
OMWB622	Genome Analysis and Bio Informatics	8
OMWB623	Evolutionary Biology - Plantae	8
OMWB624	Evolutionary Biology - Animalia	8
OMWB626	Evolutionary Ethology	8
OMWB629	Biogeography	8
The learner selects one module for 8 credits in consultation with the school director from any curriculum in this program or from any other relevant modules on honours level.		
Total of credits of the curriculum		136

N.2.11.4 Curriculum N616P : Water Sciences

The learner selects four of the elective modules in consultation with the school director. For OMWW612 the following ratio applies: participation mark : examination mark = 2:1.

A undergraduate module in parasitism is a prerequisite for OMWW614

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMWE674	Practical Work/Project	24
OMWW611	Physical-Chemical and Biological Characteristics of Inland Water	16
OMWW612	General Aquatic Toxicology, Water Pollution and Biomonitoring	16
OMWW614	Waterborne Diseases	16
OMWW629	Water Purification and Water Treatment	16
Elective modules (learner selects four)		
OMBO622	Theoretical Hydrology	8
OMBO623	Applied Hydrology	8
OMWE622	Plant Ecophysiology and Stress-physiology	8
OMWE624	Animal Ecophysiology	8
OMWE627	Advanced Ecotoxicology	8
OMWW622	Environmental Metabolism	8
OMWW623	Psychology	8
OMWW625	Wetlands	8
OMWW626	Introduction to Bioprocess Engineering / Fermentation Technology	8
OMWW627	Advanced biological waste water treatment	8
	The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.	8
Total of credits of the curriculum		136

N.2.11.5 Curriculum N617P: Plant Protection

The learner selects five of the elective modules in consultation with the school director, at least 3 modules from elective modules group A or B and the rest from elective modules group C.

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMWP611	Pest Phenology and Damage Symptoms	16
OMWP612	Principles of Integrated Pest Management	24
OMWP613	Economic Damage and Threshold Values	16
OMWP614	Practical Work/Project	24
Elective modules A (Acarology/Entomology)		
OMWP621	Biodiversity and Populations Dynamics and Agricultural Ecosystems	8
OMWP622	Morphology, Systematics and Taxonomy of Insects	8
OMWP623	Morphology, Systematics and Taxonomy of the Acari	8
OMWP624	Arthropoda/Plant Interactions	8
Elective modules B (Nematology)		
OMWP625	Biology and Systematics of Nematodes	8
OMWP626	Tropical and Subtropical Nematology	8
OMWP627	Nematode/Plant Interactions	8
OMWP628	Principles of Sustainable Nematode Control	8
Elective modules C (General themes)		
OMWA621	Biotechnology: Applications in Agriculture	8
OMWA622	Weeds: Interactions and Control	8
OMWA623	Plant Pathology	8
	The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.	8
Total of credits of the curriculum		128

N.2.12 EXAMINATIONS

Examination opportunities and relevant rules apply in terms of general rule A.8.1.

N.2.12.1 Compiling the participation mark

A participation mark for a module is calculated in terms of general rules A.1.7 and A.8.7.4 and may be compiled from tests, assignments and other forms of assessment.

N.2.12.2 Admission to examinations

Admission to the examination in any module takes place by acquiring a proof of participation issued by the school director/centre director after the requirements

of the relevant curriculum and/or module have been complied with (general rules A.1.6 and A.8.6).

N.2.12.3 Module mark

The module mark (general rules A.1.39 and A.8.7.4) is calculated from the participation mark and the examination mark at the ratio 1:1 unless it is stated otherwise in the description of the curriculum in which the relevant module is found.

N.2.12.4 Pass requirements

Passing modules and a curriculum takes place in terms of general rules A.8.7 and N.1.8 of this Calendar.

N.2.12.5 Repetition of modules

General rule A.10 applies.

N.2.12.6 Termination of studies

General rule A.9 applies.

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.B.Com. 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 (general rule A.12.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

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 A.4.1 and A.12 the specific requirements stated in the description of the relevant curricula in N.3.7 must additionally be complied with.

N.3.3 ASSUMED PRIOR LEARNING

N.3.3.1 The learner has already obtained an appropriate baccalaureus degree of which he has taken at least 96 module credits at NQF level 6 in the core subject of the relevant honours programme for which he intends to register.

N.3.3.2 If a prospective learner does not conform to N.3.3.1 he may be admitted to the Hons.B.Com. 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

Apart from exceptions that the Dean may approve this honours degree may be taken in one of the following study programmes: Computer Science-Information Systems, Statistics, Mathematics and Mathematics Education.

N.3.5 GENERAL EXIT LEVEL OUTCOMES

The outcomes described in N.2.5 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 learner already has attained will be further rounded off with greater emphasis on the accompanying research skills.

In addition to the exit level outcomes and critical outcomes as described in N.2.5 the learner will also have a specific knowledge and skills as set out in the table below. The four curricula support all of the skills in the table in varying degrees. In the table the symbols H (for high), A (for average) and L (for low) indicate to what extent each direction supports a specific outcome:

SPECIFIC OUTCOME	Curriculum N620P	Curriculum N621P	Curriculum N622P	Curriculum N623P
Knowledge, insight and skills in theoretical and practical problem handling and computations in a wide scope of advanced statistical topics, amongst which general linear models, time series, distribution-free resampling methods, multivariate statistics, advanced statistical inference, discrete data-analysis (the ability to identify appropriate models, evaluate fitting, perform parameter estimates for a variety of known models), probability theory and stochastic processes.	–	H	A	L
Knowledge of appropriate decision-making procedures and techniques to utilise in solution strategies of problems in the IT environments.	H	H	L	L
The ability to carry out statistical background studies of the statistical techniques necessary in problem solving.	–	H	A	A
A competency in gathering knowledge, collecting data, data exploratory procedures and assessment and in evaluating techniques and results in the IT environment.	A	H	A	A
A sound competency in client and project management.	A	H	A	A
The ability to put into perspective the skills learnt in graduate studies and to isolate the fundamental, at times philosophical, aspects to bring home basic insights.	H	H	H	H
A thorough insight into the possibilities of utilising information technology, as well as the limitations of current technology in solving complex problems.	H	H	A	A
The ability to master the transition to learning material at a higher level of abstraction, as is traditionally the case at this level of studies all over the world.	H	H	H	H
Communication of subject knowledge and solutions to colleagues and client will be more keenly developed and the learner will therefore be able to project a positive image as regards the contribution of information technology to maintain and extend the needs of the community to the fulfilment and support of the needs of the community.	H	H	A	A
The ability to formulate real problems and to suggest solutions for the benefit of business applications and/or technological developments.	H	H	H	A
The ability to solve a specific problem of a broad scope, usually by means of existing, but also sometimes on the basis of own investigations, techniques and approaches, and to compile a well-structured report on the findings.	A	H	H	H

SPECIFIC OUTCOME	Curriculum N620P	Curriculum N621P	Curriculum N622P	Curriculum N623P
The knowledge and ability to continue with further, especially research-based studies, in a discipline selected from the subject areas.	H	H	H	H
The ability to understand the language and structural forms in which the abstract concepts of modern mathematics are described and to have an insight into the way in which these structures are built up from the analysis of quantified data of spaces that contain inherent structural elements.	–	H	H	A
A sound insight into the way in which mathematical knowledge has come to pass and an awareness of the importance of logical proofs and their application to the solution of problems put forward.	–	H	H	H
The ability to show in a few cases in what way advanced computation techniques flow forth from the theoretical subject background.	L	H	H	H
The ability to project a positive image as regards the contribution of mathematical knowledge to sustaining and building out technological aids that are at the disposal of the community.	–	A	H	A
After further training in education a readiness to play a leading role in the development of innovative methods in building out computer and mathematics education at a secondary level.	H	A	H	H
The ability not to be bound to existing mathematical models but to see real problems in a broader context and, where meaningful, to develop alternative models.	–	H	H	H
A more acute ability to formulate real problems, interpret their solutions and to see in what way they may be applied for the benefit of business and technological developments.	H	H	H	H
The learner will have been moulded by project work to investigate and solve a specific problem of a broader scope by means of existing techniques and to compile a well-structured report on the findings; and have developed the ability to present a good oral report on project work.	H	H	H	H

N.3.6 ARTICULATION POSSIBILITIES

In addition to the articulation possibilities as stated in N.2.5 the following particulars are of importance here:

- a) Curriculum N620P grants admission to the M.Com. studies in Computer Science and Information Systems.
- b) Curriculum N621P grants admission to the M.Com. studies in Statistics.
- c) Curricula N622P and N623P grant admission to M.Com. studies in Mathematics.

N.3.7 PROGRAM: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

SCHOOL: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

Qualification code: 504140

In each of the curricula described below the learner selects modules in consultation with the school director.

Not all of the modules are presented every year.

N.3.7.1 Curriculum N620P: Computer Science-Information Systems

The curriculum is compiled as follows:

Module code	Descriptive name	Credits
First semester		
ITRW671	Project I	8
AND another FOUR of the following modules in consultation with the school director:		
ITRW613	Databases I	16
ITRW616	Artificial Intelligence I	16
ITRW618	Decision Support Systems I	16
ITRW614	Information Engineering Systems I	16
ITRW615	Computer Security I	16
ITRW611	Data Warehouses I	16
ITRW619	Capita Selecta I [#]	16
Second semester		
ITRW672	Project II	8
AND FOUR of the following modules in consultation with the school director:		
ITRW621	Data Warehouses II	16
ITRW623	Databases II	16
ITRW626	Artificial Intelligence II	16
ITRW628	Decision Support Systems II	16
ITRW624	Information Systems Engineering II	16
ITRW625	Computer Security II	16
ITRW629	Capita Selecta II [#]	16
Total number of credits of this curriculum		144

[#] The learning material of the Capita Selecta modules may also be selected in consultation with the school director from modules of appropriate subjects in the Faculty of Economic and Management Sciences.

N.3.7.2

Curriculum N621P: Statistics

The curriculum is compiled as follows:

Module code	Descriptive name	Credits
First semester		
STTK611	Project I	8
STTK612	Statistical Data-analysis I: Models	16
STTK613	Resampling Methods	16
AND two modules in consultation with the school director from the following list:		
STTK614	Statistical Inference	16
STTK615	Stochastic Processes I	16
STTK616	Survival Theory	16
STTK617	Capita Selecta	16
STTK618	Capita Selecta	16
Modules from curricula N620 and N622 and from the M.Sc. Business Mathematics curricula N809P, N810P and N811P.		
Second semester		
STTK621	Project II	8
STTK622	Statistical Data-analysis II: Time Series	16
STTK623	Multivariate Statistics	16
AND two modules in consultation with the school director from the following list:		
STTK624	Discrete Data-analysis	16
STTK625	Stochastic Processes II	16
BWIN626	Contingencies (CT5)	16
STTK633	Probability Theory	16
STTK627	Capita Selecta	16
STTK628	Capita Selecta	16
Modules from curricula N620 and N622 and from the M.Sc. Business Mathematics curricula N809P, N810P and N811P.		
Total number of credits of this curriculum		144

*Select in consultation with the school director an honours module from one of the following subjects: Robst Statistics, Monte Carlo Methods, Non-parametric methods.

N.3.7.3 Curriculum N622P: Mathematics

The curriculum is compiled as follows:

Module code	Descriptive name	Credits
WISK611	Algebra I	16
WISK612	Functional Analysis I	8
WISK613	Topology of Metric and Normed Spaces	8
WISK614	Measure and Integration Theory I	8
WISK616	General Topology	8
WISK673	Project	16
WISK625	Complex Function Theory	16
AND four modules in consultation with the school director from the following list:		
WISK615	Differential Equations I	16
TGWS612	Differential Equations II	16
TGWS611	Numerical Analysis I	16
WISK621	Algebra II	16
WISK622	Functional Analysis II	16
WISK624	Measure and Integration Theory II	16
TGWS622	Differential Equations III	16
TGWS621	Numerical Analysis II	16
TGWS673	Approximation Theory	16
WISK676	Capita Selecta	16
WISK677	Capita Selecta	16
Modules from curricula N620 and N621.		
Total number of credits of this curriculum		144

* Select in consultation with the school director an honours module from one of the following subjects: Operator theory I, Operator theory II; General topology II, Complex analysis II, Linear algebra, Discrete mathematics.

N.3.7.4 Curriculum: N623P: Mathematics Education

The curriculum is compiled as follows:

Module code	Descriptive name	Credits
WISK611	Algebra I	16
WISK612	Functional Analysis I	8
WISK613	Topology of Metric and Normed Spaces	8
WISK616	General Topology	8
WSKO672	Sets and the Number Systems	16
WSKO673	History of Mathematics	16
WSKO675	Project	16
AND in consultation with the school director elective modules to the value of 56 credits of which two modules from the following list:		
WISK614	Measure and Integration Theory I	8
WISK615	Differential Equations I	16
WISK621	Algebra II	16

WISK622	Functional Analysis II	16
WISK624	Measure and Integration Theory	16
WISK625	Complex Function Theory	16
WSKO674	Capita Selecta	16
If fewer than three modules are selected from the list of elective modules the rest may be taken in the following way: at most two other modules from curricula N620P, N621P and N622P; at most two modules from the B.Ed. programme of the Faculty of Education Sciences (if a postgraduate qualification has already been taken in consultation with the school director).		
Minimum number of credits of this curriculum		144

* Select in consultation with the school director an honours module from one of the following subjects: Operator theory I, Operator theory II; General topology II, Complex analysis II, Linear algebra, Discrete mathematics.

N.3.8 EXAMINATIONS

The examination opportunities and related rules are set out in general rule A.8.1.

N.3.8.1 Compilation of the participation mark

A participation mark for a module (general rules A.1.7 and A.8.7.4) may be compiled from tests, assignments and other forms of assessment.

N.3.8.2 Admission to examinations

Admission to the examinations is obtained by attaining a proof of participation issued by the school director after compliance with the requirements of the relevant curriculum and/or module (general rules A.1.6 and A.8.6).

N.3.8.3 Module mark

The module mark (general rules A.1.39 and A.8.7.4) is calculated from the participation mark and the examination mark at the ratio 1:1 unless otherwise stated in the description of the curriculum in which the relevant module is found.

N.3.8.4 Pass requirements

Passing modules and a curriculum takes place in terms of general rules A.8.7 and N1.8 of this Calendar.

N.3.8.5 Repetition of modules

General rule A.10 applies here.

N.3.8.6 Termination of studies

General rule A.9 applies here.

N.4 RULES FOR THE DEGREE HONOURS BACHELOR OF ARTS

Qualification codes

The honours degree follows on a baccalaureus degree. The studies may be taken full-time or part-time.

Prospective learners must, before the date set by the director involved, apply to the director involved for selection and formal admission to the programme they intend to take the following year (general rule A.12.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

N.B. Lectures for honours modules in the Faculty of Natural Sciences are presented full-time only.

N.4.1 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.4.2 ADMISSION AND REGISTRATION

The studies may be undertaken in a study programme approved by the Faculty Board. These study programmes are set out in N.4.7. Apart from the provisions in A.4.1 and A.12 the additional requirements set out in the relevant curricula in N.4.7 have to be complied with.

If the applications received are more than the specific subject group in a school can handle, the group of learners who have the greatest chance of success according to the judgement of school director will be selected for the programme. The background and potential of learners are also taken into account in this selection process.

N.4.3 ASSUMED PRIOR LEARNING

The learner has already obtained an appropriate baccalaureus degree of which he/she has taken at least 96 module credits at NQR level 6 in the core subject of the relevant honours programme for which he/she intends to register.

If the learner 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.B.A. studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

N.4.4 STUDY PROGRAMME

Save for exceptions that the Dean might approve the honours degree may be taken in the following possible study programme: Environmental Sciences with curricula from the School of Environmental Sciences and Development.

N.4.5 EXIT LEVEL OUTCOMES

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

N.4.5.1 Natural science, human science and technology problem solving

At the end of the studies the learner will be able to identify, evaluate and solve certain convergent and divergent problems in a creative and innovative way in relevant disciplines in the field of the natural sciences and human sciences.

N.4.5.2 Applying fundamental and expert knowledge

At the end of the studies the learner will have abilities to integrate a basic knowledge and techniques from natural sciences, human sciences 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 and human science knowledge and methods (with emphasis on those of the specific discipline) to problems by the appropriate use of -
 - i) formal analysis and modelling of human activities and natural phenomena, systems and problems;
 - ii) communication of theories, concepts and ideas;
 - iii) discussions about and conceptualisation of human activities and natural phenomena, systems and problems;
 - iv) management of uncertainties and risks by utilising statistical principles and methods;
 - v) computer skills and information technology;
- b) implementation of principles, laws and techniques of natural sciences and human sciences (with emphasis on those of the specific discipline) at the fundamental level to -
 - i) identify and solve open business and community problems;
 - ii) identify and utilise applications;
 - iii) make use of common fundamental expertise across the boundaries of disciplines.

N.4.5.3 Investigations, experimenting and data analysis

At the end of the studies the learner 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 learner will have a limited knowledge of the fundamental research methodology of the specific discipline.

N.4.5.4 Scientific methods, skills and information technology

At the end of the studies the learner 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 –
 - i) the evaluation of the appropriateness and limitations of software;
 - ii) the correct application and functioning of software;
 - iii) 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.4.5.5 Professional and general communication

At the end of the studies the learner will be able to –

- a) communicate effectively both orally and in writing with scientists (with emphasis on those of 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 of the specific discipline).

N.4.5.6 Impact of natural science and human science activities on the community and environment

The learner will be critically aware of -

- a) the impact of natural science and human science activities (especially those of the specific discipline) on the community and the environment;
- b) the necessity to take into account in natural science and human science activities –
 - i) the impact of technology on the community and
 - ii) the personal, social and cultural values and expectancies of those people on whom scientific activities have an influence.

N.4.5.7 Team and multidisciplinary work

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

N.4.5.8 Lifelong learning

The learner 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.4.5.9 Professional ethics and practice

The learner will be 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 will be able to make judgements according to his/her knowledge and experience.

N.4.5.10 Programme outcomes

On completing these curricula the postgraduate will be able to provide proof that he/she has the following knowledge, skills and values:

- a) the ability to retrieve subject-specific and general environmental scientific knowledge and to apply skills at limited levels;
- b) the ability to independently plan and conduct research on a limited scale, to collect, process and analyse data, and to write down these findings in a report and present them orally;
- c) the ability to apply the knowledge and skills acquired in these studies meaningfully for the benefit of the national economy and the land and its people, as an entrepreneur or in a specific work situation;
- d) the ability to act as a leader in the local or general community;
- e) 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.4.6 ARTICULATION POSSIBILITIES

- a) On successfully completing the Hons.B.A. programme the learner may be admitted to further learning for the Master's of Environmental Sciences 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 learner with this qualification in the different disciplines in which the qualification may be taken will equip the learner to continue with further learning in several specialist areas at other institutions.

N.4.7 PROGRAMME: ENVIRONMENTAL SCIENCES
SCHOOL: ENVIRONMENTAL SCIENCES AND DEVELOPMENT
Qualification code: 102170

N.4.7.1 Curriculum N631P: Geography and Environmental Management

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

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMBO672	Research project	24
OMBO874	Environmental Management I	24
OMBO875	Environmental Analysis I	16
Elective modules (select modules for at least 40 credits)		
OMBO613	Introduction to GIS	16
OMBO614	Applied GIS	16
OMBO622	Theoretical Hydrology	8
OMBO623	Applied Hydrology	8
SBEL421	Planning Management	16
The learner selects one module for 8 credits in consultation with the school director from any curriculum in this program or from any other relevant modules on honours level.		8
Total of credits of the curriculum		128

N.4.8 EXAMINATIONS

The examination opportunities and related rules are set out in general rule A.8.1.

N.4.8.1 Admission to examinations

Admission to the examinations is obtained by attaining a proof of participation issued by the school director after compliance with the requirements of the relevant curriculum and/or module (general rules A.1.6 and A.8.6).

N.4.8.2 Compilation of the participation mark

A participation mark for a module (general rules A.1.7 and A.8.7.4) may be compiled from tests, assignments and other forms of assessment.

N.4.8.3 Module mark

The module mark (general rules A.1.39 and A.8.7.4) is calculated from the participation mark and the examination mark at the ratio 1:1 unless otherwise stated in the description of the curriculum in which the relevant module is found.

N.4.8.4 Pass requirements

Passing modules and a curriculum takes place in terms of general rules A.8.7 and N1.8 of this Calendar.

N.4.8.5 Repetition of modules
General rule A.10 applies here.

N.4.8.6 Termination of studies
General rule A.9 applies here.

N.5 RULES FOR THE DEGREE MAGISTER SCIENTIAE

The M.Sc. degree is a qualification that may follow on a B.Sc. or an Honours B.Sc. degree or another recognised degree approved by the Dean.

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

Prospective learners 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 (general rule A.13.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

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

N.5.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research units and focus areas. The research units and focus areas deal with the master's and Ph.D. training curricula, i.e. curricula that contain a considerable research component. Currently three research units fall under the Faculty of Natural Sciences, viz. the Research Unit for Business Mathematics and Informatics, Environmental Sciences and Management and the Research Unit for Space Physics, as well as one research focus area, viz. the Research Focus Area of Chemical Resource Benefication.

Except for very rare exceptions, which must be approved by the Dean, research that is required for a master's dissertation or minidissertation must be conducted within a research unit or one of the research focus areas. In the following table the most important connections between schools, centres, subject groups and the corresponding research unit/focus area are represented.

School/Centre	Subjects	Research unit/Research focus area
School of Physical and Chemical Sciences	Biochemistry Chemistry Physics Natural Science, Mathematics and Technology Education	Therapeutic and Preventive Intervention*
School of Environmental Science and Development	Zoology Geography and Environmental Studies Geology Microbiology Botany Urban and Regional Planning	Separation Science and -Technology Environmental Sciences and -Management

School/Centre	Subjects	Research unit/Research focus area
School of Computer, Statistical and Mathematical Sciences	Computer Science and Information Systems Statistics and Operational Research Mathematics and Applied Mathematics	Space Physics
Centre for Business Mathematics and Informatics	Actuarial Science Business Mathematics	Environmental Sciences and -Management
School of Natural Science, Mathematics and Technology Education	Handles educational training in the Faculty of Natural Sciences	Teaching-Learning Organisation and Management
School of Computer, Statistical and Mathematical Sciences	Computer Science Statistics Applied Mathematics Mathematics	Business Mathematics and Informatics
Centre for Business Mathematics and Informatics	Actuarial Mathematics Business Mathematics Risk Analysis	Business Mathematics and Informatics
Centre for Genomic Research	Biochemistry*	Therapeutic and Preventive Intervention*

* Personnel of the subject group Biochemistry conducts research mainly in the Focus Area of Preventive and Therapeutic Intervention, which falls under the Faculty of Health Sciences. Advanced postgraduate learners in Biochemistry will therefore also be conducting their research in this focus area.

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

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 four years part-time, taken from the date of first registration for the specific programme. In terms of the procedure explained in general rule A.13.6 a learner may apply for an extension of the study period.

N.5.3 ASSUMED PRIOR LEARNING

N.5.3.1 The learner has already obtained an appropriate honours baccalaureus degree.

N.5.3.2 If the learner does not conform to the provision of N.4.3.1 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 M.Sc. studies on the strength of knowledge and skills acquired by prior learning and work experience.

N.5.3.3 Programme-specific assumed prior learning is, where applicable, indicated in each of the programme descriptions.

N.5.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in general A.13.1 and A.13.2.

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 learner 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 focus area/research unit can handle in that programme, the group of learners 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 learners 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 general rule A.13.4 and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective learners must consult this manual carefully.**

N.5.6 ARTICULATION POSSIBILITIES

- a) On successful completion of most of the M.Sc. curricula the learner may be admitted to further learning for the doctorate at NQF level 8 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 learner 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.5.7 CHANGING FROM MASTER'S STUDIES TO DOCTORATE STUDIES

General rule A.13.8 makes provision for a learner 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.5.8 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 minidissertation, research report or dissertation.

N.5.8.1 Natural science (including mathematical and computer) and technological problem solving

At the end of the studies the learner 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.5.8.2 Applying fundamental and expert knowledge

At the end of the studies the learner 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 -
 - i) formal analysis and modelling of human activities and natural phenomena, systems and problems;
 - ii) communication of theories, concepts and ideas;
 - iii) discussions and conceptualisation of human activities and natural phenomena, systems and problems;
 - iv) management of uncertainties and risks by utilising statistical principles and methods;
 - v) 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 -
 - i) identify and solve open business and community problems;
 - ii) identify and utilise applications;
 - iii) work with common fundamental expertise across the boundaries of disciplines.

N.5.8.3 Investigations, experiments and data-analysis

At the end of the studies the learner 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 learner will have a limited knowledge of the fundamental research methodology of the specific discipline.

N.5.8.4 Scientific methods, skills and information technology

At the end of the studies the learner 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 -
 - i) evaluation of the appropriateness and limitations of software;
 - ii) correct application and functioning of software;
 - iii) 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.5.8.5 Professional and general communication

At the end of the studies the learner 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.5.8.6 Impact of natural science activities on the community and environment

The learner is 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 and health science activities
 - i) the impact of technology on the community and
 - ii) the personal, social and cultural values and expectancies of those people influenced by the scientific activities.

N.5.8.7 Team and multidisciplinary work

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

N.5.8.8 Lifelong learning

The learner 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.5.8.9 Professional ethics and practice

The learner 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.5.9 PROGRAMMES IN THE RESEARCH UNIT FOR BUSINESS MATHEMATICS AND INFORMATICS AND THE CENTRE FOR BUSINESS MATHEMATICS AND INFORMATICS

N.5.9.1 Specific assumed prior learning

The learner 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 M.Sc. studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

- a) For an M.Sc. 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:
- b) An honours baccalaureus degree in Mathematics in which Statistics has been taken at level 6 grants admission to Statistics.
- c) A four-year Baccalaureus degree in Engineering with Applied Mathematics at level 6 grants admission to Applied Mathematics.
- d) 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 M.Sc. programme a learner is also required to have taken the Hons.B.Sc. qualification in Business Mathematics and Informatics, subject to the following specific prerequisites:

Magister curriculum	Honours curriculum
N809P	N610P or N609P
N810P	N611P
N811P	N612P

Switching between the curricula may take place in consultation with the centre director.

- e) Apart from the prerequisites specified for admission in N.4.9.1 (d) learners 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 (BWIN826). 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.
- f) For the M.Sc. in Risk Analysis (N830P) the candidate must already have obtained an honours degree in mathematical sciences with theoretical or practical experience in risk analysis.

N.5.9.2 Programme-specific articulation possibilities

N.5.9.2.1 M.Sc. curricula N801P-808P in Computer Science, Statistics, Applied Mathematics and Mathematics

- a) On successful completion of the M.Sc. programme the learner will have direct access to further learning for the doctoral degree at NQF level 8.
- 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 applicable and expert skills, as well as the research skills that the learner 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.5.9.2.2 M.Sc. curricula N809P-811P in Business Mathematics and N830P in Risk Analysis

This M.Sc. curriculum's grants admission to a Ph.D. in Risk Analysis.

**N.5.9.3 PROGRAM: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES
RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS**

Qualification code: 203125

A learner selects in consultation with the director of the Research Unit of Business Mathematics and Informatics and the director of the School of Computer, Statistical and Mathematical Sciences or the director of the Centre for Business Mathematics and Informatics an appropriate theme for a mini-dissertation, research project or dissertation in one of the core subjects of the curricula described below. The theme will be selected in the context of a research project of the relevant research unit. The learner selects on advice of the research director the modules – two (i.e. 64 credits) in the case of a dissertation and three (i.e. 96 credits) in the case of a research project – in such a way that they are supportive of the research to be undertaken for the research project or dissertation. In the case of the M.Sc. curriculum in Risk Analysis the learner selects two modules (i.e. 2 X 16 = 32 credits).

N.5.9.3.1 Curriculum N801P: Computer Science

This curriculum is compiled as follows: the learner selects ITRW872 (Dissertation) and in consultation with the research director and the school director TWO other modules from the following list:

Module code	Descriptive name	Credits
ITRW872	Dissertation	64
ITRW874	Parallel Computing	32
ITRW875	Mathematical Programming	32
ITRW876	Databases	32
ITRW877	Decision Support Systems	32
ITRW878	Artificial Intelligence	32
ITRW879	Integer Programming	32
ITRW881	Capita Selecta**	32
ITRW611 and ITRW621*	Data Warehouses I and II	16 + 16 = 32
ITRW614 and ITRW624*	Information Systems Engineering I and II	16 + 16 = 32
ITRW615 and ITRW625*	Computer Security I and II	16 + 16 = 32
ITRW617 and ITRW627*	Image Processing I and II	16 + 16 = 32
Total number of credits		128

*In this curriculum both these two modules have to be taken to acquire the 32 credits.

**Select in consultation with the research and school directors one advanced topic on master's level from the following: Databases, Data mining, Image processing, Decision support systems, System development methodologies, Mathematical Programming.

N.5.9.3.2 Curriculum N802P: Computer Science

This curriculum is compiled as follows: the learner selects ITRW82 (Research Project) and in consultation with the research director and the school director THREE other modules from the following list:

Module code	Descriptive name	Credits
ITRW882	Research Project	32
ITRW874	Parallel Computing	32
ITRW875	Mathematical Programming	32
ITRW876	Databases	32
ITRW877	Decision Support Systems	32
ITRW878	Artificial Intelligence	32
ITRW879	Integer Programming	32
ITRW881	Capita Selecta**	32
ITRW611 and ITRW621*	Data Warehouses I and Data Warehouses II	16 + 16 = 32
ITRW614 and ITRW624*	Information Systems Engineering I and Information Systems Engineering II	16 + 16 = 32
ITRW615 and ITRW625*	Computer Security I and Computer Security II	16 + 16 = 32
ITRW617 and ITRW627*	Image Processing I and	16 + 16 = 32

	Image Processing II	
Total number of credits		128

*In this curriculum both these two modules must both be taken to acquire the 32 credits.

**Select in consultation with the research and school directors one advanced topic on master's level from the following: Databases, Data mining, Image processing, Decision support systems, System development methodologies, Mathematical Programming.

N.5.9.3.3 Curriculum N803P: Statistics

This curriculum is compiled as follows: the learner selects STTK872 (Dissertation) and in consultation with the research director and the school director TWO other modules from the following list:

Module code	Descriptive name	Credits
STTK872	Dissertation	64
STTK874	Advanced Resampling Methods	32
STTK875	Advanced Statistical Models	32
STTK876	Advanced Multivariate Statistics	32
STTK877	Advanced Probability Theory	32
STTK878	Capita Selecta*	32
STTK879	Capita Selecta*	32
Total number of credits		128

* Select in consultation with the research and school directors one of the following topic's on Master's level: Advanced Time Series Models, Advanced Statistical Inference.

N.5.9.3.4 Curriculum N804P: Statistics

This curriculum is compiled as follows: the learner selects STTK882 (Research Project) and in consultation with the research director and the school director THREE other modules from the following list:

Module code	Descriptive name	Credits
STTK882	Research Project	32
STTK874	Advanced Resampling Methods	32
STTK875	Advanced Statistical Models	32
STTK876	Advanced Multivariate Statistics	32
STTK877	Advanced Probability Theory	32
STTK878	Capita Selecta	32
STTK879	Capita Selecta	32
Total number of credits		128

*Select in consultation with the research and school directors one of the following topic's on Master's level: Advanced Time Series Models, Advanced Statistical Inference.

N.5.9.3.5 Curriculum N805P: Applied Mathematics

This curriculum is compiled as follows: the learner selects TGWS872 (Dissertation) and in consultation with the research director and the school director TWO other modules from the following list:

Module code	Descriptive name	Credits
TGWS872	Dissertation	64
TGWS874	Numerical Analysis	32
TGWS875	Capita Selecta*	32
TGWS876	Capita Selecta*	32
Total number of credits		128

*Select in consultation with the research and school directors one of the following topic's on Master's level: Advanced control theory, Advanced control of mechanical systems, Advanced optimization of mechanical systems, Numerical analysis, Stochastic differential equations, Financial engineering.

N.5.9.3.6 Curriculum N806P: Applied Mathematics

This curriculum is compiled as follows: the learner selects TGWS882 (Research Project) and in consultation with the research director and the school director THREE other modules from the following list:

Module code	Descriptive name	Credits
TGWS882	Research Project	32
TGWS874	Numerical Analysis	32
TGWS875	Capita Selecta*	32
TGWS876	Capita Selecta*	32
Total number of credits		128

*Select in consultation with the research and school directors one of the following topic's on Master's level: Advanced control theory, Advanced control of mechanical systems, Advanced optimization of mechanical systems, Numerical analysis, Stochastic differential equations, Financial engineering.

N.5.9.3.7 Curriculum N807P: Mathematics

This curriculum is compiled as follows: the learner selects WISK872 (Dissertation) and in consultation with the research director and the school director TWO other modules from the following list:

Module code	Descriptive name	Credits
WISK872	Dissertation	64
WISK874	Algebra	32
WISK875	Functional Analysis	32
WISK876	Capita Selecta I*	32
WISK878	Capital Selecta II*	32
Total number of credits		128

- Select in consultation with the research and school directors one of the following topic's on Master's: Operator theory and its applications, Measure and integration theory, Topological vector spaces, Complex analysis, Linear algebra.

N.5.9.3.8 Curriculum N808P: Mathematics

This curriculum is compiled as follows: the learner selects WISK882 (Research Project) and in consultation with the research director and the school director TWO modules from the following list:

Module code	Descriptive name	Credits
WISK882	Research Project	32
WISK874	Algebra	32
WISK875	Functional Analysis	32
WISK876	Capita Selecta I*	32
WISK878	Capital Selecta II*	32
Total number of credits		128

* Select in consultation with the research and school directors one of the following topic's on Master's: Operator theory and its applications, Measure and integration theory, Topological vector spaces, Complex analysis, Linear algebra.

**N.5.9.4 PROGRAM: BUSINESS MATHEMATICS AND INFORMATICS
CENTRE: BUSINESS MATHEMATICS AND INFORMATICS**

Qualification code: 203126

N.5.9.4.1 Curriculum N809P: BMI [Specialisation: Quantitative Risk Management] (following on Hons.B.Sc. N610P)

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

Module code	Descriptive name	Credits
First semester		
BWIN811	Practical Risk Management	16
BWIN815	Industry Integration Project	32
ITRW612	Linear Programming I	16
	Elective Module #	16
	Elective Module #	16
Second semester		
	Elective Module #	16
BWIN826	Industry Directed Research Project	80
Total number of credits		192

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

Module code	Descriptive name	Credits
BWIN816	Modern Portfolio Theory	16
BWIN817	Retail Credit Risk	16
BWIN813	Practical Data Mining	16
BWIN818	Topical research issues in risk analysis	16

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

Module code	Descriptive name	Credits
BWIN621	Quantitative Risk Analysis II	16
BWIN627	Core Applications Part I	16
BWIN628	Finance and Investment ST5	16
BWIN629	Core Applications Part II	16
ITRW622	Linear Programming II	

The integrated assessment of this curriculum takes place during the assessment of the module BWIN826.

N.5.9.4.2 Curriculum N810P: BMI [Specialisation: Financial Mathematics] (following on Hons.B.Sc. N611P)

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

Module code	Descriptive name	Credits
First semester		
BWIN812	Pricing of Derivatives B	16
BWIN811	Practical Risk Analysis	16
BWIN815	Industry Integration Project	32
ITRW612	Linear Programming I	16
	Elective Module #	16
Second semester		
BWIN826	Industry Directed Research Project	80
	Elective Module #	16
Total number of credits		192

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

Module code	Descriptive name	Credits
BWIN817	Retail Credit Risk	16
BWIN818	Topical research issues in Risk Analysis	16
BWIN614	Investment Theory I	16
BWIN611	Quantitative Risk Analysis I	16

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

Module code	Descriptive name	Credits
ITRW622	Linear Programming II	16
STTK623	Multivariate Statistics	16
STTK624	Discrete Data Analysis	16

The integrated assessment of this curriculum takes place during the assessment of the modules BWIN826.

N.5.9.4.3 Curriculum N811P: BMI [Specialisation: Data Mining] (following on Hons.B.Sc. N612P)

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

Module code	Descriptive name	Credits
First semester		
BWIN813	Practical Data Mining	16
BWIN815	Industry Integration Project	32
ITRW612	Linear Programming I	16
	Elective Module #	16
	Elective Module #	16
Second semester		
	Elective Module #	16
BWIN826	Industry Directed Research Project	80
Total number of credits		192

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

Module code	Descriptive name	Credits
BWIN816	Modern Portfolio Theory	16
BWIN817	Retail Credit Risk	16
BWIN614	Investment Theory I	16
BWIN613	Financial Engineering I	16

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

Module code	Descriptive name	Credits
ITRW622	Linear Programming II	16
BWIN623	Financial Engineering II	16
STTK624	Discrete Data Analysis	16
ITRW624	Information Systems Engineering II	16

The integrated assessment of this curriculum takes place during the assessment of the module BWIN826.

**N.5.9.5 PROGRAM: BUSINESS MATHEMATICS AND INFORMATICS
CENTRE: BUSINESS MATHEMATICS AND INFORMATICS
Qualification code: 203127**

N.5.9.5.1 Curriculum N830P 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
BWIN872	Dissertation	128
BWIN874	Capita Selecta	32
Total number of credits		160

**N.5.10 PROGRAM: SPACE PHYSICS
RESEARCH UNIT: SPACE PHYSICS**

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.

Capita Selecta may replace the contents of two of the modules in curriculum N818P in consultation with the school director and the research director.

N.5.10.1 Curriculum N818P: Physics (following on Hons.B.Sc.)

This curriculum is compiled from FSKM821, FSKM872 and two other modules from the list below:

Module code	Descriptive name	Credits
FSKM811	Astrophysics I	16
FSKM812	Transport Theory	16
FSKM813	Astrophysics II	16
FSKM814	Heliospheric Physics	16
FSKM815	Capita Selecta I*	16
FSKM821	General Relativity	16
In consultation with the school director an honours module from the mathematical sciences may be selected.		16
FSKM872	Dissertation	80
Total number of credits		128

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

N.5.10.2 Curriculum N840P: Astrophysics and Space science

This curriculum is taken by learners in the National Astrophysics and Space Science Programme (NASSP). It is compiled from FSKN872 and lectured modules. The lectured modules, which represent 80 credits, are presented and examined by the NASSP consortium and are selected from the 16 and 32 credit modules in the list following below. **Learners are permitted to start on the dissertation only after they have passed all of the lectured modules.**

Module code	Descriptive name	Credits
FSKA874	Plasma Physics	16
FSKA875	Magnetohydrodynamics	16
FSKA876	Current topics in Cosmology	16
FSKA877	Cataclysmic variables	16
FSKA878	Extragalactic astronomy and galactic dynamics	16
FSKA879	Advanced General Relativity	16
FSKA880	High energy astrophysics and pulsars	16
FSKA881	General Astrophysics 1	16
FSKA882	Stellar structure and -evolution	16
FSKA883	Observation techniques	32
FSKA884	Space technology	32
FSKM872	Dissertation	80
	Credits for selective modules	80
Total number of credits		160

**N.5.11 PROGRAM: CHEMICAL RESOURCE BENEFICATION
RESEARCH FOCUS AREA: CHEMICAL RESOURCE BENEFICATION**

Qualification code: 203131

There are five research areas in this focus area and a research topic for an M.Sc. dissertation must therefore be selected from one of these research areas. The research areas are:

- a) *Membrane technology*: zeolite membranes, polymer membranes, water purification, chiral separations, hydro carbonic separations, pervaporation and nanofiltration.
- b) *Supercritical technology*: matrix decontamination, resin impregnation, resource recovery and extraction of essential oils.
- c) *Catalysis and synthesis*: homogeneous catalysis (isomerisation, oligomerisation, polymerisation, metathesis), organic synthesis, organometallic synthesis and polymer membranes.
- d) *Reactive separations*: reactive extraction, reactive distillation, reactive absorption, fractionating, water purification and recovery of heavy metals.
- e) *Crystallisation and precipitation*: melt crystallisation, precipitation, supercritical particle technology, ultra purification, water purification, hydrometallurgy, and pharmacy.

N.5.11.1 Curriculum N815P: Chemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
CHEN872	Dissertation	96
CHEN874	Capita Selecta*	32
Total of credits of the curriculum		128

#Select in consultation with the research director a Chemistry topic on Master's level.

N.5.12 PROGRAM: BIOCHEMISTRY

RESEARCH FOCUS AREA: THERAPEUTIC AND PREVENTIVE INTERVENTION

Qualification code: 203132

N.5.12.1 Curriculum N816P: Biochemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BCHN872	Dissertation	96
BCHN874	Capita Selecta*	32
Total of credits of the curriculum		128

#Select in consultation with the research director a Biochemistry topic on Master's level.

N.5.13 PROGRAMME: ENVIRONMENTAL SCIENCES

RESEARCH UNIT ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203194

This curriculum can only be followed if a learner already has an appropriate honours degree.

The topic of an M.Sc. 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: Anthropogenic environmental impacts, bio-remediation, sustainable utilisation; environmental remediation and restoration, ecophysiology, ecotoxicology; plant and animal parasitism, urban ecology.
- c) Water sciences and management: Psychology, industrial microbiology and fermentation biotechnology, water health, parasitology and epidemiology; water management and water purification, water treatment, aquatic ecotoxicology, aquatic ecophysiology, microbial 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 Nematod.

N.5.13.1 Curriculum N830P: Environmental Sciences (Full-Time and Part-Time)

This curriculum is composed of the following

Module code	Descriptive name	Credits
OMWN871	Dissertation	128
Total credits for the curriculum		128

NB: For further programmes in the Research Unit Environmental Sciences and Management readers are referred to N.5 and N.6.

N.5.14 PROGRAMME: CHEMISTRY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203133

This curriculum can only be followed if the learner already has an appropriate honours degree.

N.5.14.1 Curriculum N815P : Chemistry

This curriculum is composed of the following:

Module code	Descriptive name	Credits
CHEN872	Dissertation	96
CHEN874	Capita Selecta*	32
Total credits for the curriculum		128

* Choose a topic on M-level from the discipline of Chemistry in conjunction with the research director.

N.5.15 PROGRAMME: ZOOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203190

This curriculum can only be followed if the learner already has an appropriate honours degree.

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 for Environmental Sciences and Development.

N.5.15.1 Curriculum N826P: Zoology (Full-Time and Part-Time)

This curriculum is composed of the following

Module code	Descriptive name	Credits
DRKN871	Dissertation	128
Total credits for the curriculum		128

N.5.16 PROGRAMME: GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203193

This curriculum can only be followed if the learner already has an appropriate honours degree.

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):

- a) Spatial studies
- b) Environmental impact analysis and all aspects thereof
- c) Environmental management and all aspects thereof
- d) Physical and human Geography.

N.5.16.1 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	128
Total credits for the curriculum		128

NB: For further programmes in the Research Unit Environmental Sciences and Management readers are referred to N.5 and N.6.

N.5.17 PROGRAMME: MICROBIOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 203191

This curriculum can only be followed if the learner already has an appropriate honours 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 for Environmental Sciences and Development.

Curriculum N827P: Microbiology (Full-Time and Part-Time)

This curriculum is composed of the following

Module code	Descriptive name	Credits
MKBN871	Dissertation	128
	Total credits for the curriculum	128

N.5.18**PROGRAMME: BOTANY****RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT****Qualification code: 203192**

This curriculum can only be followed if the learner already has an appropriate honours degree.

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 for Environmental Sciences and Development.

N.5.18.1**Curriculum N828P: Botany (Full-Time and Part-Time)**

This curriculum is composed of the following

Module code	Descriptive name	Credits
PLKN871	Dissertation	128
	Total credits for the curriculum	128

N.5.19 PROGRAM: REACTOR PHYSICS**SCHOOL: PHYSICS****Qualification code: 203130**

This is the only M.Sc. programme in the Faculty of Natural Sciences that does not belong to a focus area. The curriculum has been designed in consultation with the National Energy Council of South Africa (Necsa) to train reactor scientists for the growing nuclear energy industry of South Africa. The contents of the Capita Selecta modules are determined in consultation with the school director.

N.5.19.1 Curriculum N814P: Reactor Science*

A recognised honours degree in Physics or Applied Mathematics grants admission to this curriculum. This curriculum is compiled from the following modules:

Module code	Descriptive name	Credits
FSKR815	Capita Selecta I	16
FSKR816	Capita Selecta II	16
FSKR817	Capita Selecta III	16
FSKR872	Dissertation	80
Total number of credits		128

*This curriculum is phased out and new registrations for N812P will therefore not be accepted in 2006.

N.5.20 PROGRAM: SCIENCE EDUCATION**SCHOOL: SCHOOL OF PHYSICAL AND CHEMICAL SCIENCES****Qualification code: 203134****N.5.20.1 Curriculum N831P: Science Education**

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

Module Code	Descriptive name	Credits
NWON874	Teaching Strategies	32
NWON875	Research Methods	32
NWON872	Dissertation	116
Total number of credits		180

N.5.21 EXAMINATIONS

- a) Admission to the examination in any module takes place in terms of general rules A.1.6 and A.8.6.
- b) Examinations for the master's degree are taken in terms of the provisions of general rule A.13.6.
- c) A dissertation or minidissertation is submitted only with the consent of the study leader(s) (general rule A.13.9).

- d) The provisions of general rule A.13.14 determine the number of times that a learner may present him-/herself for examinations.
- e) The modules BWIN815 and BWIN825 may only be presented once for examinations due to their project nature.

N.5.22 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with general rule A.8.7 and rule N.1.8 of this calendar.

N.6 RULES FOR THE DEGREE MASTER OF ENVIRONMENTAL SCIENCES

Qualification codes:

Prospective learners 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 (general rule A.13.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

N.B. 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

Learners have two options in the Master of Environmental Sciences studies:

- a) An option directed at research (Master of Environmental Studies) in curricula N820P, N821P, N822P and N 25P. This program follows on a relevant Bachelor's degree and consists of 'n year of theory followed by a 128 credits dissertation. Student who have completed the theoretical part of this program will no longer be allowed to exit with a B.Sc.Hons. degree.
- b) An option directed at environmental management in which students, on completing one of the curricula N820P-N825P, change to the Master of Environmental Sciences by following curriculum N824P (Environmental Management). This change is subject to selection. This option contains a limited research component (in the form of a 48 credits minidissertation) and the Master of Environmental Sciences is presented part-time only over two years.

Research in the Faculty of Natural Sciences is managed in research units and research focus areas. The research units and focus areas are furthermore responsible for the master's (M.Sc.) and doctorate (Ph.D.) 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.6.2 DURATION OF THE STUDIES

The minimum duration of the studies is two years full-time and three years part-time and the maximum duration is three years full-time and four years part-time, taken from the date of first registration for the relevant curriculum. In terms of the procedure set out in general rule A.13.5.2 the learner may apply for an extension of the period of study.

N.6.3 ASSUMED PRIOR LEARNING

- N.6.3.1 The learner has already obtained an appropriate baccalaureus degree.

N.6.3.2 If the learner does not conform to the provision of N.5.3.1 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 Master of Environmental Sciences studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

N.6.3.3 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 general A.13.1 and A.13.2.

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 learner 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 focus area/research unit can handle in that programme, the group of learners 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 learners 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 grounds of the provisions in general rule A.13.4 and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective learners 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 focus area.

N.6.6 ARTICULATION POSSIBILITIES

- a) On completion of the theoretical section of curriculum N818P it is possible to switch to the Master's Degree in Environmental Management (Master of Environmental Management) and to complete the modules lacking for this degree. Candidates will be subject to selection.
- b) A learner having completed this degree may be admitted to Ph.D. studies in a core subject in which adequate credits have been obtained.
- c) General rule A.13.8 makes provision for a learner who is registered for a master's degree and has, according to the unanimous judgement of the study leader and the research and school directors concerned, attained 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.6.7 EXIT LEVEL OUTCOMES

N.6.7.1 General exit level outcomes

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

- a) the ability to apply subject-specific and general environmental scientific knowledge and skills in addressing environmental issues and in identifying, analysing and solving environmental issues;
- 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 current knowledge and to remain at the forefront of the latest technology and experimental methods in environmental sciences;
- d) the ability to apply the knowledge and skills acquired in these studies meaningfully as an entrepreneur or for the benefit of the national economy and the people in a specific work situation;
- e) the ability to act as a leader in the local or general community;
- f) the ability to communicate professionally or in general with scientists and the community, whether orally or in writing, while making use of the appropriate structure, style and graphic and electronic support.

N.6.7.2 Specific exit level outcomes

N.6.7.2.1 Knowledge

On completing this qualification the learner ought to be able to provide proof that he/she has knowledge of and insight into a selected section of the following:

fundamental environmental management systems, impact, analysis, legislation, economics, policy and ethics; function and ecology of natural environments, including the biotic and abiotic influences on soil, water, agricultural ecosystems and air; the nature and impact of interference/disturbances, pollution and anthropogenetic influences on soil, water and air, and the bioremediation, rehabilitation or restoration thereof; ecological aspects like population dynamics and modelling, energy flow and community analysis, urban ecology, community ecology and sustainable ecosystem utilisation; ecophysiology, stress physiology, ecotoxicology; evolutionary biology of plants and animals, cladistic principles, biological nomenclature and curation of biodiversity; genome analysis, conservation biology and biogeographic patterns; molecular biology; principles of integrated plague management systems and the application of biotechnology in agriculture; biodiversity and population dynamics in natural and agricultural ecosystems and the assessment of plague phenology, damage symptoms, economic damage and threshold values; principles of chemical insect management, plant disease and weed management, as well as application methods; morphology, systematics and taxonomy of plague organisms and interactions with plants, aspects of physico-chemical and biological properties of water and water management; aquatic toxicology, water pollution and biomonitoring, water health, as well as water purification and treatment; environmental metabolism, bio-economic

aspects of swamps/marshes and modelling; bioprocess engineering and fermentation biotechnology.

N.6.7.2.2 Skills

On successful completion of this qualification the learner ought to be competent in a selected section of:

sampling methods in terrestrial and aquatic environments; chemical and biological analysis of soil and water samples; the use of analytical apparatus in modern practising of science and GIS; basic techniques in qualifying and monitoring biodiversity, as well as curation techniques; techniques in isolating and analysing genetic material; techniques in determining environmental impacts and methods of environmental impact analyses; digital processing of data, multivariate analysis, statistical analyses and other relevant computer skills; planning, collecting, analysing, interpreting data and writing down the findings in a research project or a dissertation that conforms to scientific standards; oral, written and visual communication of all forms of information; functioning in groups and applying responsible and effective self-management; creating an own frame of thought in writing a dissertation.

N.6.7.2.3 Values

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

environmental, research and conservation ethics from a fundamental perspective; the development of a holistic view on the position of a specific subject in environmental sciences; appreciation of the nationally and internationally shared responsibility and stewardship regarding the management and conservation of the environment and biodiversity.

N.6.8 PROGRAMME: ENVIRONMENTAL SCIENCES

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 217104

N.6.8.1 Programme rules

- a) For part-time learners who, due to their work conditions, are unable to make use of the laboratories and research infrastructure of the Potchefstroom campus of North West University admission to these curricula is dependent on such learners' access to an appropriate laboratory and research infrastructure.
- b) On completion of the theoretical section it is possible to switch from curriculum N825P to the Master of Environmental Management degree and complete the lacking modules of the curriculum N 824P of that degree. **Candidates will be subject to selection.**
- c) Programme-specific rules are, where applicable, indicated in the description of each curriculum.

N.6.8.2 Curriculum N820P : Ecological Remediation and Sustainable Utilisation (following on B.Sc.)

The dissertation is compulsory. The learner selects four of the Elective Modules A in consultation with the school director and the research director. Learners from the Tourism environment elect the Elective Modules B.

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMWE611	Rehabilitation of Disturbed Areas	16
OMWE612	Anthropogenic Environmental Impacts and Biological Remediation	16
OMEW621	Sustainable Ecosystem Utilisation and Restoration	16
OMWE615	Conservation Biology	16
OMWE674	Practical Work/Project	24
Elective modules (learner selects four)		
Elective Modules A		
OMWE614	Applied Soil Science	8
OMWE621	Urban Ecology	8
OMWE622	Plant Physiology and Stress-physiology	8
OMWE623	Plant Growth and Development	8
OMWE624	Animal Ecophysiology	8
OMWE627	Advanced Ecotoxicology	8
The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.		
Elective Modules B		
ONTP672	Ecotourism (Year module)	32
ONTP673	Marketing Tourism (Year module)	32
Dissertation		
OMWO872	Dissertation	128
Total of credits of the curriculum		264

N.6.8.3 Curriculum N821P : Biodiversity and Conservation Biology (following on B.Sc.)

The dissertation is compulsory. The learner selects four of the Elective Modules A in consultation with the school director and the research director. Learners from the Tourism environment elect the Elective Modules B.

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMWB611	Biodiversity: Past, Present and Future Tendencies	16
OMWB613	Systematics in Practice	16
OMEW621	Sustainable Ecosystem Utilisation and Restoration	16
OMWE615	Conservation Biology	16

OMWE674	Practical Work/Project	24
Elective modules A (learner selects four)		
OMWB622	Genome Analysis and Bio-informatics	8
OMWB623	Evolutionary Biology - Plantae	8
OMWB624	Evolutionary Biology - Animalia	8
OMWB626	Evolutionary Ethology	8
OMWB628	Reconstructing Phylogenies	8
OMWB629	Biogeography	8
The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.		
Elective Modules B (Only for learners from the tourism environment)		
ONTP672	Ecotourism (Year module)	32
ONTP673	MarketingTourism (Year module)	32
Dissertation		
OMWO872	Dissertation	128
Total of credits of the curriculum		264

N.6.8.4**Curriculum N822P : Water Sciences (following on B.Sc.)**

The dissertation is compulsory. The learner selects four of the elective modules in consultation with the school director and the research director.

For OMWW612 the following ratio applies: participation mark : examination mark = 2:1.

A undergraduate module in parasitism is a prerequisite for OMWW614

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	8
OMWW611	Physical-Chemical and Biological Characteristics of Inland Water	16
OMWW612	General Aquatic Toxicology, Water Pollution and Biomonitoring	16
OMWW614	Waterborne Diseases	16
OMWW629	Water Purification and Water Treatment	16
OMWE674	Practical Work/Project	24
Elective modules (learner selects four)		
OMWW622	Environmental Metabolism	8
OMWW623	Psychology	8
OMWE627	Advanced Ecotoxicology	8
OMWW625	Wetlands	8
OMWW626	Introduction to Bioprocess Engineering / Fermentation Technology	8
OMWW627	Advanced biological waste water treatment	8
OMWE622	Plant Ecophysiology and Stress-physiology	8
OMWE624	Animal Ecophysiology	8
OMBO622	Theoretical Hydrology	8
OMBO623	Applied Hydrology (Only fulltime)	8
The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.		
Dissertation		
OMWO872	Dissertation	128
Total of credits of the curriculum		264

N.6.8.5

Curriculum N823P: Plant Protection (following on B.Sc.)

The dissertation is compulsory. The learner selects five of the elective modules in consultation with the school director and the focus area director, at least 3 modules from elective modules groups A or B and the rest from elective modules group C.

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	8
OMWP611	Pest Phenology and Damage Symptoms	16
OMWP612	Principles of Integrated Pest Management	24
OMWP613	Economic Damage and Threshold Values	16
OMWP614	Practical Work/Project	24
Elective modules A (Acarology/Entomology)		
OMWP621	Biodiversity and Populations Dynamics and Agricultural Ecosystems	8
OMWP622	Morphology, Systematics and Taxonomy of Insects	8
OMWP623	Morphology, Systematics and Taxonomy of the Acari	8
OMWP624	Arthropoda/Plant Interactions	8
Elective modules B (Nematology)		
OMWP625	Biology and Systematics of Nematodes	8
OMWP626	Tropical and Subtropical Nematology	8
OMWP627	Nematode/Plant Interactions	8
OMWP628	Principles of Sustainable Nematode Control	8
Elective modules C (General themes)		
OMWA621	Biotechnology: Applications in Agriculture	8
OMWA622	Weeds: Interactions and Control	8
OMWA623	Plant Pathology	8
The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.		
Dissertation		
OMWO872	Dissertation	128
Total of credits of the curriculum		264

N.6.8.6 Curriculum N825P: Environmental Analysis and Management (following on B.Sc.)

The dissertation is compulsory. The learner selects modules to the value of 40 credits from the elective modules:

Module code	Descriptive name	Credits
Compulsory modules		
OMBO611	Introduction to Environmental Management	16
OMBO672	Research Project	24
OMBO874	Environmental Management	24
OMBO875	Environmental Analysis	24
Elective modules (learner selects modules to the value of 40 credits)		
OMBO613	Introduction to GIS	16
OMBO614	Applied GIS	16
OMBO622	Theoretical Hydrology	8
OMBO623	Applied Hydrology (Only fulltime)	8
SBEL421	Planning Management	16
The learner selects one module to the value of 8 credits in consultation with the School Director from any curriculum in this program or any other relevant module at honours level.		8
Dissertation		
OMBO872	Dissertation	128
Total of credits of the curriculum		256

N.6.9 EXAMINATIONS

- a) Admission to the examination in any module is granted in terms of general rules A.1.6 and A.8.6.
- b) Examinations for the master's degree are taken in terms of the provisions of general rule A.13.6.
- c) A dissertation or minidissertation is submitted only with the written consent of the study leader(s) (general rule A.13.9).
- d) The provisions of general rule A.13.14 determine the number of times that a learner may present him-/herself for examinations.

N.6.10 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with general rule A.8.7 and rule N.1.8 of this calendar.

N.7 RULES FOR THE DEGREE MASTER OF ENVIRONMENTAL MANAGEMENT

Prospective learners 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 (general rule A.13.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

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

N.7.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research units and research focus areas. The research units and focus areas are furthermore responsible for the master's (M.Sc.) and doctorate (Ph.D.) 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 two years part-time and the maximum duration is three years part-time, taken from the date of first registration for the relevant curriculum. In terms of the procedure set out in general rule A.13.5.2 the learner may apply for an extension of the period of study

N.7.3 ASSUMED PRIOR LEARNING

N.7.3.1 The learner has already obtained an honours baccalaureus degree in Geography and Environmental Studies.

N.7.3.2 If the learner does not conform to the provision of N.7.3.1 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.

N.7.3.3 On the ground of the assessment of individual merits by the school director, in consultation with the research director, a prospective learner may be required to pass certain fundamental and core modules before he/she will be admitted to the Master of Environmental Management studies.

N.7.3.4 Programme specific assumptions are, where applicable, indicated in the programme descriptions.

N.7.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in general A.13.1 and A.13.2.

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 learner 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 focus area/research unit can handle in that programme, the group of learners 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 learners 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 in general rule A.13.4 and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective learners 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 focus area.

N.7.6 ARTICULATION POSSIBILITIES

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

N.7.7 EXIT LEVEL OUTCOMES

N.7.7.1 General exit level outcomes

On successful completion of this qualification the learner 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 minidissertation;
- 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.7.7.2 Specific exit level outcomes

N.7.7.2.1 Knowledge

On completion of the qualification the learner 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.7.7.2.2 Skills

On successful completion this course the learner 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 learner will further be able to:

- a) independently plan, collect, analyse and interpret data and report the findings in a minidissertation 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.7.7.2.3 Values

On completion of the degree the learner 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.7.8 PROGRAMME: ENVIRONMENTAL MANAGEMENT RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 218106

N.7.8.1 Programme rules

- a) This programme is presented part-time only and extends over two years.
- b) Learners 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.
- d) If a student has successfully completed the compulsory modules, but not in view of completing OMBO873, the student may apply that the degree B.Sc.Hons. (Geography and Environmental Management) be conferred to him/her after the student has completed additional module(s) to the value of 48 credits from curricula N613P, N614P, N615P, N616P or N617P in consultation with the director.

N.7.8.2 Curriculum N824P : Environmental Management (following on a relevant honours degree)

The curriculum consists of:

Module code	Descriptive name	Credits
Compulsory modules		
OMBO878	Environmental Management 2	40
OMBO879	Environmental Analysis 2	40
Minidissertation		
OMBO873	Minidissertation	80
Total of credits of the curriculum		160

N.7.9 EXAMINATIONS

- a) Admission to the examination in any module is granted in terms of general rules A.1.6 and A.8.6.
- b) Examinations for the master's degree are taken in terms of the provisions of general rule A.13.6.
- c) A dissertation or minidissertation is submitted only with the written consent of the study leader(s) (general rule A.13.9).
- d) The provisions of general rule A.13.14 determine the number of times that a learner may present him-/herself for examinations.

N.7.10 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with general rule A.8.7 and rule N.1.8 of this calendar.

N.8 RULES FOR THE DEGREE MAGISTER COMMERCII

Prospective learners 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 (general rule A.13.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

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

N.8.1 INTRODUCTION

The M.Com. degree is a qualification in the Faculty of Natural Sciences following on a B.Com., Hons.B.Com. degree or an appropriate B.Sc. or Hons.B.Sc. 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.8.2 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 three years full-time and five years part-time, taken from the date of first registration for the specific programme. In the case of curricula following on a baccalaureus degree, the minimum duration is two years and the maximum duration four years. In terms of the procedure set out in general rule A.13.5.2 the learner may apply for an extension of the period of study.

N.8.3 ASSUMED PRIOR LEARNING

N.8.3.1 The learner has already obtained an appropriate baccalaureus degree and/or appropriate honours baccalaureus degree. For an M.Com. 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.

N.8.3.2 If a learner does not conform to the provision of N.7.3.1 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 M.Com. studies on the strength of knowledge and skills acquired by prior learning and work experience that led to learning.

N.8.3.3 Programme-specific assumed learning is, where applicable, indicated in each of the programme descriptions.

N.8.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in general A.13.1 and A.13.2.

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 learner 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 focus area/research unit can handle in that programme, the group of learners 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 learners 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 on the basis of the provisions in general rule A.13.4 and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective learners must consult this manual carefully.**

N.8.6 ARTICULATION POSSIBILITIES

On successful completion of one of these M.Com. curricula the learner 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 learner 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.8.7 CHANGING FROM MASTER'S STUDIES TO DOCTOR'S STUDIES

General rule A.13.8 makes provision for a learner 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

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

N.8.8.1 Knowledge

- a) Knowledge of the research methodology and techniques in one of the subjects that will be demonstrated by writing a minidissertation or dissertation on an advanced topic.
- b) Knowledge of two or more advanced topics from one or more of the subjects as indicated below:
 - i) *Computer Science*: linear programming, databases, data warehouses, pseudo-intelligence, decision support systems, information systems engineering and computer security;
 - ii) *Statistics*: advanced resampling methods, statistical models, multivariate statistics, probability theory, stochastic processes and survival theory;
 - iii) *Mathematics*: functional analysis, operator theory, algebra, Riesz spaces and Banach lattices.

N.8.8.2 Skills

On successful completion of the programme the learner 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.8.9 PROGRAMME: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 505110

A learner selects, in consultation with the research director of the Unit for Business Mathematics and Informatics, an appropriate theme for a minidissertation or dissertation in the core subject of the curriculum in which he is interested. Further the learner selects the modules (three in the case of a minidissertation and two in the case of a dissertation) on advice of the research director in such a way that these modules are supportive of the research undertaken for the minidissertation or dissertation. Amongst others the selection is made from the modules in the table in each of the programme descriptions, but it may also be made from other relevant sections of the core subject(s) (under the heading *Capita Selecta*).

N.8.9.1 Curriculum N850P : Computer Science and Information Systems

This curriculum is compiled as follows: The learner selects in consultation with the research director and the school director either ITRW872 (Dissertation) and TWO other modules from the list below or ITRW873 (Minidissertation) and THREE other modules from the list below, with the proviso that for certain modules specific requirements apply. A learner may also be admitted (or advised) to take a course from the Faculty of Economic and Management Sciences.

Module code	Descriptive name	Credits
ITRW872	Dissertation	64
ITRW873	Minidissertation	32
ITRW877	Decision Support Systems	32
ITRW878	Artificial Intelligence	32
ITRW879	Integer Programming	32
ITRW876	Databases	32
ITRW881	Capita Selecta**	32
ITRW612 and ITRW622*	Linear Programming 1 and II	16 +16 = 32
ITRW614 and ITRW624*	Information Systems Engineering I and Information Systems Engineering II	16 + 16 = 32
ITRW615 and ITRW625 *	Computer Security I and Computer Security II	16 + 16 = 32
Total number of credits of the curriculum		128

* In this curriculum these two modules must both be taken to acquire 32 credits.

**Select in consultation with the research and school directors one advanced topic on master's level from the following: Databases, Data mining, Image processing, Decision support systems, System development methodologies.

N.8.9.2 Curriculum N851P : Statistics

This curriculum is compiled as follows: The learner selects in consultation with research director and the school director either STTK872 (Dissertation) and TWO other modules from the following list or STTK873 (Minidissertation) and THREE other modules from the following list:

Module code	DESCRIPTIVE NAME	Credits
STTK872	Dissertation	64
STTK873	Minidissertation	32
STTK874	Advanced Resampling Methods	32
STTK875	Advanced Statistical Models	32
STTK876	Advanced Multivariate Statistics	32
STTK877	Advanced Probability Theory	32
STTK878	Capita Selecta *	32
STTK879	Capita Selecta*	32
Total number of credits of the curriculum		128

* Select in consultation with the research and school directors one of the following topic's on Master's: Advanced Time Series Models, Advanced Statistical Inference.

N.8.9.3 Curriculum N852P : Mathematics

This curriculum is compiled as follows: The learner selects in consultation with the research director and the school director either WISK872 (Dissertation) and TWO other modules from the following list or WISK873 (Minidissertation) and THREE other modules from the following list:

Module code	Descriptive name	Credits
WISK872	Dissertation	64
WISK873	Minidissertation	32
WISK874	Algebra	32
WISK875	Functional Analysis	32
WISK876	Capita Selecta I*	32
WISK878	Capital Selecta I*I	32
Total number of credits of the curriculum		128

* Select in consultation with the research and school directors one of the following topic's on Master's: Operator theory and its applications, Measure and integration theory, Topological vector spaces, Complex analysis, Linear algebra.

N.8.10 EXAMINATIONS

- Admission to the examination in any module is granted in terms of general rules A.1.6 en A.8.6.
- Examinations for the master's degree are taken in terms of the provisions of general rule A.13.6.
- A dissertation of minidissertation is submitted only with the written consent of the study leader(s) (general rule A.13.9).
- The provisions of general rule A.13.14 determine the number of times that a learner may present him-/herself for examinations.

N.8.11 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with general rule A.8.7 and rule N.1.8 of this calendar.

N.9 RULES FOR THE DEGREE MAGISTER ARTIUM ET SCIENTIAE (PLANNING)

Prospective learners 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 (general rule A.13.1). Only learners 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 learners are also taken into account in this selection process. Late applications will only be considered if an additional learner can be accommodated in the relevant subject group.

N.9.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research units and research focus areas. The research units and focus areas are furthermore responsible for the master's (M.Sc.) and doctorate (Ph.D.) 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.9.2 DURATION OF THE STUDIES

The minimum duration of the studies is minimum one year and maximum two years full-time and minimum two years and maximum four years part-time, taken from the date of first registration for the relevant curriculum. In terms of the procedure set out in general rule A.13.5.2 the learner may apply for an extension of the period of study.

N.9.3 ASSUMED PRIOR LEARNING

N.9.3.1 The learner has an appropriate honours baccalaureus degree.

N.9.3.2 If the learner does not conform to the provision of N.8.3.1 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 M.Art. et Scien. studies on the strength of knowledge and skills acquired by prior learning and work experience.

N.9.3.3 A learner must have command of Afrikaans or English.

N.9.3.4 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 general A.13.1 and A.13.2.

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 learner 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 focus area/research unit can handle in that programme, the group of learners 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 learners 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 of general rule A.13.4 and the relevant provisions in the *Manual for Postgraduate Studies*. **Prospective learners must consult this manual carefully.**

N.9.6 ARTICULATION POSSIBILITIES

On taking this degree the learner may be admitted to further learning for the Ph.D. degree in Urban and Regional Planning.

N.9.7 CHANGING FROM MASTER'S TO DOCTOR'S STUDIES

General rule A.13.8 makes provision for a learner 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.9.8 EXIT LEVEL OUTCOMES

On completion of this qualification the learner 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.

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

**N.9.9 PROGRAM: URBAN AND REGIONAL PLANNING
FOCUS AREA: ENVIRONMENTAL SCIENCES AND MANGEMENT**

Qualification code: 119102

N.9.9.1 Curriculum N825P : Urban and Regional Planning (Full-time or Part-time)

Module code	Descriptive name	Credits
SBEL871	Dissertation	128
Total of credits for curriculum		128

N.9.10 EXAMINATIONS

- a) A dissertation is submitted in terms of general rule A.13.9.6.
- b) The examinations for the master's degree are taken in terms of general rule A.13.6.
- c) A dissertation is submitted only with the written consent of the study leader(s) (general rule A.13.9).
- d) The provisions of general rule A.13.14 determine the number of times that a learner may present him-/herself for examinations.

N.9.11 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with general rule A.8.7 and rule N.1.8 of this calendar.

N.10 RULES FOR THE DEGREE PHILOSOPHIAE DOCTOR

The Ph.D. 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 learners must apply to the relevant research director for selection and formal admission to the intended programme in the following year (general rule A.14.1). Only learners 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 learners are also taken into account in this selection process.

New Ph.D. learners must register before 30 June of the year in which they wish to commence their studies.

N.10.1 INTRODUCTION

Research in the Faculty of Natural Sciences is managed in research units and research focus areas. The research units and focus areas are responsible for the master's (M.Sc.) and doctorate (Ph.D.) training curricula, i.e. curricula that contain a considerable research component.

Currently three research units fall under the Faculty of Natural Sciences, viz. the Research Unit for Business Mathematics and Informatics, Environmental Sciences and Management and the Research Unit for Space Physics, as well as one research focus area, viz. the Research Focus Area of Chemical Resource Benefication.

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 unit or one of the RESEARCH UNIT. In the following table the most important connections between schools, centres, subject groups and the corresponding research unit/focus area are represented.

School/Centre	Subjects	Research unit/RESEARCH UNIT
School of Physical and Chemical Sciences	Chemistry	Environmental Sciences and Management Chemical Resource Benefication
	Physics	Space Physics
	Natural Science, Mathematics and Technology Education	Teaching-Learning Organisation and Management
School of Environmental Sciences and Development	Zoology Geography and Environmental Studies Microbiology Botany Urban and Regional Planning	Environmental Sciences and Management

School/Centre	Subjects	Research unit/RESEARCH UNIT
School of Computer, Statistical and Mathematical Sciences	Computer Science Statistics Applied Mathematics Mathematics	Business Mathematics and Informatics
Centre for Business Mathematics and Informatics	Actuarial Mathematics Business Mathematics Risk Analysis	Business Mathematics and Informatics
Centre for Genomic Research	Biochemistry*	Therapeutic and Preventive Intervention*

* Staff of the subject group Biochemistry conducts research mainly in the Focus Area of Preventive and Therapeutic Intervention, which falls under the Faculty of Health Sciences. Advanced postgraduate learners in Biochemistry will therefore also be conducting their research in this focus area.

The Ph.D. curricula that are presented in the Faculty of Natural Sciences are in this calendar classified in the research unit or the RESEARCH UNIT in which the research component of the programme falls.

N.10.2 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 general rule A.13.6 a learner may apply for an extension of the study period.

General rule A.14.5 applies to learners of whom the registration for master's degree has been changed to registration for a doctor's degree (Ph.D.).

N.10.3 ASSUMED PRIOR LEARNING

N.10.3.1 The learner has already obtained an appropriate master's degree.

N.10.3.2 If the learner does not conform to N.9.3.1 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 Ph.D. studies on the strength of prior learning and work experience that led to learning.

N.10.3.3 Programme-specific assumed learning is, where applicable, indicated in each of the programme descriptions.

N.10.4 ADMISSION AND REGISTRATION

The admission requirements and the prescribed dates for registration are set out in general rules A.14.1 and A.14.2.

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 learner 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 focus area/research unit can handle in that programme, the group of learners 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 learners will also be taken into account in this selection process.

N.10.5 APPROVAL OF THE STUDY PROGRAMME

Approval of the study programme takes place in terms of the provisions in general rule A.14.4 and the relevant provisions in the ***Manual for Postgraduate Studies***. **Prospective learners must consult this manual carefully.**

N.10.6 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 learner 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.10.7 EXIT LEVEL OUTCOMES

The learner 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 learner 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 learner 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:

Learners 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.10.8 PROGRAMME: COMPUTER, STATISTICAL AND MATHEMATICAL SCIENCES

RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS

Qualification code: 204110

There are five research programmes in this unit. The thesis may be undertaken in Computer Science or Statistics or Applied Mathematics or Risk Analysis. The research programmes in the Research Unit for Business Mathematics and Informatics determine the research direction in which the thesis is conducted:

- a) *Computer Science*: linear programming, decision support systems, operational research, artificial intelligence and mathematical programming;
- b) *Statistics*: resampling theory and non-parametric curve estimation;
- c) *Mathematics*: ordered vector spaces and algebras, operator theory, functional analysis and partial differential equations;
- d) *Applied Mathematics*: approximation and optimisation, mathematical modelling, numerical analysis and control theory;
- e) *Risk Analysis*: portfolio theory, asset and liability analysis, market, credit and operational risk analysis and data mining.

N.10.8.1 Curriculum N901P: Computer Science

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
ITRW971	Thesis	256

N.10.8.2 Curriculum N902P: Statistics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
STTK971	Thesis	256

N.10.8.3 Curriculum N903P: Applied Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
TGWS971	Thesis	256

N.10.8.4 Curriculum N904P: Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
WISK971	Thesis	256

**N.10.9 PROGRAMME: BUSINESS MATHEMATICS AND INFORMATICS
RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS**

Qualification code: 204111

Curriculum N905P: BUSINESS MATHEMATICS AND INFORMATICS

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BWIN971	Thesis	256

**N.10.10 PROGRAMME: RISK ANALYSIS
RESEARCH UNIT: BUSINESS MATHEMATICS AND INFORMATICS**

Qualification code: 204133

Curriculum N915P: Business Mathematics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BWIR971	Thesis	256

**N.10.11 PROGRAM: SPACE PHYSICS
RESEARCH UNIT FOR SPACE PHYSICS**

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 rays in the heliosphere;
- d) geomagnetic effects on electromagnetic and cosmic rays as studied by means of observations in Antarctica.

N.10.11.1 Curriculum N906P: Physics

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
FSKN971	Thesis	256

**N.10.12 PROGRAMME: CHEMICAL RESOURCE BENEFICATION
RESEARCH UNIT: CHEMICAL RESOURCE BENEFICATION**

Qualification code: 204113

There are five research areas in this focus area and a research topic for a Ph.D. thesis must therefore be selected from one of these research areas. The research areas are:

- a) *Membrane technology*: zeolitic membranes, polymer membranes, water purification, chiral separations, hydrocarbonic separations, pervaporation and nanofiltration.
- b) *Supercritical technology*: matrix decontamination, resin impregnation, resource recovery and extraction of essential oils.
- c) *Catalysis and synthesis*: homogeneous catalysis (isomerisation, oligomerisation, polymerisation, metathesis), organic synthesis, organometallic synthesis and polymer membranes.
- d) *Reactive separations*: reactive extraction, reactive distillation, reactive absorption, fractionating, water purification and reclaiming of heavy metals.
- e) *Crystallisation and precipitation*: melt crystallisation, precipitation, supercritical particle technology, ultra purification, water purification, hydrometallurgy and pharmacy.

N.10.12.1 Curriculum N907P: Chemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
CHEN971	Thesis	256

**N.10.13 PROGRAMME: ENVIRONMENTAL SCIENCES
RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT**

Qualification code: 204114

The topic for a Ph.D. 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 parasitism, urban ecology.

- c) Water sciences and management: Psychology, industrial microbiology and fermentation-biotechnology, water health, parasitology and epidemiology, water management and water purification, water treatment, aquatic ecotoxicology, aquatic ecophysiology, microbial 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 Nematod.

N.10.13.1 Curriculum N914P: Environmental sciences

Module code	Descriptive name	Credits
OMWN971	Thesis	256

N.10.14 PROGRAMME: CHEMISTRY
RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT
Qualification code: 204120

N.10.14.1 Curriculum N907P : Chemistry

This curriculum is composed of the following

Module code	Descriptive name	Credits
CHEN971	Thesis	256

N.10.15 Programme: ZOOLOGY
RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT
Qualification code: 204136

This curriculum can only be followed if the learner already has an appropriate M.Sc. 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 for Environmental Sciences and Development.

N.10.15.1 Curriculum N908P : Zoology

This curriculum is composed of the following

Module code	Descriptive name	Credits
DRKN971	Thesis	256

N.10.16 PROGRAMME: GEOGRAPHY AND ENVIRONMENTAL MANAGEMENT

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204137

This curriculum can only be followed if the learner already has an appropriate M.Sc. 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.10.16.1 Curriculum N909P : Geography and Environmental Management

This curriculum is composed of the following

Module code	Descriptive name	Credits
GGFN971	Thesis	256

N.10.17 PROGRAMME: MICROBIOLOGY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204135

This curriculum can only be followed if the learner already has an appropriate M.Sc. 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 for Environmental Sciences and Development.

N.10.17.1 Curriculum N910P : Microbiology

This curriculum is composed of the following

Module code	Descriptive name	Credits
MKBN971	Thesis	256

N.10.18 PROGRAMME: BOTANY

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204134

This curriculum can only be followed if the learner already has an appropriate M.Sc. 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 for Environmental Sciences and Development.

N.10.18.1 Curriculum N911P : Botany

This curriculum is composed of the following

Module code	Descriptive name	Credits
PLKN971	Thesis	256

N.10.19 PROGRAMME: URBAN AND REGIONAL PLANNING

RESEARCH UNIT: ENVIRONMENTAL SCIENCES AND MANAGEMENT

Qualification code: 204115

N.10.19.1 Curriculum N912P: Urban and Regional Planning

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
SBEL971	Thesis	256

N.10.20 PROGRAMME: BIOCHEMISTRY

RESEARCH UNIT: PREVENTIVE AND THERAPEUTIC INTERVENTION

Qualification Code: 204116

N.10.20.1 Curriculum N913P: Biochemistry

This curriculum is compiled as follows:

Module code	Descriptive name	Credits
BCHN971	Thesis	256

N.10.21 PROGRAMME: REACTOR PHYSICS**SCHOOL: PHYSICS****Qualification code: 204117**

This Ph.D. programme in the Faculty of Natural Sciences that does not belong to a focus area. The curriculum has been designed in consultation with the National Energy Council of South Africa (Necsa) to train reactor scientists for South Africa's growing nuclear energy industry.

N.10.21.1 Curriculum N920P: Reactor Science

An M.Sc. in Reactor Science grants admission to this curriculum. This curriculum is structured from the following modules:

Module code	Descriptive name	Credits
FSKR972	Thesis	256

N.10.22 PROGRAM: SCIENCE EDUCATION**SCHOOL: SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION****Qualification code: 204118**

This Ph.D. programme in the Faculty of Natural Sciences that does not belong to a focus area.

N.10.22.1 Curriculum N921P: Science Education

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

Module Code	Descriptive Name	Credits
NWON971	Thesis	256

N.10.23 EXAMINATIONS

- a) Examinations for the doctorate are taken in terms of the provisions of general rule A.12.5.
- b) Submitting the thesis takes place in terms of general rule A.12.7.
- c) The number of times that a learner may present him-/herself for examinations and the repetition of modules are determined by the provisions of general rule A.12.12.

N.10.24 PASS REQUIREMENTS

Passing modules and a curriculum takes place in accordance with general rule A.8.7 and rule N.1.8 of this calendar.