POTCHEFSTROOM CAMPUS

NATURAL SCIENCES

UNDERGRADUATE PROGRAMMES

Address all correspondence to:

The Registrar
North-West University
Potchefstroom Campus
Private Bag X6001
Potchefstroom
2520

Tel: (018)299-1111/2222
Fax: (018)299-2799
Internet: http://www.nwu.ac.za

PLEASE MENTION YOUR UNIVERSITY NUMBER IN ALL CORRESPONDENCE.

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

http://www.nwu.ac.za/webfm_send/57621

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

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

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

Table of Contents

Compiled by Mrs H Swart
Administrative Manager, Faculty of Natural Sciences,
October 2016

FACULTY OF NATURAL SCIENCES

OFFICIALS
DEAN

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

SCHOOL DIRECTORS

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

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

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

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

RESEARCH DIRECTORS and CENTRE DIRECTORS

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

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

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

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

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

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

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

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

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

Administrative Manager
Mrs H Swart, BBibl (UNISA)

SUBJECT GROUP CHAIRPERSONS

Biochemistry
Dr R Louw, PhD Biochemistry (NWU)

Botany
Prof SJ Siebert, PhD (UP)

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

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

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

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

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

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

Microbiology
Dr S Claassens, PhD (NWU)

Physics
Prof C Venter BSc (PU for CHE), MSc (NWU), PhD (NWU)

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

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

Zoology
Prof MS Maboeta, PhD (Stellenbosch University)

FACULTY BOARD

The Faculty Board existing of the following members:

- The Dean
- School/Centre and Research entity Directors
- Full Professors
- Subject Group Chairpersons
- One student representatives of each School
- Two representatives of designated groups of each School
- One representative from the Faculties of Economic and Management Sciences, Education Sciences, Engineering and Health Sciences
- Administrative Manager

N.1 FACULTY RULES

N.1.1 AUTHORITY OF THE GENERAL ACADEMIC RULES (A-RULES)

The faculty rules that apply to the different qualifications, programmes and curricula of the Faculty and are included in this *Calendar* are subject to the rules contained in *General Rules* of the University, as determined by the Council of the University on recommendation of the Senate from time to time, and therefore the faculty rules have to be read together with those General Rules.

A-Rules available on the web page at: http://www.nwu.ac.za/webfm_send/57621

N.1.2 EVALUATION OF ACADEMIC LITERACY

a) All Natural Sciences students (except students in curricula N134P, N135P, N136P, N137P, N183P and N150P) must register for the module AGLA111 [Afrikaans] or AGLE111 [English]. The module selected is taken into account for purposes of credits.

b) Student enrolled for the curricula N134P, N135P, N136P, N137P, N183P and N150P, must report for a compulsory test of skills in academic literacy in order that their ability to function in an academic environment may be evaluated. The purpose of the test is to identify students who, due to inadequate academic skills, run the risk of failing to complete their study programme successfully within the stipulated period. Students may decide themselves whether they want to take the test in Afrikaans or English. With the exception of students identified as borderline cases by the test, each student has only one opportunity to write the test. Students regarded as borderline cases will be afforded a second opportunity. It is the student's responsibility to establish his/her results within 14 days of writing the test and to register for the correct module and in the correct semester.

c) Students who are identified as borderline cases must register for module AGLA111 [Afrikaans]/AGLE111 [English], depending on the language in which they have taken the compulsory skills test. The credits earned for these modules do not contribute to the number of credits required by a curriculum, but are regarded as additional credits.

d) To be admitted to the examination in AGLA111/AGLE111 a participation mark of 35% is required. Students, who are not admitted to the examination in AGLA111/AGLE111, or who fail the relevant examination, as well as two or more other modules, will have to be re-evaluated by the Evaluation Committee if they want to continue their studies the following semester. In order to avoid termination of studies, AGLA111/AGLE111 must be passed at the end of the second historic year at the latest.

e) Admission to module AGLA121/AGLE121, which is compulsory for all students who register at the University for the first time, requires that a student who had to complete AGLA111/AGLE111 beforehand, should obtain a module mark of at least 40% in AGLA111/AGLE111. The module AGLA121/AGLE121 carries a weight of 12 credits, which contributes to the number of credits required by the curriculum for which the student is registered. The module has to be taken in the language in which the compulsory skills test and AGLA111/AGLE111 were taken. AGLA/E121consists of three papers, viz. Academic Literacy, Computer and

Information Skills and Reading Skills. There is a subminimum in each of the three components. The student must pass each of the three components in the same semester in which he/she has registered for the module in order to pass the module.

f) Students who failed the module AGLA111/AGLE111, but were allowed to continue with AGLA121/AGLE121 and who passed the examination in this module, may have the results of AGLA111/AGLE111 condoned by the relevant school director to allow for a pass mark in the module.

g) Students who have already successfully completed a module[s]/course[s] equivalent to AGLA111, AGLA121 or AGLE111, AGLE121 at another institution and can provide proof of the relevant achievement[s], may apply in writing to the **Head of the Centre for Academic and Professional Language Practice** for formal recognition thereof.

N.1.3 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/content/policy_rules

N.1.4 CAPACITY CONSTRAINTS

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. Because of capacity constraints and the overflow of students in certain fields of study, students will be selected for admission to these fields according to their scholastic achievements.

N.1.5 PROVISIONAL ADMISSION REQUIREMENTS FOR UNDER-GRADUATE STUDIES (POTCHEFSTROOM CAMPUS) 2017

a) GENERAL ADMISSION REQUIREMENTS

Taking due cognisance of the General Rules and faculty rules as contained in the relevant yearbooks and with specific reference to the A-rule that determines a **National Senior Certificate** has been obtained and that the minimum statutory requirements for admission to **Diploma** and/or **B-degree studies** at a university in the RSA have been complied with, the University reserves the right to consider candidates' applications on the basis or their results.

b) CALCULATION OF THE ADMISSION POINTS SCORE(APS) SCORE IN THE FACULTY OF NATURAL SCIENCES

Selection model: Determining the APS

NSC scale	APS score
8 (90-100%)	8
7 (80-89%)	7
6 (70-79%)	6
5 (60-69%)	5
4 (50-59%)	4
3 (40-49%)	3
2 (30-39%)	2
1 (0-29%)	1

APS: Admission Points Score

1. **APS score: The** results obtained in four prescribed designated and two NSC subjects are used for the calculation of the APS Score. The results obtained in Life Orientation are excluded.

2. **Language requirement:** A pass at level 4 (50-59%) in two languages, including the language of instruction on either the Home or First additional Language level.

3. **Mathematics requirement:**

   A student who wishes to follow any module in Mathematics, with the exception of Mathematical Techniques (WISN112, WISN113 or WISN123), must have obtained a mark of at least 60% (level 5) in the grade 12 Mathematics exam or at least 70% (level 6) in another Mathematics exam considered by the Senate as equivalent to the above.

   Comments:

   - Students who do not meet these requirements, but who managed to obtain a Mathematics mark of at least 50% (level 4) or at least 60% (level 5) in another Mathematics exam considered by the Senate as equivalent to the above, are admitted to a refresher course in Mathematics presented in January by the School of Computer, Statistical and Mathematical Sciences. If such students perform satisfactorily in the tests taken during this course, they may be considered for admission to Mathematical modules.

   - Prospective students who do not meet the grade 12 requirement for enrolling for WISN111, and who have not attended the refresher course,

can gain admission to WISN111 in the second study year by passing the module Mathematical Techniques (WISN112, WISN113 or WISN123) in the first study year, provided that persons seeking to follow this route to obtain admission to programmes that would otherwise have been inaccessible to them, should take into consideration that they may not be able to complete their studies in the minimum period.

- A student who wishes to take Mathematical Techniques (WISN 112, WISN 113 or WISN 123) has to comply with prerequisites of the program the student intends to study. If a student wishes to take Mathematical Techniques (WISN 112, WISN 113 or WISN 123) in order to qualify for WISN 111 in the next year, or for non-degree purposes, the student, must have obtained a mark of at least 40% (level 3) in the grade 12 Mathematics exam, or at least 50% (level 4) in another Mathematics exam considered by the Senate as equivalent to the above.

N.1.6 RE-CURRICULATION OF QUALIFICATIONS AND PROGRAMMES TO ADHERE TO HEQSF REQUIREMENTS

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

QUALIFICATION NAME	WITH specialisation	NEW Qualification and Curriculum code as from 2017	OLD Qualification and Curriculum code
BSc Qualifications			
Bachelor of Science in Information Technology		**2DX H01** **N301P**	264100 N150P
Bachelor of Science in Biological Sciences	Botany and Biochemistry	**2DK H02** **N301P**	200118 N170P
Bachelor of Science in Biological Sciences	Zoology and Physiology	**2DK H03** **N301P**	200118 N185P
Bachelor of Science in Biological Sciences	Microbiology and Physiology	**2DK H04** **N301P**	200118 N186P
Bachelor of Science in Biological Sciences	Chemistry and Physiology	**2DK H06** **N301P**	200190 N177P
Bachelor of Science in Biological Sciences	Zoology and Biochemistry	**2DK H07** **N301P**	200118 N160P
Bachelor of Science in Biological Sciences	Zoology and Microbiology	**2DK H08** **N301P**	200118 N163P
Bachelor of Science in Biological Sciences	Zoology and Botany	**2DK H09** **N301P**	200118 N164P

Bachelor of Science in Biological Sciences	Microbiology and Botany	**2DK H10** **N301P**	200118 N169P
Bachelor of Science in Environmental Sciences	Geology and Geography	**2DJ H01** **N301P**	200118 N147P
Bachelor of Science in Environmental Sciences	Geology and Botany	**2DJ H02** **N301P**	200118 N148P
Bachelor of Science in Environmental Sciences	Botany and Chemistry	**2DJ H03** **N301P**	200118 N149P
Bachelor of Science in Environmental Sciences	Zoology and Chemistry	**2DJ H04** **N301P**	200118 N161P
Bachelor of Science in Environmental Sciences	Zoology and Geography	**2DJ H05** **N301P**	200118 N162P
Bachelor of Science in Environmental Sciences	Geography and Botany	**2DJ H06** **N301P**	200118 N165P
Bachelor of Science in Environmental Sciences	Geology and Chemistry	**2DJ H07** **N301P**	200118 N180P
Bachelor of Science in Environmental Sciences	Zoology and Geology	**2DJ H08** **N301P**	200118 N182P
Bachelor of Science in Environmental Sciences	Geology and Microbiology	**2DJ H09** **N301P**	200118 N181P

N.1.6.1 Faculty specific admission requirements

DEGREE/DIPLOMA	REQUIRED NSC SUBJECTS PLUS SELECTION CRITERIA	APS	SELECTION TEST
BSc (3 yrs) ***Programme: Physical and Chemical Sciences*** ***(Qualification code – 200190)***			
Chemistry-Physics **N151P** Chemistry, Mathematics-Applied Maths **N152P** Physics-Mathematics **N154P** Physics-Applied Maths **N155P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
Chemistry-Biochemistry **N174P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs) ***Programme: Computer and Mathematical Sciences*** ***(Qualification code – 200191)***			
Physics-Computer Science **N153P** Computer Science-Statistics **N156P** Computer Science-Mathematics **N157P** Statistics-Mathematics **N158P** Mathematics **N159P** Computer Science-Economics **N175P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No

Mathematics-Economics **N176P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code – 2DX H01 ***Qualification name : Bachelor of Science in Information Technology***			
Bachelor of Science in Information Technology **N301P**	Mathematics level 4 (50-59%)	26	No
Bachelor of Science in Environmental and Biological Sciences			
BSc (3 yrs) ***Programme: Environmental and Biological Sciences*** ***(Qualification code – 200118)***			
Microbiology-Biochemistry **N167P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs) ***Programme: Environmental and Biological Sciences*** ***(Qualification code – 200118)***			
Microbiology-Chemistry **N168P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs) **Programme: Environmental and Biological Sciences** **(Qualification code – 200118)**			
Geography-Computer Sciences **N166P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
Bachelor of Science in Biological Sciences			
BSc (3 yrs): Qualification code : 2DK H02 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Botany and Biochemistry **N301P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DK H06 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Chemistry and Physiology **N301P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No

BSc (3 yrs): Qualification code : 2DK H07 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Zoology and Biochemistry **N301P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DK H03 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Zoology and Physiology **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DK H04 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Microbiology and Physiology **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DK H08 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Zoology and Microbiology **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DK H09 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Zoology and Botany **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DK H10 ***Qualification name : Bachelor of Science in Biological Sciences***			
Programme: Microbiology and Botany **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
Bachelor of Science in Environmental Sciences			
BSc (3 yrs): Qualification code : 2DJ H03 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Botany and Chemistry **N301P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H04 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Zoology and Chemistry **N301P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No

BSc (3 yrs): Qualification code : 2DJ H07 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Geology and Chemistry **N301P**	Mathematics level 5 (60-69%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H01 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Geology and Geography **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H02 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Geology and Botany **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H05 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Zoology and Geography **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H06 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Geography and Botany **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H08 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Zoology and Geology **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BSc (3 yrs): Qualification code : 2DJ H09 ***Qualification name : Bachelor of Science in Environmental Sciences***			
Programme: Geology and Microbiology **N301P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No

BSc (3 yrs) ***Programme: Tourism (Qualification code – 200119)***			
Tourism-Zoology-Botany **N171P** Tourism-Geography-Botany **N172P** Tourism-Geography-Zoology **N173P**	Mathematics level 4 (50-59%) and Physical Science at level 4 (50-59%)	26	No
BArt et Scien (4 yrs) ***Programme: Planning (Qualification code – 118101)***			
Urban and Regional Planning **N183P**	Selection: The deadline for applications is 30 June. Late applications will be considered. Mathematics level 5 (60-69%)	28	**Yes**
BSc (3 yrs) ***Programme: Quantitative Risk Management (Qualification code – 200166)***			
Quantitative Risk Management **N134P**	Mathematics level 6 (70% and higher)	32	No
BSc (3 yrs) ***Programme: Financial Mathematics (Qualification code – 200167)***			
Financial Mathematics **N135P**	Mathematics level 6 (70% and higher)	32	No
BSc (3 yrs) ***Programme: Data Mining (Qualification code – 200168)***			
Data Mining **N136P**	Mathematics level 6 (70% and higher)	32	No
BSc (3 yrs) ***Programme: Actuarial Science (Qualification code – 200123)***			
Actuarial Science **N137P**	Mathematics level 6 (70% and higher)	32	No

N.1.7 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 another institution, or informally (from experience), is an indispensable element in deciding on admission to and awarding credits with a view to placement in an explicitly selected 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 from experience. At all times the question will be what the level of the skills is, and skills will be assessed in the context of the exit level skills required by 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 can and must take place in a valid, trustworthy and fair way, within the normal existing policy on awarding credits to prospective and existing students, whether they are from this or another institution.

d) For processing an application for recognition of prior learning a non-refundable administrative levy is payable as determined by the University from time to time.

N.1.8 AMENDMENT OF CURRICULUM AND/OR QUALIFICATION

Converting from one curriculum to another (including amendment of qualification or programme) is by way of a student request form. The full transcript of the student along with the maximum period of the study, are hereby considered. Admission is subject to the approval of the Dean.

N.1.9 REGISTRATION

Registration is the prescribed completed process a student has to follow to register as a student of North-West University (see General Rule 1.3.5).

N.1.10 REGISTRATION OF ADDITIONAL MODULES

Apart from the required modules of the relevant curriculum, a student may take additional modules in terms of the provision in the General Rule 2.3.4.

N.1.11 DURATION OF STUDIES

The minimum duration of the studies for a BSc degree is three years and the maximum duration for completing the degree is four years.

N.1.12 LANGUAGE MEDIUM

The language of instruction in all undergraduate contact sessions is Afrikaans, unless otherwise indicated. Educational interpreting to English will be available in all first- and second-year modules as of 2017 (where requested). All study guides, tests and examination papers are made available to students in both Afrikaans and English. Students may answer any written or oral test or examination in either Afrikaans or English. Lectures in all the years of Actuarial Sciences and Urban and Regional Planning are already interpreted to English.

N.1.13 TRAINING OF TEACHERS

The Faculty of Natural Sciences regards the training of teachers to be of such importance that information regarding the Postgraduate Certificate in Education (PGCE) is summarised below for the convenience of prospective teachers. However, students should not neglect consulting the PGCE calendar of the Faculty of Education Sciences for complete information.

The following curricula comply with the entry requirements of the PGCE:

Qualification /Curriculum code	**Programme/ Curriculum name**	**PGCE Field of specialisation**
2DJ H04 N301P***	Zoology and Chemistry	Physical Science
2DJ H05 N301P *	Zoology and Geography	Life Sciences Geography
2DK H08 N301P *	Zoology and Microbiology	Life Sciences*
2DK H09 N301P	Zoology and Botany	Life Sciences
2DJ H06 N301P **	Geography and Botany	Life Sciences Geography
200118 N166P	Geography- Computer Sciences	Geography Information Technology
2DK H10 N301P **	Microbiology and Botany	Life Sciences
2DJ H03 N301P ***	Botany and Chemistry	Physical Science
200190 N151P	Chemistry-Physics	Physical Science Mathematics
200190 N152P	Chemistry, Mathematics-Applied Mathematics	Physical Science Mathematics
200190 N154P	Physics-Mathematics	Mathematics
200190 N155P	Physics-Applied Mathematics	Mathematics
200190 N174P	Chemistry-Biochemistry	Physical Science
200191 N153P	Physics-Computer Science	Information Technology Mathematics
200191 N156P	Computer Science - Statistics	Information Technology Mathematics
200191 N157P	Computer Science - Mathematics	Information Technology Mathematics
200191 N158P	Statistics-Mathematics	Mathematics
200191 N159P	Mathematics	Mathematics
200191 N175P	Computer Science - Economics	Information Technology Economics

200191 N176P	Mathematics-Economics	Mathematics Economics

* Only if Botany II is selected.
** Only if Zoology II is selected.
*** Only if Physics I is selected.

a) Nature and aims of the PGCE

The PGCE serves as a professional 'capping' qualification for candidates who have completed an appropriate 360 or 480 credits Bachelor's degree and would like to join the education profession. With this certificate an educator can teach from Grade 7 to Grade 12.

b) Duration of studies

The minimum duration of the study is one (1) year and the maximum duration is two (2) years.

c) Method of delivery

This qualification can be taken only full-time Contact the Faculty of Education Sciences for more information

d) Admission requirements

A first university degree with two recognised school subjects.

Students must also be able to take two (2) methodologies in order to obtain the PGCE qualification. The curriculum of the certificate must be structured as follows:

- Recognised school subject/learning area at level 3 + recognised school subject/learning area at level 2.

Students must enrol for the methodologies of the subject in which he/she obtained the highest qualification.

Exceptions

A student who wants to take **Life Sciences** as methodology need to present one of the subjects Botany, Zoology or Physiology at level three and another of these subjects at level 2.

A student who wants to take **Physical Sciences** as methodology needs to present one of the subjects Chemistry or Physics on level three and the other at level 1 OR both subjects at level 2.

A student who wants to take the Methodology of **Mathematics** must have completed Mathematics on level 2 or otherwise Mathematics on level 1 with one of the following on level 2: Statistics, Mathematical Statistics, Applied Mathematics and Financial Mathematics.

A student who wants to take the Methodology of **Life Orientation** must have **Psychology** and one of the following subjects on degree level: Sociology, Political Studies, Human Movement Science, Labour -and Industrial studies, Human Rights and Ethics or Nutrition. The student must also have a second school subject on degree level for the second methodology.

A student who wants to take the Methodology of any **language** must have completed that language at level 3.

Students who have as yet not completed their first degree may in rare cases be admitted to the PGCE. Such students should direct applications to the applicable School Director at the Faculty of Education Sciences.

e) Directed observation

Before starting the PGCE a student must attend an approved school for preparatory compulsory work related training for at least two weeks.

N.1.14 EXAMINATIONS

a) Examination opportunities

Examination opportunities and relevant rules are in accordance with the General Rule 2.4.

b) Composition of the participation mark

The participation mark for a module (General Rule 2.4.2) is compiled from tests, assignments and practical work. For every teaching-learning task (class tests, assignments, exercises etc.) that is carried out by means of formative assessment in a module, a mark is allocated. A student's participation mark is the weighed mean of all these marks.

The relationship between theory and practical work for the calculation of the participation mark for the modules in the relevant study stated.

c) Admission to examinations

- Admission to examinations in any module is granted by acquiring a proof of participation (see General Rule 2.4.2).
- In terms of the General Rule 2.4.2 a proof of participation will only be issued to a student in the Faculty of Natural Sciences if he –
    - has complied with the specific requirements of the module as set out in the relevant study guide;
    - where applicable, has completed the practical work required for a module; and
    - has obtained a participation mark of at least 35% for every first level module and 40% for every second and third level module.
- Proof of participation obtained for a module for the first examination opportunity is transferred without any change to the second examination opportunity (see General Rule 2.4.4.3).

d) Number of examination opportunities

The General Rule 2.4.4.1 regulates the number of examination opportunities. An implication of these rules is that a student who has not passed a module with the second examination opportunity will not be entitled to exemption from classes.

Students in Actuarial Science, i.e. students taking the curriculum N137P, who would like to be considered for actuarial exemption, must write their examinations during the first examination opportunity. Complete requirements for students in Actuarial Science may be obtained from the Director of the Centre for Business Mathematics and Informatics.

e) Module mark

The module mark for every module is calculated (see General Rule 2.4.4.3) from the participation mark and the examination mark at the ratio of 1:1.

f) Pass requirements of a module and a curriculum

The terms and conditions for passing modules and curricula are set out in the General Rule 2.4.3.

The subminimum for all modules in the examination is 40%.

Where a first-semester module (in the first year) has been failed with a module mark of not less than 40% and a second-semester module in the same subject, which follows on it and for which it is prescribed as assumed learning, is passed, the school director may award a pass mark of not more than 50% in that first-semester module. (This applies only for first year modules).

If a first-time entering student is registered for a first semester module for the first time and fails that module with no less than 40%, and passes a second semester module in the same subject following on the first semester module for which the first semester module is prescribed as assumed learning, the school director concerned may retroactively award a pass mark of no more than 50% for the first semester module; provided that this may, at most, be done regarding one module in the student's curriculum per year.

g) Access to marked examination work

With reference to General Rule 2.4.9 a student can officially apply at the School Director for access to marked examination work as well as the memoranda.

Application to view answer papers must be made within a maximum period of five working days after the marks have been made available.
If approved the student may view the answer paper and memorandum in the presence of the lecturer and subject group chairperon concerned. Any bona fide errors can be corrected. Students may still make use of the second opportunity of examinations, after access is allowed to marked examination work of the first examination.

h) Chemistry: Practical recognition (General Rule 2.3.2.5)

If a student repeats a chemistry module, such a student may apply **once off** for recognition from the specific module's practical component, with the condition that the student achieved at least 60% as a final practical mark in the previous two years.

i) Attainment of qualification (See General Rule 2.5.1)

A degree is obtained when a student has passed in the examination of all the modules prescribed in the curriculum concerned.

- **Qualification with distinction**

With reference to General Rule 2.5.2 a B-degree is conferred with distinction, where the student completes the degree in the minimum period of study and has achieved a weighted average of at least 75% in the modules of the major subjects, designated by H in each curriculum (core modules). See N3.6.

  - For purposes of calculating the average, modules completed at other institutions and that are recognised as such by the NWU, must be taken into account.

j) Relation between credits and teaching periods

With regard to practical work (for example Chemistry, Physics, Zoology etc.), four continuous periods every second week are allocated for practical work at the first year level and four continuous periods per week at the second and third year level. Depending on the nature of the different subjects, deviations from this guideline might be found.

k) Relation between credits and examination papers

The duration of an examination paper of a 8 and12-credit module is usually two hours and the duration of examination papers that count for 16, 24 or 32 credits is usually three hours.

l) Progress in a curriculum based on prerequisites

In compiling each curriculum care has been taken that assumed learning, i.e. the necessary prior knowledge and the general level of insight and experience needed to complete the modules prescribed with ease in a specific semester of a curriculum, has been acquired in the preceding semesters. A student having failed one or more modules in a preceding semester will therefore probably not be adequately equipped to take the modules of the following semester. Such students are URGENTLY advised to consult the director of the relevant school BEFOREHAND to find out which modules of the semester concerned they may take with a reasonable expectancy of success.

The aim of the rules below is to make sure that a student in any semester will only take those modules of which he has the minimum prior knowledge.

A module in any subject may only be taken if it conforms to the requirements regarding the assumed learning, as indicated in the list of modules of the relevant subject. In terms of the General Rule 2.3.3.1 apply in the Faculty of Natural Sciences, when a first semester module in a particular year level is set in the faculty rules as assumed learning for a second semester module, a module mark of at least 40% must be achieved in the first semester module concerned, before the student may continue with the second semester module.

When students change from one curriculum to another, the entrance level in the new curriculum will have to be determined in consultation with the director of the school under which the relevant curriculum falls.

m) Termination of studies

In terms of the General Rule 2.4.8, the rules below apply in the Faculty of Natural Sciences. Students who have to apply for readmission in terms of these rules probably have neither the ability nor the motivation to complete the relevant curriculum successfully.

A student who has obtained *less* than half of the credits of year level 1 of a curriculum must apply for readmission. If this application is successful, the student will have to plan his curriculum for the second study year in consultation with the school director or his delegated.

A student who, having completed his second historic study year, has not yet obtained half of the prescribed credits of the first two years of a curriculum, must apply for readmission. If the application is successful, the student will not be permitted to take any modules from year level three in his historic third study year, but he will only be allowed to register for the lacking modules of year levels 1 and 2.

A student who, having completed his third historic study year, has not yet obtained all of the credits of the first two study years of the curriculum, must apply for readmission. If this application is successful, the student's curriculum for his fourth study year will have to be planned in consultation with the director of the relevant school.

Important:: No student's studies will be terminated in terms of these faculty rules before he and/or his parents have been invited in writing to explain his circumstances personally or in writing to the Dean.

N.1.15 PROFESSIONAL STATUS

Any person who has obtained one of the following qualifications in a natural science field at a university in South Africa and has acquired experience as indicated below, may register as a Professional Natural Scientist (Pr.Sci.Nat.) with the South African Council for Natural Scientific Professions:

- 4-year BSc or Hons BSc (that preferentially includes a research module), plus three years of experience in a natural science profession;
- MSc and two years of experience in a natural science profession;
- DSc or PhD plus one year of experience in a natural science profession.

First year of study: 70% of the modules passed, should be in natural sciences, namelyBiology I (Botany I and Zoology I), Chemistry I, Mathematics I, Physics I or another natural science subject such as Geology 1.

Second and third year **of study:** 80% of the modules passed should be in the natural sciences of which 50% should be in the respective discipline or directly supportive of the discipline. (Exit level for registration as a Certified Natural Scientist).

Fourth year of study (Honours level): Preferably, 100% of the modules passed should be in the natural sciences of which 80% should be in the respective discipline or directly supportive to nthe discipline. (Exit level for registration as Candidate and Professional Natural Scientist)

Students who have obtained an honours qualification or higher, in Biochemistry may apply to the Health Professions Council of south Africa for registration as an intern medical scientist through an institution that offers such internships. Upon completion of the internship the candidate will be eligible for registration as a medical scientist.

Students who have **registered for** the BArt et Scien (Planning) qualification may apply for registration as a Candidate Planner, according to the regulations (Planning Professions Act, 36 of 2002) of the South African Council for Planners (SACPLAN). After a minimum of two years in practice and completion of the instructions for registration, such a student will be able to register as a Professional Planner [TRP (SA)/SS(SA)].

N.1.16 MODULES LACKING TO COMPLETE DEGREE

If a student lacks **five** modules **at the most** to complete his/her degree, these modules may be completed at UNISA, subject to the following conditions:

- The degree must be completed within **five years**. If it takes longer, a written application must be made for extension of the studies.
- At least **one** core module must be completed at NWU.
- The student must register both at NWU and at UNISA.

N.1.17 SCHOOLS AND CENTRES IN THE FACULTY

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

School/Centre	Subject Group
School of Biological Sciences	Botany Microbiology Zoology
School of Physical and Chemical Sciences	Biochemistry Chemistry Physics)
School of Geo- and Spatial Sciences	Geography and Environmental Management Geology Urban and Regional Planning
School of Computer, Statistical and Mathematical Sciences	Computer Science and Information Systems Mathematics and Applied Mathematics Statistics and Operational Research
Centre for Business Mathematics and Informatics	Actuarial Science Data-mining Financial Mathematics Quantitative Risk Management

Research in the Faculty is managed in research entities. These research entities are further responsible for the master's and doctoral training programmes, i.e. programmes that contain a significant research component.

The Faculty consists fo the following Research Entities and Centres:

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

N.2 QUALIFICATIONS, PROGRAMMES AND CURRICULA

Different qualifications (degrees) can be obtained in the Faculty of Natural Sciences. A specific qualification may be obtained in one or more programmes (the term *programme* indicates a specific field of study), and in each programme one or more curricula are available. A prospective student must therefore first decide which qualification he wants to obtain. For example, after a student has decided he would like obtain a BSc degree, he has to select a programme, for instance the physical and chemical programme, the computer and mathematical programme or the environmental and biological programme etc. If the student decides on the environmental and biological programme for instance, he must then study the different curricula offered in this programme and finally decide on a curriculum. Information and the rules for the different qualifications, programmes and curricula are explained in this Calendar.

North-West University is authorised to award the following degrees in undergraduate studies in the Faculty of Natural Sciences:

LIST OF QUALIFICATIONS AND PROGRAMMES

Qualification	**Programme and code**	**Curriculum and curriculum code**	**Method of delivery**
Baccalaureus Scientiae (BSc)	Physical and Chemical Sciences: **200 190**	Chemistry-Physics **N151P** Chemistry, Mathematics-Applied Mathematics **N152P** Physics-Mathematics **N154P** Physics-Applied Mathematics **N155P** Chemistry-Biochemistry **N174P**	Full-time
Qualification name	**Qualification code**	**WITH specialisation in (Programme and Programme code)**	**Method of delivery**
Bachelor of Science in Information Technology (BSc IT)	**2DX H01**	Information Technology N301P	Full-time
Qualification	**Programme and code**	**Curriculum and curriculum code**	**Method of delivery**
Baccalaureus Scientiae (BSc)	Computer and Mathematical Sciences **200 191**	Physics-Computer Science **N153P** Computer Science-Statistics **N156P** Computer Science-Mathematics	Full-time

		N157P Statistics-Mathematics **N158P** Mathematics **N159P** Computer Science-Economics **N175P** Mathematics-Economics **N176P**	
Qualification	**Programme and code**	**Curriculum and curriculum code**	**Method of delivery**
Baccalaureus Scientiae (BSc)	Environmental and Biological Sciences: **200 118**	Microbiology-Biochemistry **N167P** Microbiology-Chemistry **N168P** Geography-Computer Science **N166P**	Full-time
Qualification name	**Qualification code**	**WITH specialisation in (Programme and Programme code)**	**Method of delivery**
Bachelor of Science in Biological Sciences (BSc)	**2DK H02**	Botany and Biochemistry N301P	Full-time
Bachelor of Science in Biological Sciences (BSc)	**2DK H06**	Chemistry and Physiology N301P	Full-time
Bachelor of Science in Biological Sciences (BSc)	**2DK H07**	Zoology and Biochemistry N301P	Full-time
Bachelor of Science in Biological Sciences (BSc)	**2DK H03**	Zoology and Physiology N301P	Full-time
Bachelor of Science in Biological Sciences (BSc)	**2DK H04**	Microbiology and Physiology N301P	Full-time
Bachelor of Science in Biological Sciences (BSc)	**2DK H08**	Zoology and Microbiology N301P	Full-time
Bachelor of Science in	**2DK H09**	Zoology and Botany N301P	Full-time

Biological Sciences (BSc)			
Bachelor of Science in Biological Sciences (BSc)	**2DK H10**	Microbiology and Botany N301P	Full-time
Qualification name	**Qualification code**	**WITH specialisation in (Programme and Programme code)**	**Method of delivery**
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H03**	Botany and Chemistry N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H04**	Zoology and Chemistry N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H07**	Geology and Chemistry N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H01**	Geology and Geography N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H02**	Geology and Botany N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H05**	Zoology and Geography N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H06**	Geography and Botany N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H08**	Zoology and Geology N301P	Full-time
Bachelor of Science in Environmental Sciences (BSc)	**2DJ H09**	Geology and Microbiology N301P	Full-time
Qualification	**Programme and code**	**Curriculum and curriculum code**	**Method of delivery**
Baccalaureus Scientiae (BSc)	Tourism **200 119**	Tourism-Zoology-Botany **N171P** Tourism-Geography-Botany **N172P**	Full-time

		Tourism-Geography-Zoology **N173P**	
Baccalaureus Scientiae (BSc)	Quantitative Risk Management **200 166**	Quantitative Risk Management **N134P**	Full-time
Baccalaureus Scientiae (BSc)	Financial Mathematics **200 167**	Financial Mathematics **N135P**	Full-time
Baccalaureus Scientiae (BSc)	Data Mining **200 168**	Data Mining **N136P**	Full-time
Baccalaureus Scientiae (BSc)	Actuarial Science **200 123**	Actuarial Science **N137P**	Full-time
Baccalaureus Artium et Scientiae (B Art et Scien)	Planning **118 101**	Urban and Regional Planning **N183P**	Full-time

N.3 RULES FOR THE DEGREE BACCALAUREUS SCIENTIAE (BSC)

N.3.1 DURATION (MINIMUM AND MAXIMUM DURATION)

The minimum duration of the studies for a BSc degree is three years and the maximum duration for completing the degree is four years.

N.3.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.

N.3.3 FACULTY-SPECIFIC REQUIREMENTS

See paragraph N.1.6.

N.3.4 STRUCTURE OF A GENERIC BACCALAUREUS SCIENTIAE DEGREE

The diagram shows how a generic BSc degree is compiled. Professional degrees are compiled differently.

<table>
<tr><th></th><th colspan="12">Semester 1</th><th colspan="12">Semester 2</th></tr>
<tr><td>Year 1 (Tot. cr.= 120)</td><td colspan="2">12</td><td colspan="2">12</td><td colspan="2">12</td><td colspan="2">12</td><td colspan="4">12 AGLE</td><td colspan="2">12</td><td colspan="2">12</td><td colspan="2">12</td><td colspan="2">12</td><td colspan="4">12 AGLE</td></tr>
<tr><td>Year 2 (Tot. cr. = 120)</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td colspan="6">12 WVNS</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td>8</td><td colspan="6">12 WVNS</td></tr>
<tr><td>Year 3 (Tot. cr.= 128)</td><td colspan="4">16</td><td colspan="4">16</td><td colspan="4">16</td><td colspan="4">16</td><td colspan="4">16</td><td colspan="4">16</td><td colspan="4">16</td><td colspan="4">16</td></tr>
<tr><td>TOTAL CREDITS (368)</td><td colspan="12">184 credits</td><td colspan="12">184 credits</td></tr>
</table>

N.3.5 OUTCOMES OF A GENERIC BACCALAUREUS SCIENTIAE DEGREE

i) General

At the end of the studies, the student will have the ability to integrate the basic knowledge and techniques of the core subjects in the curriculum he completed with a view to investigating phenomena in nature relevant to the core subjects of the curriculum and solving relevant problems.

ii) Knowledge

The student must have a thorough knowledge of the core subjects of the curriculum he completed in order to be able to apply his knowledge; to understand the physical reality in terms of this knowledge; and to be ready to continue with postgraduate studies in one of the core subjects.

iii) Skills

The student must have acquired the following skills:

- the ability to retrieve knowledge and information electronically and otherwise in preparation of lifelong learning;

- the ability to perform mathematical-analytical and mathematical-numerical data processing, problem solving and modelling;
- the ability to process, evaluate and report on scientific information;
- where applicable, the basic laboratory skills;
- the ability to work in groups and where necessary to exercise the necessary leadership.

iv) Values

The student ought to have acquired the following values:

- the ability to understand and strive after the normative aspects of practising science and in this way demonstrate a sense of responsibility towards fellow human beings and the environment in scientific investigations;
- scientific honesty and integrity.

N.3.6 CURRICULA/PROGRAMMES

All of the curricula in this programme are compiled from the module list in N.14.
NOTE: Core modules (majors) are indicated by a (H).

Every year a student registers subject to the rules valid for the specific year. If the curriculum for which a student registered the previous year has been changed in this Calendar, the curriculum/programme of the student will be adapted according to the version in this Calendar. If possible, adaptation will be done in such a way that a student's load of studies will not be aggravated.

If obstacles such as insurmountable clashes in the schedule should arise because of necessary curriculum/programme changes, the Dean may decide that students who enrolled previously must switch to the changed curriculum/programme, even if an aggravation should result.

In the case where students have to repeat one or more modules at a specific year level of a curriculum/programme, the following apply:

- The total number of credits of the modules taken by a student in any semester at any year level, also by the student who has to repeat modules, is limited in accordance with the General Rule 2.3.4.3;
- The Faculty cannot undertake that modules that have to be repeated and the other modules that must be taken will all fit in the class schedule. Clashes that arise because of modules that have to be repeated will result in the student having to take those modules in a future year.
- If a student has not completed the modules of a specific year level of the curriculum/programme for which he enrolled in the minimum prescribed period of study, and the modules of the specific year level of the curriculum/programme have since been changed, the Dean may decide that the student must complete the relevant year level as published in the latest edition of the Calendar. This means that if a student must repeat a module that has since been replaced by another module, the Dean may decide that the student must take the latter module.

N.3.7 ARTICULATION POSSIBILITIES

- Credits will be awarded for modules that have been passed in other faculties or at other universities, provided such modules contribute to the outcomes and total credit requirements of the curriculum/programme concerned.
- With the basic and applied skills that the student has acquired by this qualification in the mathematical, computer and natural science disciplines he will be prepared to continue further learning in several specialised subject areas at other institutions.

N.4 PROGRAMME: PHYSICAL AND CHEMICAL SCIENCES (200190)

N.4.1 SPECIFIC PROGRAMME OUTCOMES

a) General

At the end of the studies, the student will have the ability to integrate the basic knowledge and techniques of Physics and Mathematics in the curriculum he completed with a view to investigating phenomena in nature relevant to the core subjects of the curriculum and solving relevant problems.

b) Knowledge

- The student must have knowledge and insight into concepts, structures, procedures, models, theories, principles, research methods and the place and boundaries of science in man's life.
- The student must understand the physical reality in terms of this knowledge.
- Besides knowledge of the subject, the student must also have insight into the encyclopaedia and coherence of science by understanding amongst others that problems are not solved in isolation.
- The student must be ready to continue with postgraduate studies in one of the core subjects.

c) Skills

The student must have the following skills:

- identifying and solving problems in a critical and creative manner;
- embarking on entrepreneurship;
- retrieving knowledge and information;
- applying effective and responsible self-management;
- describing natural phenomena in a mathematical-analytical and mathematical-numerical manner;
- problem solving and modelling;
- applying sufficient knowledge and experience in an applicable programming language and/or data visualising software in order to do basic processing and calculations and to represent results graphically;
- investigating astrophysical phenomena empirically (experimentally) with an optical telescope, processing data meaningfully, representing it graphically and interpreting it in a theoretical framework;
- basic laboratory skills;
- acquiring, commanding, applying, analysing, integrating and evaluating knowledge in a well-founded manner;
- communicating knowledge scientifically in different media and therefore having command of listening, reading, talking, writing, arguing and computer skills;
- using science and technology adequately, effectively and responsibly with regard to the environment and own health and that of others;
- demonstrating efficient learning skills, realising the importance of life-long learning;
- accuracy and punctuality;
- articulating and justifying an own way of thinking (paradigm);
- processing and evaluating scientific information and reporting on it;
- working in a group and exercising/accepting leadership.

d) Values

The student must have the following values:

- understanding and pursuing the normative aspects of science and by doing that demonstrating a sense of responsibility towards society and environment in scientific research;
- scientific honesty;
- thinking in a principled way, which becomes clear in well-founded adaptability;
- pursuing excellence;
- devotion and integrity.

e) Awareness of the importance of

- participating as a responsible citizen in the activities of the local, national and international community;
- cultural and esthetical sensitivity to the variety of social structures, and the possibilities and constraints of a plural society.

N.4.2 ADMISSION REQUIREMENTS FOR THE QUALIFICATION

See paragraph N.1.5.

N.4.3 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.4.4 CURRICULUM: CHEMISTRY AND PHYSICS – N151P

Compilation of curriculum N151P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	CHEN211	H	8	CHEM311	H	16
CHEM111	H	12	CHEN212	H	8	CHEN312	H	16
FSKS111	H	12	FSKS211	H	8	FSKS311	H	16
ITRW112	X	12	FSKS212	H	8	FSKS312	H	16
WISN111	X	12	TGWN211	X	8			
			WISN211	X	8			
			WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	CHEN222	H	8	CHEN321	H	16
CHEM121	H	12	CHEN223	H	8	CHEN322	H	16
FSKS121	H	12	FSKS221	H	8	FSKS321	H	16
TGWN122	X	12	FSKS222	H	8	FSKS322	H	16
WISN121	X	12	TGWN223	X	8			
			WISN224 **OR** *WISN225	X	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

Very important to note the following:

Students who wish to take either WISN313 or WISN323, must select WISN224 as elective.

*The Physics Subject Group recommends WISN225, although WISN224 is also acceptable.

N.4.5 CURRICULUM: CHEMISTRY, MATHEMATICS AND APPLIED MATHEMATICS – N152P

Compilation of curriculum N152P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	CHEN211	H	8	CHEM311	H	16
CHEM111	H	12	CHEN212	H	8	CHEN312	H	16
FSKS111	X	12	FSKS211	X	8	TGWN312	H	16
STTN111	X	12	TGWN211	H	8	WISN312	H	16
WISN111	H	12	WISN211	H	8			
			WISN212	H	8			
			WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	CHEN222	H	8	CHEN321	H	16
CHEM121	H	12	CHEN223	H	8	CHEN322	H	16
FSKS121	X	12	FSKS222	X	8	TGWN322	H	16
TGWN122	H	12	TGWN223	H	8	WISN322	H	16
WISN121	H	12	WISN224	H	8			
			WISN226	H	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.4.6 CURRICULUM: PHYSICS AND MATHEMATICS – N154P

Compilation of curriculum N154P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	FSKS211	H	8	FSKS311	H	16
FSKS111	H	12	FSKS212	H	8	FSKS312	H	16
ITRW115	X	12	TGWN211	X	8	WISN313	H	16
CHEM111 **OR** STTN111	X	12	TGWN213	X	8	WISN312	H	16
WISN111	H	12	WISN211	H	8			
			WISN212	H	8			
			WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	FSKS221	H	8	FSKS321	H	16
FSKS121	H	12	FSKS222	H	8	FSKS322	H	16
ITRW124	X	12	TGWN221	X	8	WISN323 **OR** FSKS323	H	16
TGWN122	X	12	TGWN223	X	8	WISN322	H	16
WISN121	H	12	WISN224	H	8			
			WISN226	H	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.4.7 CURRICULUM: PHYSICS AND APPLIED MATHEMATICS – N155P

Compilation of curriculum N155P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	FSKS211	H	8	FSKS311	H	16
FSKS111	H	12	FSKS212	H	8	FSKS312	H	16
ITRW115	X	12	TGWN211	H	8	TGWN311	H	16
CHEM111 **OR** STTN111	X	12	TGWN213	H	8	TGWN312	H	16
WISN111	H	12	WISN211	X	8			
			WISN212	X	8			
			WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	FSKS221	H	8	FSKS321	H	16
FSKS121	H	12	FSKS222	H	8	FSKS322	H	16
ITRW124	X	12	TGWN221	H	8	TGWN321 **OR** FSKS323	H	16
TGWN122	H	12	TGWN223	H	8	TGWN322	H	16
WISN121	H	12	WISN224	X	8			
			*WISN226 **OR** WISN227	X	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

Very important to note the following:

*Students who wish to take WISN322, must select WISN226 as elective.

N.4.8 CURRICULUM: BIOCHEMISTRY-CHEMISTRY – N174P

Compilation of curriculum N174P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
CHEM111	H	12	FLGX213	X	16	BCHS316	H	16
FLGX113	X	12	BCHN213	H	16	BCHS317	H	16
FSKS113	X	12	CHEN211	H	8	CHEM311	H	16
WISN111	X	12	CHEN212	H	8	CHEN312	H	16
AGLE111	X	12	WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	CHEN222	H	8	BCHS321	H	16
CHEM121	H	12	CHEN223	H	8	BCHS322	H	16
FSKS123	X	12	BCHN222	H	16	CHEN321	H	16
FLGX123	X	12	FLGX223	X	8	CHEN322	H	16
WISN121	X	12	FLGX224	X	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.5 PROGRAMME: COMPUTER AND MATHEMATICAL SCIENCES (200191)

N.5.1 SPECIFIC PROGRAMME OUTCOMES

The goal of this qualification is to train graduates scientifically in an outcomes-based programme in which the subjects Computer Science, Applied Mathematics, Mathematics, Statistics, Physics and Economics figure strongly. Graduates who have completed this programme will be able to serve nationally as data-analysts, (industrial) mathematicians, computer scientists, programmers, systems analysts, database administrators, teachers, etc, and will also be ready to proceed nationally and internationally (depending on the focus inside this programme) with post graduate studies in the economical, physical, computer, statistical and mathematical sciences. The qualification will equip graduates with degree level expertise and appropriate skills in the field of Mathematics, Applied Mathematics, Statistics, Computer Science, Physics and Economics, in which a worldwide shortage, especially in South Africa, of well-qualified and equipped human resources exists, especially in the field of Mathematics.

N.5.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.

N.5.3 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.5.4 CURRICULUM: PHYSICS AND COMPUTER SCIENCE – N153P

Compilation of curriculum N153P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	H	12	ITRW212	H	16	ITRW311	H	16
WISN111	X	12	WISN211	X	8	ITRW316	H	16
STTN111	X	12	WISN212	X	8	FSKS311	H	16
FSKS111	H	12	FSKS211	H	8	FSKS312	H	16
AGLE111	X	12	FSKS212	H	8			
			WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW124	H	12	ITRW222	H	16	ITRW321	H	16
WISN121	X	12	TGWN223	X	8	ITRW322	H	16
TGWN122	X	12	*WISN226 **OR** WISN227	X	8	FSKS321	H	16
FSKS121	H	12	FSKS221	H	8	FSKS322	H	16
AGLE121	X	12	FSKS222	H	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

Very important to note the following:

Students who wish to take WISN322, must select WISN226 as elective.

*The Subject Group Physics recommends WISN226, although WISN227 is also acceptable.

N.5.5 CURRICULUM: COMPUTER SCIENCE AND STATISTICS – N156P

Compilation of curriculum N156P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	H	12	ITRW212	H	16	ITRW311	H	16
STTN115	H	12	STTN215	H	16	ITRW316	H	16
WISN111	X	12	WISN211	X	8	STTN315	H	32
FSKS111	X	12	WISN212	X	8			
AGLE111	X	12	WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW124	H	12	ITRW222	H	16	ITRW321	H	16
STTN125	H	12	STTN225	H	16	ITRW322	H	16
WISN121	X	12	WISN224	X	8	STTK321	H	24
TGWN122	X	12	WISN226	X	8	STTK322	H	8
AGLE121	X	12	WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.5.6 CURRICULUM: COMPUTER SCIENCE AND MATHEMATICS – N157P

Compilation of curriculum N157P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	H	12	ITRW212	H	16	ITRW311	H	16
WISN111	H	12	WISN211	H	8	ITRW316	H	16
STTN115	X	12	WISN212	H	8	WISN313	H	16
FSKS111	X	12	STTN215	X	16	WISN312	H	16
AGLE111	X	12	WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW124	H	12	ITRW222	H	16	ITRW321	H	16
WISN121	H	12	WISN224	H	8	ITRW322	H	16
STTN125	X	12	WISN226	H	8	WISN323	H	16
TGWN122	H	12	STTN225	X	16	WISN322	H	16
AGLE121	X	12	WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.5.7 CURRICULUM: STATISTICS AND MATHEMATICS – N158P

Compilation of curriculum N158P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	X	12	ITRW212	X	16	WISN313	H	16
FSKS111	X	12	WISN211	H	8	WISN312	H	16
WISN111	H	12	WISN212	H	8	STTN315	H	32
STTN115	H	12	STTN215	H	16			
AGLE111	X	12	WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
TGWN122	H	12	ITRW222	X	16	WISN323	H	16
ITRW124	X	12	WISN224	H	8	WISN322	H	16
WISN121	H	12	WISN226	H	8	STTK321	H	24
STTN125	H	12	STTN225	H	16	STTK322	H	8
AGLE121	X	12	WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.5.8 CURRICULUM: MATHEMATICS – N159P

Compilation of curriculum N159P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
FSKS111	X	12	STTN215	X	16	TGWN311	H	16
ITRW112	X	12	TGWN211	H	8	TGWN312	H	16
STTN115	X	12	TGWN213	H	8	WISN313	H	16
WISN111	H	12	WISN211	H	8	WISN312	H	16
AGLE111	X	12	WISN212	H	8			
			WVNS211	X	12			
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	STTN225	X	16	TGWN321	H	16
ITRW123	X	12	TGWN221	H	8	TGWN322	H	16
STTN125	X	12	TGWN223	H	8	WISN323	H	16
TGWN122	H	12	WISN224	H	8	WISN322	H	16
WISN121	H	12	WISN226	H	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.5.9 CURRICULUM: COMPUTER SCIENCE AND ECONOMICS – N175P

Compilation of curriculum N175P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	H	12	ECON211	H	16	EKRP311	H	16
WISN111	X	12	ITRW212	H	16	ECON311	H	16
ECON111	H	12	WISN211	X	8	ITRW311	H	16
ACCF111 **OR** ACCS111	X	16	WISN212	X	8	ITRW316	H	16
AGLE111	X	12	WVNS211	X	12			
Total 1st semester		**64**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW124	H	12	ECON221	H	16	EKRP321	H	16
WISN121	X	12	ITRW222	H	16	ECON321	H	16
ECON121	H	12	WISN224	X	8	ITRW321	H	16
ACCF121 **OR** ACCS121	X	16	WISN226	X	8	ITRW322	H	16
AGLE121	X	12	WVNS221	X	12			
Total 2nd semester		**64**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**128**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**376**

N.5.10 CURRICULUM: MATHEMATICS AND ECONOMICS – N176P

Compilation of curriculum N176P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	X	12	ECON211	H	16	ECON311	H	16
WISN111	H	12	ITRW212	X	16	TGWN312	H	16
ECON111	H	12	WISN211	H	8	WISN313	H	16
ACCF111 **OR** ACCS111	X	16	WISN212	H	8	WISN312	H	16
AGLE111	X	12	WVNS211	X	12			
Total 1st semester		**64**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW124	X	12	ECON211	H	16	ECON321	H	16
WISN121	H	12	ITRW222	X	16	TGWN322	H	16
ECON121	H	12	WISN224	H	8	WISN323	H	16
ACCF121 **OR** ACCS121	X	16	WISN226	H	8	WISN322	H	16
AGLE121	X	12	WVNS221	X	12			
Total 2nd semester		**64**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**128**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**376**

N.6 PROGRAMME: ENVIRONMENTAL AND / OR BIOLOGICAL SCIENCES

N.6.1 SPECIFIC PROGRAMME OUTCOMES

The Faculty of Science has a number of approved curricula that have a good basic training in environmental sciences. In compiling the programme/curricula work possibilities and manpower needs of our country are also considered. This programme/curriculum prepares the student for postgraduate studies (**Honours in Environmental Sciences**), recommended in order to registration with the South African Council for Natural Scientific Professions (SACNASP).

On completing this programme, the student must be able –

- to demonstrate a well-rounded and systematic knowledge base of the biological and earth sciences, with the focus on environmental sciences, which comprise aspects of zoology, botany, microbiology, geology, soil science, environmental management and geography;
- to demonstrate a coherent and critical understanding of applicable key terms, rules, concepts, principles and theories, and be able to place new knowledge in existing theoretical frameworks and apply processes and techniques in a wider environmental perspective;
- to identify and analyse general environmental problems and issues and to use the most important research methods to propose theoretically driven solutions;
- to demonstrate well developed skills in gathering information, analysing and integrating quantitative and qualitative data and communicating information, own ideas and opinions, in writing and orally, using well structured arguments and IT skills effectively;
- to act as a lifelong student in the job market and to participate in value-adding economic activities in an entrepreneurial way.

N.6.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.

N.6.3 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6

Students that register for programmes/curriculums that include DRKS311, DRTS311, PLKN323, PLTN323, GDKN221 or GLGN321, should be aware that a compulsory field excursion forms part of this module.

N.6.3.1 Physiology

a) Students can not request recognition for FLGX113 on the grounds that FLGX114 or FLPX113 have been successfully completed, or visa versa.
b) Students can not request recognition for FLGX123 on the grounds that FLGX124 or FLPX123 have been successfully completed, or visa versa.
c) Students can not request recognition for module FLPX113 on the grounds that FLGX113 or FLGX114 have been successfully completed, or visa versa.
d) Students can not request recognition for module FLPX123 on the grounds that FLGX123 or FLGX124 have been successfully completed, or visa versa.

N.6.4 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H01

N.6.4.1 Programme: Geology and Geography – N301P

N.6.4.2 Faculty-specific rules

A compulsory soil mapping camp takes place for second-year soil science students (i.e. students who have registered for GDKN 221) during the winter recess. Second-year students will hand in a soil map and a report, of which the mark will contribute to the practical mark for GDKN221. Third-year geology students (i.e. students who have registered for GLGN 321) will attend a compulsory geology mapping camp in the same period. A geological map and a report will be handed in during the second semester, of which the mark contributes to laboratory mark for GLGN 321. NO excuses for absence from the mapping camp will be accepted. In the event of illness, the onus is on the student to catch up with the work and to hand in the required assignments, maps and reports, as applicable, to be considered for admission to the examination. The practical examination of each geology and soil science module is compulsory to be considered for admission to the examination.
This programme prepares the student for admission to the Honours in Environmental Sciences with specialisation in Environmental Geology. The programme is compiled for a niche market in South Africa in Environmental Geology, presented only at the NWU.

Compilation of this programme: (There will be a limited intake of students majoring in Geology due to capacity restrictions.)

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN112	H	12	GLGN211	H	16	GLGN311	H	32
GGFS112	H	12	GGFS212	H	16	GGFS312	H	32
CHEM111	X	12	GDKN211	H	16			
FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN122	H	12	GLGN221	H	16	GLGN321	H	32
GGFS121	H	12	GGFS222	H	16	GGFS322	H	32
GDKN121	X	12	GDKN221	H	16			
CHEM121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

Students who did not pass GGFS211 in 2013 will have to pass GGFS222.
Students who did not pass GGFS221 in 2013 will have to pass GGFS212.
.

N.6.5 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H02

N.6.5.1 Programme: Geology and Botany – N301P

N.6.5.2 Faculty-specific rules

See paragraph N.6.4.1

Compilation of this programme: (There will be a limited intake of students majoring in Geology due to capacity restrictions.)

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN112	H	12	GLGN211	H	16	GLGN311	H	32
PLKS111	H	12	PLKN213	H	16	PLKS312	H	32
CHEM111	X	12	GDKN211	H	16			
FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN122	H	12	GLGN221	H	16	GLGN321	H	32
PLKS121	H	12	PLKS221	H	16	PLKN323	H	32
GDKN121	H	12	GDKN221	H	16			
CHEM121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.6 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H03

N.6.6.1 Programme: Botany and Chemistry – N301P

N.6.6.2 Faculty-specific rules

See paragraph N.6.4.1.

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
PLKS111	H	12	PLKN213	H	16	PLKS312	H	32
CHEM111	H	12	CHEN211 **&** CHEN212	H	8 8	CHEM311	H	16
WISN111	X	12	BCHN213	X	16	CHEN312	H	16
GLGN112 **OR** DRKS111 **OR** FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
PLKS121	H	12	PLKS221	H	16	PLKN323	H	32
CHEM121	H	12	CHEN222 **&** CHEN223	H	16	CHEN321	H	16
WISN121	X	12	BCHN222	X	16	CHEN322	H	16
GLGN122 **OR** DRKS121 **OR** FSKS123	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.7 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H04

N.6.7.1 Programme: Zoology and Chemistry – N301P

Compilation of this programme:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS111	H	12	DRKN211	H	16	DRKS311	H	32
CHEM111	H	12	CHEN211 **&** CHEN212	H	8 8	CHEM311	H	16
FLGX113 **OR** *FSKS113	X	12	BCHN213 **OR** FLGX213	X	16	CHEN312	H	16
WISN111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS121	H	12	DRKS221	H	16	DRKN321	H	16
CHEM121	H	12	CHEN222 **&** CHEN223	H	8 & 8	DRKS322	H	16
FLGX123 **OR** *FSKS123	X	12	BCHN222 **OR** FLGX223 **&** FLGX224	X	16	CHEN321	H	16
WISN121	X	12	WVNS221	X	12	CHEN322	H	16
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

*Take note: FSKS113/123 - No elective is available at level 2 for FSKS.

N.6.8 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H05

N.6.8.1 Programme: Zoology and Geography – N301P

Compilation of this programme:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS111	H	12	DRKN211	H	16	DRKS311	H	32
GGFS112	H	12	GGFS212	H	16	GGFS312	H	32
CHEM111	X	12	PLKN213 **OR** FLGX213	X	16			
FLGX113 **OR** PLKS111 **OR** *FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS121	H	12	DRKS221	H	16	DRKN321	H	16
GGFS121	H	12	GGFS222	H	16	DRKS322	H	16
CHEM121	X	12	PLKS221 **OR** FLGX223 **&** FLGX224	X	16	GGFS322	H	32
FLGX123 **OR** PLKS121 **OR** *FSKS123	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

Students who did not pass GGFS211 in 2013 will have to pass GGFS222.
Students who did not pass GGFS221 in 2013 will have to pass GGFS212.
*Take note: FSKS113/123 - No elective is available at level 2 for FSKS.

N.6.9 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H06

N.6.9.1 Programme: Geography and Botany – N301P

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GGFS112	H	12	GGFS212	H	16	GGFS312	H	32
PLKS111	H	12	PLKN213	H	16	PLKS312	H	32
CHEM111	X	12	DRKN211 **OR** **MKBN211 GDKN211	X	16			
DRKS111 **OR** *FSKS113 **OR** *GLGN112	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GGFS121	H	12	GGFS222	H	16	GGFS322	H	32
PLKS121	H	12	PLKS221	H	16	PLKN323	H	32
CHEM121	X	12	DRKS221 **OR** **MKBS221 GDKN221	X	16			
DRKS121 **OR** *FSKS123 **OR** *GLGN122 **GDKN121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

Students who did not pass GGFS211 in 2013 will have to pass GGFS222.
Students who did not pass GGFS221 in 2013 will have to pass GGFS212.
*Take note: FSKS113/123 and GLGN112/122 - No elective is available at level 2.
** GDKN can be taken as elective due to timetable clashes with MKBS.

N.6.10 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H07

N.6.10.1 Programme: Geology and Chemistry – N301P

N.6.10.2 Faculty-specific rules

See paragraph N.6.4.1

Compilation of this programme: (There will be a limited intake of students majoring in Geology due to capacity restrictions.)

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN112	H	12	GLGN211	H	16	GLGN311	H	32
CHEM111	H	12	CHEN211 & CHEN212	H	8 8	CHEM311	H	16
WISN111	X	12	GDKN211	H	16	CHEN312	H	16
FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN122	H	12	GLGN221	H	16	GLGN321	H	32
CHEM121	H	12	CHEN222 & CHEN223	H	8 8	CHEN321	H	16
GDKN121	H	12	GDKN221	H	16	CHEN322	H	16
WISN121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.11 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H08

N.6.11.1 Programme: Zoology and Geology – N301P

N.6.11.2 Faculty-specific rules

See paragraph N.6.4.1

Compilation of this programme: (There will be a limited intake of students majoring in Geology due to capacity restrictions.)

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS111	H	12	DRKN211	H	16	DRKS311	H	32
GLGN112	H	12	GLGN211	H	16	GLGN311	H	32
CHEM111	X	12	GDKN211	H	16			
PLKS111 **OR** FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS121	H	12	DRKS221	H	16	DRKN321	H	16
GLGN122	H	12	GLGN221	H	16	DRKS322	H	16
GDKN121	H	12	GDKN221	H	16	GLGN321	H	32
CHEM121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.12 ENVIRONMENTAL SCIENCES: QUALIFICATION CODE: 2DJ H09

N.6.12.1 Programme: Geology and Microbiology – N301P

N.6.12.2 Faculty-specific rules

See paragraph N.6.4.1

Compilation of this programme: (There will be a limited intake of students majoring in Geology due to capacity restrictions.)

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN112	H	12	GLGN211	H	16	GLGN311	H	32
CHEM111	X	12	GDKN211	H	16	MKBS313	H	16
FSKS113	X	12	MKBN211	H	16	MKBS314	H	16
PLKS111 **OR** DRKS111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GLGN122	H	12	GLGN221	H	16	GLGN321	H	32
GDKN121	H	12	GDKN221	H	16	MKBS325	H	32
CHEM121	X	12	MKBS221	H	16			
PLKS121 **OR** DRKS121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.13 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H02

N.6.13.1 Programme: Botany and Biochemistry – N301P

Compilation of this programme:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
PLKS111	H	12	PLKN213	H	16	PLKS312	H	32
CHEM111	X	12	BCHN213	H	16	BCHS316	H	16
WISN111	X	12	CHEN211 **&** CHEN212	X	8 8	BCHS317	H	16
DRKS111 **OR** GLGN112	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
PLKS121	H	12	PLKS221	H	16	PLKN323	H	32
CHEM121	X	12	BCHN222	H	16	BCHS321	H	16
WISN121	X	12	CHEN222 **&** CHEN223	X	8 8	BCHS322	H	16
DRKS121 **OR** GLGN122	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.14 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H03

N.6.14.1 Programme: Zoology and Physiology – N301P

See paragraph N.6.3.1

Compilation of this programme:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	DRKN211	H	16	DRKS311	H	32
CHEM111	X	12	FLGX213	H	16	FLGX312	H	8
DRKS111	H	12	MKBN211	X	16	FLGX313	H	8
FLGX113	H	12	WVNS211	X	12	FLGX314	H	16
FSKS113 **OR** PLKS111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	DRKS221	H	16	DRKN321	H	16
CHEM121	X	12	FLGX223	H	8	DRKS322	H	16
DRKS111	H	12	FLGX224	H	8	FLGX325	H	16
FLGX123	H	12	MKBS221	X	16	FLGX326	H	16
FSKS123 **OR** PLKS121	X	12	WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.15 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H04

N.6.15.1 Programme: Microbiology and Physiology – N301P

See paragraph N.6.3.1

Compilation of this programme:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	CHEN211	X	8	FLGX312	H	8
CHEM111	X	12	CHEN213	X	8	FLGX313	H	8
DRKS111	X	12	FLGX213	H	16	FLGX314	H	16
FLGX113	H	12	MKBN211	H	16	MKBS313	H	16
FSKS113	X	12	WVNS211	X	12	MKBS314	H	16
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	BCHN222	X	16	FLGX325	H	16
CHEM121	X	12	FLGX223	H	8	FLGX326	H	16
DRKS121	X	12	FLGX224	H	8	MKBS325	H	32
FLGX123	H	12	MBKS221	H	16			
FSKS123	X	12	WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.16 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H06

N.6.16.1 Programme:: Chemistry and Physiology – N301P

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE111	X	12	BCHN213	X	16	CHEM311	H	16
CHEM111	H	12	CHEN211	H	8	CHEN312	H	16
FLGX113	H	12	CHEN212	H	8	FLGX312	H	8
FSKS113	X	12	FLGX213	H	16	FLGX313	H	8
WISN111	X	12	WVNS211	X	12	FLGX314	H	16
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
AGLE121	X	12	BCHN222	X	16	CHEN321	H	16
CHEM121	H	12	CHEN222	H	8	CHEN322	H	16
FLGX123	H	12	CHEN223	H	8	FLGX325	H	16
FSKS123	X	12	FLGX223	H	8	FLGX326	H	16
WISN121	X	12	FLGX224	H	8			
			WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.17 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H07

N.6.17.1 Programme: Zoology and Biochemistry – N301P

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS111	H	12	DRKN211	H	16	DRKS311	H	32
CHEM111	H	12	BCHN213	H	16	BCHS316	H	16
FLGX113	X	12	CHEN211 **&** CHEN212	X	8 8	BCHS317	H	16
WISN111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS121	H	12	DRKS221	H	16	DRKN321	H	16
CHEM121	H	12	BCHN222	H	16	DRKS322	H	16
FLGX123	X	12	CHEN222 **&** CHEN223	X	16	BCHS321	H	16
WISN121	X	12	WVNS221	X	12	BCHS322	H	16
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

N.6.18 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H08

N.6.18.1 Programme: Zoology-Microbiology – N301P

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS111	H	12	DRKN211	H	16	DRKS311	H	32
CHEM111	H	12	MKBN211	H	16	MKBS313	H	16
FLGX113	X	12	BCHN213 **OR** PLKN213 **OR** FLGX213	X	16	MKBS314	H	16
PLKS111 **OR** *FSKS113	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS121	H	12	DRKS221	H	16	DRKN321	H	16
CHEM121	H	12	MKBS221	H	16	DRKS322	H	16
FLGX123	X	12	BCHN222 **OR** PLKS221 **OR** FLGX223 **&** FLGX224	X	16	MKBS325	H	32
PLKS121 **OR** *FSKS123	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

*Take note: FSKS113/123 - No elective is available at level 2 for FSKS.

N.6.19 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H09

N.6.19.1 Programme: Zoology-Botany – N301P

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS111	H	12	DRKN211	H	16	DRKS311	H	32
PLKS111	H	12	PLKN213	H	16	PLKS312	H	32
CHEM111	X	12	BCHN213 **OR** GDKN211 **OR** MKBN211	X	16			
FLGX113 **OR** *FSKS113 **OR** GLGN112	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
DRKS121	H	12	DRKS221	H	16	DRKN321	H	16
PLKS121	H	12	PLKS221	H	16	DRKS322	H	16
CHEM121	X	12	BCHN222 **OR** GDKN221 **OR** MKBS221	X	16	PLKN323	H	32
FLGX123 **OR** *FSKS123 **OR** GDKN121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

*Take note: FSKS113/123 - No elective is available at level 2 for FSKS.

N.6.20 BIOLOGICAL SCIENCES: QUALIFICATION CODE: 2DK H10

N.6.20.1 Programme: Microbiology and Botany – N301P

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
PLKS111	H	12	MKBN211	H	16	MKBS313	H	16
CHEM111	X	12	PLKN213	H	16	MKBS314	H	16
FSKS113	X	12	BCHN213 **OR** DRKN211	X	16	PLKS312	H	32
DRKS111 **OR** *GLGN112	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
PLKS121	H	12	MKBS221	H	16	MKBS325	H	32
CHEM121	X	12	PLKS221	H	16			
FSKS123	X	12	BCHN222 **OR** DRKS221	X	16	PLKN323	H	32
DRKS121 **OR** *GLGN122	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of programme credits								**368**

*Take note: GLGN112/122 - No elective is available at level 2 for GLGN.

N.6.21 ENVIRONMENTAL AND BIOLOGICAL SCIENCES: QUALIFICATION CODE: 200118

N.6.21.1 Curriculum: Geography-Computer Science – N166P

Compilation of curriculum N166P:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GGFS112	H	12	GGFS212	H	16	GGFS312	H	32
ITRW112	H	12	ITRW212	H	16	ITRW311	H	16
GLGN112	X	12	PLKN213 **OR** GLGN211	X	16	ITRW316	H	16
*STTN111 **OR** PLKS111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
GGFS121	H	12	GGFS222	H	16	GGFS322	H	32
ITRW124	H	12	ITRW222	H	16	ITRW321	H	16
GLGN122	X	12				ITRW322	H	16
*STTN121 **OR** PLKS121	X	12	PLKS221 **OR** GLGN221	X	16			
AGLE121	X	12	WVNS221	X	12			
Total 2nd semester		**60**	**Total 2nd semester**		**68**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**128**	**Total year level 3**		**128**
Total of curriculum credits								**376**

Students who did not pass GGFS211 in 2013 will have to pass GGFS222.
Students who did not pass GGFS221 in 2013 will have to pass GGFS212.
*Take note:STTN111/121 - No elective is available at level 2 for STTN.

N.6.22 ENVIRONMENTAL AND BIOLOGICAL SCIENCES: QUALIFICATION CODE: 200118

N.6.22.1 Curriculum: Microbiology-Biochemistry – N167P

Compilation of curriculum N167P:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
CHEM111	H	12	MKBN211	H	16	MKBS313	H	16
WISN111	X	12	BCHN213	H	16	MKBS314	H	16
FSKS113	X	12	CHEN211 **&** CHEN212	X	16	BCHS316	H	16
PLKS111 **OR** FLGX113	X	12	WVNS211	X	12	BCHS317	H	16
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
CHEM121	H	12	MKBS221	H	16	MKBS325	H	32
WISN121	X	12	BCHN222	H	16			
FSKS123	X	12	CHEN222 **&** CHEN223	X	16	BCHS321	H	16
PLKS121 **OR** FLGX123	X	12	WVNS221	X	12	BCHS322	H	16
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.6.23 ENVIRONMENTAL AND BIOLOGICAL SCIENCES: QUALIFICATION CODE: 200118

N.6.23.1 Curriculum: Microbiology-Chemistry – N168P

Compilation of curriculum N168P:

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
CHEM111	H	12	MKBN211	H	16	MKBS313	H	16
WISN111	X	12	CHEN211 & CHEN212	H	8 8	MKBS314	H	16
FSKS113	X	12	BCHN213	X	16	CHEM311	H	16
DRKS111	X	12	WVNS211	X	12	CHEN312	H	16
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
CHEM121	H	12	MKBS221	H	16	MKBS325	H	32
WISN121	X	12	CHEN222 & CHEN223	H	8&8			
FSKS123	X	12	BCHN222	X	16	CHEN321	H	16
DRKS121	X	12	WVNS221	X	12	CHEN322	H	16
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

N.7 PROGRAMME: TOURISM (200119)

The Faculty Board of Natural Sciences has approved a number of curricula that provide a good basic training in tourism. In compiling the curricula, possible occupations and our country's need for human resources were also considered. These curricula also prepare the student for postgraduate studies (Honours in Environmental Sciences). These studies are recommended in view of registration with the South African Council for Natural Scientific Professions (SACNASP).

N.7.1 SPECIFIC PROGRAMME OUTCOMES

On completing this programme, the student must be able –

- to demonstrate a well-rounded knowledge and insight into the subject contents of fundamental, core and alternative modules of subject combinations completed, and the application of these the multidisciplinary environmental and tourism field;
- to demonstrate skills in identifying and analysing environmental- and tourism problems and in collecting, evaluating and interpreting the necessary information and data and using these to propose possible solutions and also to manage human resources in a creative way;
- as an individual or member of a group, to communicate in an ethical and responsible manner information and solutions verbally, electronically and in writing to peers and professional people;
- to use entrepreneurial skills in identifying opportunities in practice and developing these while maintaining respect for society and the environment.

N.7.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.

N.7.3 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.7.4 CURRICULUM: TOURISM WITH ZOOLOGY AND BOTANY – N171P

Compilation of curriculum N171P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
TMBP111	H	12	TMBP211	H	16	TMBP311	H	16
DRKS111	H	12	DRKN211	H	16	TMBP312	H	16
PLKS111	H	12	PLKN213	H	16	DRKS311	H	32
CHEM111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
BMAN121	H	12	TMBP221	H	16	TMBP321	H	16
DRKS121	H	12	DRKS221	H	16	TMBP322	H	16
PLKS121	H	12	PLKS221	H	16	DRKS322	H	16
CHEM121	X	12	WVNS221	X	12	PLTN323	H	24
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**72**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**136**
Total of curriculum credits								**376**

N.7.5 CURRICULUM: TOURISM WITH GEOGRAPHY AND BOTANY – N172P

Compilation of curriculum N172P

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
TMBP111	H	12	TMBP211	H	16	TMBP311	H	16
GGFS112	H	12	GGFS212	H	16	TMBP311	H	16
PLKS111	H	12	PLKN213	H	16	GGFS312	H	32
CHEM111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
BMAN121	H	12	TMBP221	H	16	TMBP321	H	16
GGFS121	H	12	GGFS222	H	16	GGFS322	H	32
PLKS121	H	12	PLKS221	H	16	PLTN323	H	24
CHEM121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**72**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**136**
Total of curriculum credits								**376**

Students who fail GGFS211 in 2013 will have to pass GGFS222.
Students who fail GGFS221 in 2013 will have to pass GGFS212.

N.7.6 CURRICULUM: TOURISM WITH GEOGRAPHY AND ZOOLOGY – 173P

Compilation of curriculum N173P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
TMBP111	H	12	TMBP211	H	16	TMBP311	H	16
GGFS112	H	12	GGFS212	H	16	TMBP312 **OR** DRTS311 **	H	16
DRKS111	H	12	DRKN211	H	16	GGFS312	H	32
CHEM111	X	12	WVNS211	X	12			
AGLE111	X	12						
Total 1st semester		**60**	**Total 1st semester**		**60**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
BMAN121	H	12	TMBP221	H	16	TMBP321	H	16
GGFS121	H	12	GGFS222	H	16	GGFS322	H	32
DRKS121	H	12	DRKS221	H	16	TMBP322 **OR** DRKS322	H	16
CHEM121	X	12	WVNS221	X	12			
AGLE121	X	12						
Total 2nd semester		**60**	**Total 2nd semester**		**60**	**Total 2nd semester**		**64**
Total year level 1		**120**	**Total year level 2**		**120**	**Total year level 3**		**128**
Total of curriculum credits								**368**

****Selection possibilities depend on the student's choice for postgraduate studies: Zoology/Tourism. If students consider post graduate study in Environmental Sciences, DRKS311 should be selected.**

Students who fail GGFS211 in 2013 will have to pass GGFS222.
Students who fail GGFS221 in 2013 will have to pass GGFS212.

N.8 PROGRAMME: QUANTITATIVE RISK MANAGEMENT (200166)

N.8.1 PROGRAMME OUTCOMES

The programme outcomes discussed for the BSc degree in N.3 also apply to this programme. In addition, the student will also have the following specific knowledge and skills.

a) Knowledge

On completing the programme, the student will have adequate knowledge and insight into the following topics:

- Functioning of an economy, introductory micro- and macroeconomics, determining the national income and the influence of different policy measures on it, national accountancy concepts and the macro-equilibrium equation, economic conjuncture and stabilisation, transferring funds between countries, exchange rate systems, balance of payment and international monetary system; monetary policy in South Africa.
- The impact of the asset and liability management of banks on the national economy. Risk, liquidity policy, lending policy, liability management and the apportionment of capital by banks, the South African futures market. Functioning of derivative instruments and their application to risk hedging.
- The nature, aim and basic theory of accountancy. Financial statements, fixed assets and depreciation. Control, departmental and manufacturing accounts. Partnerships, close corporations and appropriate GAAP viewpoints.
- Probability theory, sampling theory and techniques, and statistical inference.
- Theory and topology of real numbers and finite dimensional vector spaces, algebraic and measurable spaces, integrals of measurable functions and monotone convergence, linear transformations between general vector spaces, complex functions, ordinary and partial linear differential equations, optimisation.
- Basic computer literacy, object-directed programming language, artificial intelligence, data structures and algorithms, and modern IT developments.

b) Skills

On completing this programme, the student will have the following skills:

- The ability to identify and solve convergent and divergent quantitative risk management problems in a creative and pro-active manner.
- In-depth knowledge of and insight into the financial markets and financial risk instruments and related problems, together with the ability to solve problems in interaction with other disciplines.
- The ability to identify and develop quantitative financial risk, computer and data analysis techniques and/or approaches on an entrepreneurial basis with a view to managing financial risks.
- The ability to work efficiently as an individual or in a team in an organisation in order to address quantitative financial risk management problems.
- The ability to organise and manage own activities in a responsible and efficient manner to attain desired aims.
- The ability to handle questionnaires, meaningful data collecting methods, data presentation methods and exploratory data evaluation by using amongst others

statistical computer software (e.g. Statistica, S-Plus and SAS), as well as standard executive inference methods over wide range.

- The ability to prepare and present written an oral reports and presentations professionally.
- Mathematical modelling of practical problems by using partial differential equations, combinatory mathematics, linear programmes and optimisation methods, together with computerised implementation where applicable.
- Programming in a modern high-level language, together with the ability to analyse and design computer systems and algorithms.
- The ability to handle database management systems with ease.

c) Articulation possibilities

The programme grants admission to postgraduate studies in Hons BSc(BMI) programmes and may grant admission to honours studies in Economics, Statistics or Computer Science. The honours BSc(BMI) programmes are subject to the following requirements:

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

N.8.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.
Permission requirements for all Business Mathematics and Informatics courses (N134P, N135P, N136P and N137P), Mathematics 70-79% (level 6), and APS Score 32.

Mathematics Refresher course
Before the classes start in the beginning of the year, there will be a refresher course for Mathematics. All students that enrol for curriculums where the module WISN111 appears, are strongly recommended to do the refresher course.

N.8.3 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.8.4 CURRICULUM: QUANTITATIVE RISK MANAGEMENT (200166) – N134P

Compilation of curriculum N134P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCF111 **OR** ACCC111	H	16	ECON211	H	16	BWIA313	H	24
BWIA111	X	12	EKRP211	H	16	EKRP311	H	16
ECON111	H	12	STTN215	H	16	STTN315	H	32
ITRW112	X	12	WISN211	X	8			
STTN115	H	12	WISN212	X	8			
WISN111	X	12	WVES311	X	12			
Total 1st semester		**76**	**Total 1st semester**		**76**	**Total 1st semester**		**72**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCF121 **OR** ACCC121	H	16	EKRP221	H	16	BWIN321	H	16
AGLE121	X	12	STTN225	H	16	EKRP321	H	16
BWIA121	H	12	TGWN223	X	8	FINM221	H	16
ECON121	H	12	WISN226	X	8	STTK321	H	24
ITRW123	X	12	WVES221	X	12	STTK322	H	8
STTN125	H	12						
WISN121	X	12						
Total 2nd semester		**88**	**Total 2nd semester**		**60**	**Total 2nd semester**		**80**
Year Module			**Year Module**			**Year Module**		
			BWIA271	H	32			
Total year level 1		**164**	**Total year level 2**		**168**	**Total year level 3**		**152**
Total of curriculum credits								**484**

N.9 PROGRAMME: FINANCIAL MATHEMATICS (200167)

N.9.1 PROGRAMME OUTCOMES

See N.8.1 to N.8.3.

N.9.2 CURRICULUM: FINANCIAL MATHEMATICS – N135P

Compilation of curriculum N135P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCS111 **OR** ACCF111	H	16	ECON211	H	16	BWIA313	H	24
ECON111	H	12	EKRP211	H	16	STTN315	H	32
ITRW112	X	12	STTN215	H	16	WISN313	H	16
STTN115	H	12	WISN211	H	8			
WISN111	X	12	WISN212	H	8			
BWIA111	H	12	WVES311	X	12			
Total 1st semester		**76**	**Total 1st semester**		**76**	**Total 1st semester**		**72**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCS121 **OR** ACCF121	H	16	EKRP221	H	16	BWIN321	H	16
AGLE121	X	12	STTN225	H	16	STTK321	H	24
BWIA121	H	12	TGWN223	X	8	STTK322	H	8
ECON121	H	12	WISN224	H	8	WISN323	H	16
ITRW123	X	12	WISN226	H	8			
STTN125	H	12	WVES221	X	12			
WISN121	X	12						
Total 2nd semester		**88**	**Total 2nd semester**		**68**	**Total 2nd semester**		**64**
Year Module			**Year Module**			**Year Module**		
			BWIA271	H	32			
Total year level 1		**164**	**Total year level 2**		**176**	**Total year level 3**		**136**
Total of curriculum credits								**476**

N.10 PROGRAMME: DATA MINING (200168)

N.10.1 PROGRAMME OUTCOMES

See N.8.1 to N.8.3.

N.10.2 CURRICULUM: DATA MINING – N136P

Compilation of curriculum N136P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCS111 **OR** ACCF111	H	16	ITRW212	H	16	ITRW311	H	16
BWIA111	H	12	ITRW213	H	16	ITRW317	H	16
ECON111	H	12	ITRW214	H	16	STTN315	H	32
ITRW112	X	12	STTN215	H	16			
STTN115	H	12	WISN211	X	8			
WISN111	X	12	WISN212	X	8			
			WVES311	X	12			
Total 1st semester		**76**	**Total 1st semester**		**92**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCS121 **OR** ACCF121	H	16	ITRW123	H	12	ITRW325	H	16
AGLE121	X	12	ITRW222	H	16	ITRW321	H	16
BWIA121	H	12	STTN225	H	16	STTK321	H	24
ECON121	H	12	TGWN223	X	8	STTK322	H	8
ITRW124	H	12	WISN226	H	8			
STTN125	H	12	WVES221	X	12			
WISN121	X	12						
Total 2nd semester		**88**	**Total 2nd semester**		**72**	**Total 2nd semester**		**64**
Year Module			**Year Module**			**Year Module**		
Total year level 1		**164**	**Total year level 2**		**164**	**Total year level 3**		**128**
Total of curriculum credits								**456**

N.11 PROGRAMME: ACTUARIAL SCIENCE (200123)

The Faculty of Natural Sciences has approved one curriculum that provides a good basic training in actuarial science. In compiling this curriculum, possible occupations and our country's need for human resources were also considered. Furthermore this curriculum prepares the student for postgraduate studies in actuarial science (Hons BSc, curricula N609P), which are recommended with a view to registration with the South African Council for Natural Scientific Professions (SACNASP).

N.11.1 PROGRAMME OUTCOMES

a) Knowledge

On completing the programme, the student will have adequate knowledge and insight into the following topics:

- Functioning of an economy. Introductory micro- and macroeconomics. Determining the national income and the influence of different policy measures on it. National accounting concepts and the macro-equilibrium equation. Economic conjuncture and stabilisation. Transferring funds between countries, exchange rate systems. Balance of payment and international monetary system. Monetary policy in South Africa.
- The impact of the asset and liability management of banks on the national economy. Risk, liquidity policy, lending policy, liability management and the apportionment of capital by banks, interaction between bank risks and the monetary policy and regulations of the Reserve Bank. South African futures market. Functioning of derivative instruments and their application to risk hedging.
- The nature, aim and basic theory of accountancy. Financial statements, fixed assets and depreciation. Control, departmental and manufacturing accounts. Partnerships, close corporations and appropriate GAAP viewpoints.
- Close corporations, conversion of enterprises, company financial statements, pre-incorporation income, debentures, analysis and interpretation of financial statements, cash flow, deferred taxes. Lease agreements in financial statements, earnings per share, adjustments for previous years and group financial statements.
- Probability theory, sampling theory and techniques.
- Theory and topology of real numbers and finite dimensional vector spaces, algebraic and measurable spaces, integrals of measurable functions and monotone convergence, linear transformations between general vector spaces, ordinary and partial linear differential equations and optimisation.
- Basic computer literacy, including the operation and components of a computer, storage of data, use of a spreadsheet and problem solving.
- Object-based programming language, including the basic structures, data types, methods, class

b) Skills

On completing this programme, the student will be able to demonstrate that he/she has the following skills:

- Identifying and solving convergent and divergent actuarial financial problems in a creative and pro-active manner.

- In-depth knowledge and insight into the financial markets and financial instruments and relevant problems, together with the ability to solve problems in interaction with other disciplines.
- Identifying and assessing financial risk, computer and data analysis techniques and/or approximations on an entrepreneurial basis, in order to manage financial risks.
- The ability to work effectively as an individual or in a team in an organisation and to address actuarial and financial problems.
- The ability to identify and investigate training and occupational possibilities in actuarial science, as well as research possibilities.
- The ability to master questionnaires and meaningful data collecting methods, to handle data presentation methods and exploratory data evaluation by using amongst others statistical computer software (e.g. Statistica, S-Plus and SAS), together with standard executive inference methods over wide range.
- The ability to prepare and present professional written and oral reports.
- Mathematical modelling of practical problems by using partial differential equations, combinatory mathematics, linear programmes and optimisation methods, together with computerised implementation where applicable.
- Programming in a modern high-level language, together with the ability to analyse and design computer systems and algorithms.
- The ability to do calculations, analyse and solve problems with the aid of a spreadsheet and to design algorithms and handle problems in an object-based programming language.

c) Articulation possibilities

The programme grants admission to postgraduate studies in the Hons BSc (Actuarial Science) programme and may also grant admission to honours studies in Economics and Statistics. Students who passed the Hons BSc (Actuarial Science) may also apply for admission to the Master's Degree in Business Mathematics and Informatics (see Postgraduate Calendar).

N.11.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.

Permission requirements for all Business Mathematics and Informatics courses (N134P, N135P, N136P and N137P), Mathematics 70-79% (level 6), APS Score 32.

The following is only relevant to students who are from 2013 first year students in the N137P curriculum:

- If a student does not obtain a final mark of at least 60% for both BWIA121 and STTN125 in the first year of registration, then the student may not continue with the N137P 2nd year curriculum.
- If a 2nd year student does not pass BWIA271 in the first year of registration, then the student may not continue with the N137P 3rd year curriculum.

- If a 3rd year student fail two or more of the following modules: BWIA313, BWIA314, BWIA324, BWIA371 in the first year of registration, then the student may not continue with the N137P curriculum.

In any of the above events the student must discuss the matter with either the Nominated Accreditation Actuary or Director of the Centre for BMI.

Mathematics Refresher course

Before the classes start in the beginning of the year, there will be a refresher course for Mathematics. All students that enrol for curriculums where the module WISN111 appears, are strongly recommended to do the refresher course.

N.11.3 LANGUAGE MEDIUM

The language of instruction for contact students in this curriculum is Afrikaans. Lectures are interpreted into English for students who are not proficient in Afrikaans.

In certain modules the language of instruction is English and lectures are interpreted into Afrikaans if requested.

N.11.4 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.11.5 CURRICULUM: ACTUARIAL SCIENCE (200123) – N137P

This curriculum is presented in English and Afrikaans (see N11.3), with interpreting into Afrikaans or English upon request.

Compilation of curriculum N137P

YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCF111 **OR** ACCC111	H	16	ECON211	H	16	BWIA313	H	24
BWIA111	X	12	EKRP211	H	16	BWIA314	H	12
ECON111	H	12	STTN215	H	16			
ITRW112	X	12	WISN211	X	8	STTN315	H	32
STTN115	H	12	WISN212	X	8			
WISN111	X	12	WVES311	X	12			
Total 1st semester		**76**	**Total 1st semester**		**76**	**Total 1st semester**		**68**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ACCC121	H	16	EKRP221	H	16	BWIN321	H	16
AGLE121	X	12	FINM221	H	16	STTK321	H	24
BWIA121	H	12	STTN225	H	16	STTK322	H	8
ECON121	H	12	TGWN223	X	8	BWIA324	H	12
ITRW123	X	12	WISN226	X	8			
STTN125	H	12	WVES221	X	12			
WISN121	X	12						
Total 2nd semester		**88**	**Total 2nd semester**		**76**	**Total 2nd semester**		**60**
Year Module			**Year Module**			**Year Module**		
			BWIA271	H	32	BWIA371	H	32
Total year level 1		**164**	**Total year level 2**		**184**	**Total year level 3**		**160**
Total of curriculum credits								**508**

N.12 PROGRAMME: INFORMATION TECHNOLOGY
QUALIFICATION CODE: 2DX H01

N.12.1 PROGRAMME OUTCOMES

This programme provides a good basic training in information technology. In compiling the curricula for this programme the Faculty also considered possible occupations and the need of our country for human resources. Furthermore this programme prepares the student for postgraduate studies (Hons BSc and/or M.Sc.) in computer science, which are recommended in view of registration with the South African Council for Natural Scientific Professions (SACNASP).
The purpose of the qualification is to:

- provide South Africa with graduates who have specific and relevant theoretical knowledge and practical skills in information technology. This will contribute to broadening the leadership base through well-qualified citizens for innovative and knowledge-based contributions to economic and other supporting activities for the country and its people;
- equip graduates with grade-level expertise and applied skills in the field of Information Technology (Computer Science and Information Systems) which is globally and especially in South Africa a shortage of well qualified and well-appointed human resources exist, and.
- enable graduates to enter the labour market of information technology as entrepreneurs or as employees of organisations at national and international level. The foundation laid as lifelong learners, will enable graduates to contribute to the support of strategic decision making and eventually to direct contributions in this regard.

The student will also have the following specific knowledge and skills, viz. he will have the ability to:

- contribute in a professional manner and according to modern, acceptable methodologies to the design, development and delivery of computer systems in accordance with business needs and principles;
- contribute meaningfully to the management of information and information sources on the basis of his knowledge and understanding of appropriate concepts, structures, models, theories, principles and research methods;
- solve IT relevant problems in the context of approaches and techniques of other appropriate disciplines by means of a thorough, practice-directed knowledge of and insight into the field of information technology (IT);
- realise the necessity to ensure continuing competency and to remain at the forefront of the latest technology and techniques, and as a lifelong student to stay involved with these by means of established and well-developed learning skills.

N.12.2 ADMISSION REQUIREMENTS OF THE QUALIFICATION

See paragraph N.1.5.

N.12.3 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.12.4 INFORMATION TECHNOLOGY: QUALIFICATION CODE: 2DX H01 (N301P)

Compilation of this programme:

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3		
First semester			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW112	H	12	ITRW211	H	8	ITRW311	H	16
STTN111	X	12	ITRW212	H	16	ITRW313	H	8
WISN111 **OR** WISN113	X	12	ITRW213	H	16	ITRW315	H	8
BMAN111	X	12	ITRW214	H	16	ITRW316	H	16
ACCS111 **OR** ACCF111	X	16	WVNS211	X	12	ITRW317	H	16
Total 1st semester		**64**	**Total 1st semester**		**68**	**Total 1st semester**		**64**
YEAR LEVEL 1			**YEAR LEVEL 2**			**YEAR LEVEL 3**		
Second semester			**Second semester**			**Second semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
ITRW123	H	12	ITRW222	H	16	ITRW321	H	16
ITRW124	H	12	ITRW225	H	16	ITRW322	H	16
STTN121	X	12	BMAN222	X	16	ITRW324	H	16
ACCS121 **OR** ACCF121	X	16	WVNS221	X	12	ITRW325	H	16
AGLE121	X	12	WISN223	X	8			
Total 2nd semester		**64**	**Total 2nd semester**		**68**	**Total 2nd semester**		**64**
Total year level 1		**128**	**Total year level 2**		**136**	**Total year level 3**		**128**
Total of programme credits								**392**

N.13 RULES FOR THE DEGREE BACCALAUREUS ARTIUM ET SCIENTIAE (PLANNING) (118101)

N.13.1 PROGRAMME OUTCOMES

The Faculty Board of Natural Sciences has approved curriculum N183P, which provides professional training in urban and regional planning. In compiling this curriculum, possible occupations and our country's need for human resources were also considered. This curriculum also conforms to the requirements of the South African Council for Town and Regional Planners and prepares the student for admission to studies of the degree MArt et Scien(Plan.)

On completing this programme, the student should be able:

- to demonstrate a broad and systematic knowledge base of urban and regional planning and techniques, and of other subject-specific contents that have been presented in the programme to bring about sustainable development in urban and rural environments;
- to have the ability to identify, analyse and argue theoretically driven solutions to complex and real-life planning problems and issues in an ethically responsible way;
- to demonstrate skills to collect, analyse critically, to process by computer, to integrate and evaluate results of current research and scientific and professional literature in the field of urban and regional planning, as well as quantitative and qualitative data, and to communicate his/her findings to peers and professional persons in writing and orally;
- to act as entrepreneur by utilising knowledge and skills in planning consultation and development.

N.13.2 DURATION (MINIMUM AND MAXIMUM DURATION)

The minimum duration of the studies for this degree is four years and the maximum duration for completing the degree is five years.

N.13.3 ADMISSION REQUIREMENTS OF THE QUALIFICATION

a) The requirements of this qualification with regard to prior learning are described in N.1.7.

b) Students are only admitted to the BArt et Scien (Plan.) degree if they have been selected for admission. A maximum of 25 candidates, i.e. first-time university students, will be selected annually.

N.13.4 FACULTY-SPECIFIC ADMISSION REQUIREMENTS

See paragraph N.1.6.

N.13.5 LANGUAGE MEDIUM

The language of instruction for contact students in this curriculum is Afrikaans. Lectures are interpreted into English for students who are not proficient in Afrikaans.

In certain modules the language of instruction is English and the lectures are interpreted into Afrikaans if requested.

N.13.6 COMPLETION OF RESEARCH PROJECT (DISSERTATION/ARTICLE)

Students must complete practical work for SBES 471 fulltime during first and second semester under supervision of personnel in the respective subject group. The following requirements are to be met:

- An explanatory outline of the research project about a suitable topic within the subject group urban and regional planning should be sent to the school director to review before end of February for consideration.
- On recommendation from subject group, a study leader will be appointed by the school director from joint personnel in the subject group. The student reserves the right to request that a specific personnel to supervise his/her studies. If deemed necessary the school director may with recommendation of subject group appoint a support- or assistant study leader from other subject groups and / or from the private or public sector.
- Students are to submit monthly progress reports on the research project to the study leader. The progress report will consist of work completed in the previous month as well as work to be undertaken in the next month.

N.13.7 EXAMINATION OF THE PRACTICAL EXAM (SBPR421)

A date will be determined by the Subject Group when the practical exam will occur. The exam can consist of written and/or oral components and can include methodologies and practices that were dealt with during the programme.

N.13.8 PROGRAMME: PLANNING

N.13.8.1 Curriculum: Urban and Regional Planning (118101) – N183P

This curriculum is presented in English and Afrikaans (see N13.5). Interpreting services are available if requested.

Compilation of curriculum N183P

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3			YEAR LEVEL 4		
First semester			**First semester**			**First semester**			**First semester**		
Module code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
SBES111	H	12	SBRS211	H	16	SBRS311	H	16	SBSS471*	H	48*
GGFS112	H	12	SBSS211	H	16	SBSS311	H	16	SBRS411	H	16
ECON111	X	12	GGFS212	H	16	GGFS312**	X	32	SBSS412	H	16
WISN113	X	12	ECON211	X	16				SBSL412	H	16
STTN111	X	12	WVNS211	X	12						
Total 1ste semester		**60**	**Total 1ste semester**		**76**	**Total 1ste semester**		**64**	**Total 1ste semester**		**96**

YEAR LEVEL 1			YEAR LEVEL 2			YEAR LEVEL 3			YEAR LEVEL 4		
Second semester			**Second semester**			**Second semester**			**Second semester**		
Module Code	**Core**	**Cr**	**Module code**	**Core**	**Cr**	**Module Code**	**Core**	**Cr**	**Module code**	**Core**	**Cr**
SBES121	H	12	SBSL221	H	16	SBES321	H	16	SBES421	H	16
GGFS121	H	12	ECON321	X	16	SBRS321	H	16	SSBP421	H	16
ECON121	X	12	SBRS221	H	16	ECON322	X	16			
STTN124	X	12	SSBP221	H	16	SBSS321	H	16			
AGLE121	X	12	WVNS221	X	12	SECO321	H	16			
Total 2de semester		**60**	**Total 2de semester**		**76**	**Total 2de semester**		**80**	**Total 2de semester**		**32**

Total Year level 1	**120**	**Total Year level 2**	**152**	**Total Year level 3**	**144**	**Total Year level 4**	**128**
Credit Total of the curriculum							**544**

*SBSS471 offered over two semesters (16 credits in first semester) and (32 credits in the second semester)

****GGFS222 as a prerequisite for GGFS312:** Students in N183P are exempted from the requirement GGFS222, as it is not a compulsory module. Students achieve the outcomes of GGFS222 (Human Geography), by completion of the compulsory Urban and Regional Planning modules.

.

N.14 MODULE LIST

** In terms of the General Rule 2.3.3.1 apply in the Faculty of Natural Sciences, when a first semester module in a particular year level is set in the faculty rules as assumed learning for a second semester module, a module mark of at least 40% must be achieved in the first semester module concerned, before the student may continue with the second semester module.The prerequisites between study years are 50%.

Subjects and Module codes	Descriptive name	Prerequisites	Credits
Accountancy			
ACCC111	Accounting: Framework, Foundations, Cycle and Financial Reporting	Mathematics level 5 (60-69)	16
ACCC121	Accounting for different entity forms	ACCC111 (50) **or** ACCF111 (65)	16
ACCF111	Financial Accounting: Basic Concepts, Accounting Systems and Elementary Financial Reporting	Mathematics level 4 (50-59)	16
ACCF121	Financial Accounting: Elementary Financial Reporting, Partnerships, and Companies	ACCF111 (40) **or** ACCC111 (40)	16
ACCS111	Financial Accounting (Special) – Basic Concepts, Accounting Cycle and Accounting Systems		16
ACCS121	Financial Accounting (Special) – Bank Reconciliation, Elementary Financial Reporting and Analysis and Interpretation of Elementary Financial Statements	ACCS111 (40)	16
Academic Literacy			
AGLE111	Introduction to Academic Literacy		12
AGLE121	Academic Literacy	AGLE111	12
Biochemistry **			
BCHN213	Introductory Biochemistry	CHEM111 CHEM121 **or** CHEN122	16
BCHN222	Metabolism	CHEM111 CHEM121 **or** CHEN122	16
BCHS316	Enzymology	BCHN222 CHEN211 CHEN212 CHEN222 CHEN223	16
BCHS317	Molecular Biology	BCHN213 CHEN211 CHEN212 CHEN222 CHEN223	16
BCHS321	Analytical Biochemistry	BCHS317 (40)	16
BCHS322	Biochemistry Research Project	BCHS316 (40) BCHS317 (40)	16

Business Management			
BMAN111	Introduction to Business Management		12
BMAN222	Entrepreneurial Opportunities		16
Business Mathematics and Informatics **			
BWIA111	Introduction to Financial Mathematics		12
BWIA121	Introduction to Actuarial Science	BWIA111 (40) WISN111 (40)	12
BWIA271	Financial Mathematics (A201/CT1)	BWIA121 WISN121	32
BWIA313	Actuarial Statistical Models	BWIA271	24
BWIA314	Stochastic Processes (A202/CT4)	BWIA271	12
BWIA324	Survival Models (A202/CT4)	BWIA271	12
BWIA371	Contingencies (A203/CT5)	BWIA271	32
BWIN321	BMI Project: Capital Markets Modelling and Analysis		16
Chemistry **			
CHEM111	Introductory Inorganic and Physical Chemistry		12
CHEM121	Introductory Organic Chemistry		12
CHEN211	Analytical Methods II	CHEM111 CHEM121	8
CHEN212	Physical Chemistry II	CHEM111 CHEM121 WISN111 WISN121	8
CHEN213	Organic Chemistry II Pharmacy/Biological Sciences	CHEM111 CHEM121	8
CHEN222	Inorganic Chemistry II	CHEM111 CHEM121 WISN111 WISN121	8
CHEN223	Organic Chemistry II	CHEM111 CHEM121	8
CHEM311	Analytical Methods III	CHEN211 CHEN212	16
CHEN312	Physical Chemistry III	CHEN212	16
CHEN321	Inorganic Chemistry III	CHEN222 CHEN212	16
CHEN322	Organic Chemistry III	CHEN223 CHEN212	16
Zoology **			
DRKS111	Invertebrates		12
DRKS121	Chordates	DRKS111 (40)	12
DRKN211	Developmental Biology	DRKS111 DRKS121	16
DRKS221	Comparative Animal Physiology	DRKS111 DRKS121	16
DRKS311	Ecology	DRKS211 DRKS221	32
DRKN321	Animal Parasitology	DRKS211 DRKS221 DRKS311 (40)	16

DRKS322	Ethology	DRKN211 DRKS221 DRKS311 (40) DRTS311 (40)	16
DRTS311	Ecology: Tourism	DRKN211 DRKS221	16
Economics			
ECON111	Introduction to Economics		12
ECON121	Basic Micro- and Macroeconomics		12
ECON211	Macroeconomics	ECON121 (40) WISN112 (40) **or** WISN123 (40)	16
ECON221	Micro-economics	ECON121 **&** WISN112/123 (40)	16
ECON311	Fiscal and Monetary Policy		16
ECON321	Economic Analysis		16
ECON322	Development Economics		16
Economics: Risk Management			
EKRP211	Introduction to Risk Management		16
EKRP221	Investment Management		16
EKRP311	Bank Risk Management		16
EKRP321	Financial Markets	WISN111/112/123	16
Financial Management			
FINM221	Financial Management: Introduction	ACCF121 **or** ACCC121 (40) **&** WISN112	16
Physics **			
FSKS111	Mechanics, Oscillations, Waves and Theory of Heat.		12
FSKS113	Physics for Biology I		12
FSKS121	Electricity, Magnetism, Optics, Atomic and Nuclear Physics	FSKS111 (40) WISN111 (40)	12
FSKS123	Physics for Biology II	FSKS113/111 (40)	12
FSKS211	Electricity and Magnetism	FSKS121 **&** TGWN121 **or** TGWN122 **or** WISN121	8
FSKS212	Optics	FSKS121 **&** TGWN121 **or** TGWN122 **or** WISN121	8
FSKS221	Special Relativity	FSKS121 FSKS211 (40) WISN121	8
FSKS222	Introductory Quantum Physics	FSKS121 FSKS211 (40) WISN121	8
FSKS311	Electromagnetism	FSKS211 WISN211	16
FSKS312	Wave Mechanics	FSKS211 FSKS212 WISN211	16

		FSKS222	
FSKS321	Thermodynamics	FSKS121 WISN211	16
FSKS322	Nuclear Physics and Elementary Particles	FSKS312 (40)	16
FSKS323	Astro- and Space physics	FSKS211 FSKS221 FSKS222	16
Physiology			
FLGX113	Introductory Physiology		12
FLGX123	Membrane and Muscle Physiology	FLGX113 (40)	12
FLGX213	Endocrine System and Digestion	FLGX113	16
FLGX223	Physiological Defence Mechanisms	FLGX113	8
FLGX224	Metabolism	FLGX213 (40)	8
FLGX312	Excretion		8
FLGX313	Respiration		8
FLGX314	Cardiovascular Physiology		16
FLGX325	Neurophysiology		16
FLGX326	Reproductive and Environmental Physiology		16
Geography **			
GGFS112	Introduction to Physical Geography		12
GGFS121	Introductory to Human Geography		12
GGFS212	Physical Geography	GGFS(111)112 **&** GGFS121	16
GGFS222*	Human Geography	GGFS(111)112 **&** GGFS121	16
GGFS312*	GIS and Remote Sensing	GGFS(211)212 **&** GGFS(221)222*	32
GGFS322	Applied Geography	GGFS(211)212 **&** GGFS(221)222 **&** GGFS(311)312 (40)	32
***Prerequisites for Urban and Regional Planning students are unique and will be dealt with, within the Faculty.**			
Geology **			
GLGN112	Geology and the Environment		12
GLGN122	South African Geology	GLGN112 (40)	12
GLGN211	Mineralogy and Igneous Petrology	GLGN112 GLGN122	16
GLGN221	Sedimentology, Structural Geology and Neotectonics	GLGN112 GLGN122 GLGN211 (40)	16
GLGN311	Metamorphic Petrology and Geochemistry	GLGN112 GLGN211 GLGN221	32
GLGN321	Hydrogeology	GLGN112 GLGN211 GLGN221 GLGN311 (40)	32
Soil Science **			
GDKN121	Introduction to Soil Science		12

GDKN211	Advanced Soil Science	GDKN121	16
GDKN221	Soil Degradation and Rehabilitation	GDKN211 (40)	16
Computer Science and Information Technology **			
ITRW112	Introduction to Computers and Programming		12
ITRW115	Programming for Engineers I (C++)		12
ITRW123	Graphic Interface Programming I	ITRW112 **or** ITRW115 (40)	12
ITRW124	Programming I	ITRW112 **or** ITRW115 (40)	12
ITRW126	Programming for Engineers (Visual Basic)	ITRW112 **or** ITRW115 (40)	12
ITRW211	Graphic Interface Programming II	ITRW123	8
ITRW212	Programming II	ITRW124	16
ITRW213	Systems Analysis I	ITRW123 **or** ITRW124	16
ITRW214	Decision Support Systems I	WISN113 **or** WISN111 **or** WISN123	16
ITRW222	Data Structures and Algorithms	ITRW212 (40)	16
ITRW225	System Analysis and Design II	ITRW213 (40)	16
ITRW311	Databases I	ITRW222 **or** ITRW225	16
ITRW313	Expert Systems	ITRW211 **or** ITRW212	8
ITRW315	Communication Skills	ITRW222 **or** ITRW225 (knowledge/ experience of IT **or** Computer Science at 3rd year level)	8
ITRW316	Operating Systems	ITRW222	16
ITRW317	Artificial Intelligence	ITRW222 (knowledge/ experience of IT **or** Computer Science at 3rd year level)	16
ITRW321	Databases II	ITRW311 (40)	16
ITRW322	Computer Networks	ITRW316 (40)	16
ITRW324	IT Developments	ITRW311 **or** ITRW316 (40) (knowledge/experience of IT **or** Computer Science at 3rd year level)	16
ITRW325	Decision Support Systems II	ITRW214	16
**Microbiology ** **			
MKBN121	Microbiology for Nursing		12
MKBN211	Introductory Microbiology	CHEM111 CHEM121	16
MKBS221	Introductory Microbial Genetics, Virology and Immunology	MKBN211 (40)	16

MKBS313	Microbial Physiology	MKBN211 MKBS221	16
MKBS314	Recombinant DNA Technology and Industrial Microbiology	MKBN211 MKBS221	16
MKBS325	Diversity and Ecology of Micro-organisms	MKBN211 MKBS221	32
MKBX213	Microbiology for Food and Nutrition		8
MKPN111	Microbiology (for Pharmacy)		12
Botany **			
PLKS111	Plant structure and function		12
PLKS121	Biodiversity and Environmental Botany		12
PLKN213	Plant Genomics	PLKS111**&** PLKS121	16
PLKS221	Flora of South Africa (Plant Systematics and Phytogeography)	PLKS111 PLKS121	16
PLKS312	Plant Physiology	PLKN213(212)	32
PLKN323	Plant Ecology	PLKN213(212) PLKS221 PLKS312(311) (40)	32
PLTN323	Plant Ecology: Tourism	PLKS221	24
Urban and Regional Planning **			
SBES111	Historical development of Civilizations	Admission requirements as described in N.1.6	12
SBES121	Urban Morphology	SBES111 (40)	12
SBES321	Engineering for planning	SBSS311 (40) SBSS211	16
SBES421	Strategic and project management for planners	SBRS411 (40) SBSL412 (40) SBSS412 (40)	16
SBSS211	Planning approaches and practice	SBES111 SBES121	16
SBSL221	Urban Design	SBSS211 (40)	16
SBRS211	Introduction to Regional planning	SBES111 SBES121 ECON111 ECON121	16
SBRS221	Regional Plans	SBRS211 (40) ECON211 (40)	16
SBRS311	Regional economics	SBRS211 SBRS221 ECON321	16
SBSS311	Commercial planning and development	SBSL221	16
SBSS321	Transport planning and systems	SBRS311 (40) SBSS311 (40)	16
SBRS321	Regional development and analysis	SBRS311 (40) WISN113/123 STTN111 STTN121/124	16
SBRS411	Regional analysis and application	SBRS311 SBRS321	16

		ECON322	
SBSL412	Land use management and residential development	SBES321 SBSS321	16
SBSS412	Integrated housing development	SBES321 SBSS321 SBSS311	16
SBSS471	Research project	SBES321 SBSS321 SBRS321 SSBP221 SECO321	32
SSBP221	Private law for planners	SBSS211 (40)	16
SSBP421	Planning practice	SBES321 SBSS321 SBRS411 (40) SBSL412 (40) SSBP221 SECO321	16
SECO321	Urban ecology for planners	SBSS311 (40) GGFS112(111) GGFS121 GGFS212(211) GGFS312 (40)	16
Statistics **			
STTN111	Descriptive Statistics		12
STTN115	Descriptive Statistics and Inference		12
STTN121	Introductory Statistical Inference I	STTN111 **or** STTN115 (40)	12
STTN122	Introductory Statistics		12
STTN124	Practical Statistics	STTN111 **or** (40) STTN115 **or** (40) STTN122	12
STTN125	Introductory probability theory	STTN111 **or** (40) STTN115 **or** (40) STTN122 **&** WISN111 (40)	12
STTN215	Probability and Sampling Theory	STTN125 WISN121	16
STTN225	Statistical Inference and Data Analysis	STTN215 (40)	16
STTN315	Statistical Inference and Time Series Analysis	STTN225 (221)	32
STTK214	Statistics for Life Sciences'		16
STTK321	Linear Models	STTN315 (311) (40)	24
STTK322	Statistics project	STTN315 (311) (40)	8
Applied Mathematics **			
TGWN121 (BEng)	Statics and Mathematical Modelling	WISN111 (40) FSKS111 (40)	12
TGWN122 (BSc)	Mathematical Modelling and Vector Algebra	WISN111 (40) FSKS111 (40)	12
TGWN211	Dynamics I	WISN121 **&** TGWN121 **or** TGWN122	8

TGWN213	Differential Equations	WISN121	8
TGWN221	Dynamics II	TGWN(212)213 (40) **&** TGWN121 **or** TGWN122	8
TGWN223	Numerical Analysis	WISN121	8
TGWN311	Partial Differential Equations	WISN225 **or** WISN224(221)	16
TGWN312	Partial Differential Equations (Numerical)	WISN225 **or** WISN224(221)	16
TGWN321	Dynamics III	TGWN211	16
TGWN322	Optimisation	WISN211 WISN212	16
Tourism			
TMBP111	Introduction to Tourism Management		12
TMBP211	Applied Tourism Management	BMAN121	16
TMBP221	Tourism Marketing		16
TMBP311	Sustainable ecotourism Management		16
TMBP312	Introduction to Event Management (choice module)		16
TMBP321	Game Farm Management		16
TMBP322	Applied Event Management (choice module)		16
Mathematics **			
WISN111	Introductory Algebra and Analysis I		12
WISN112	Mathematical Techniques		12
WISN113	Basic Mathematical Techniques		12
WISN121	Introductory Algebra and Analysis II	WISN111 (40)	12
WISN123	Mathematical Techniques		12
WISN211	Analysis III	WISN121	8
WISN212	Linear Algebra I	WISN121	8
WISN223	Discrete Mathematics	WISN111 (40) **or** WISN112 (40) **or** WISN113 (40) **or** WISN123	8
WISN224	Analysis IV	WISN211 (40)	8
WISN225	Engineering Analysis	WISN211 (40)	8
WISN226	Linear Algebra II	WISN212 (40)	8
WISN227	Applied Linear Algebra	WISN212 (40)	8
WISN312	Combinatorics	WISN121	16
WISN313	Complex Analysis	WISN224 (221)	16
WISN322	Algebraic Structures	WISN226 (222)	16
WISN323	Real Analysis	WISN224 (221)	16
Understand the Economic and Natural Worlds			
WVES221	Understanding the economic world		12
WVES311	Business ethics		12
WVNS211	Understand the Natural World		12
WVNS221	Science and Society		12

N.15 MODULES

N.15.1 METHOD OF DELIVERING

All modules are offered full-time by means of contact teaching.

N.15.2 ASSESSMENT METHODS

Assessment will be communicated to students at the outset of each semester.
Assessment methods include:

a) Formative assessment methods (homework, class tests, semester tests, reports on practical sessions, assignments) and other appropriate methods.
b) Summative assessment methods, including a two or three hour examination paper.

N.15.3 MODULE OUTCOMES

N.15.3.1 ACCOUNTING

Module code: ACCC111	**Semester 1**	**NQF Level: 5**
Title**: Accounting: Framework, Foundations, Cycle and Financial Reporting**		
Module outcomes: On completion of the module, the student should demonstrate: • integrated knowledge of basic transactions in the accounting cycle; • an ability to identify and evaluate elements of financial statements, within a familiar context; • an ability to gather information from source documents and communicate financial information reliably, accurately and coherently when preparing a set of basic financial statements; and • acceptable behaviour within the academic environment, inclusive of adherence to rules on plagiarism and copyright principles, and the ability to interact and collaborate effectively with others while taking co-responsibility for his/her own learning progress.		
Module code: ACCC121	**Semester 2**	**NQF Level: 5**
Title**: Accounting for different entity forms**		
Module outcomes: On completion of the module, the student should demonstrate: • integrated knowledge of accounting in different entity forms; • an ability to identify and evaluate elements of financial statements, within an unfamiliar context; • an ability to communicate financial information reliably, accurately and coherently when preparing a set of financial statements, including selected basic disclosures in the notes in the financial statements; and • acceptable behaviour within the academic environment, inclusive of adherence to rules on plagiarism and copyright principles, and the ability to interact and collaborate effectively with others whilst taking co-responsibility for his/her own learning progress.		
Module code: ACCF111	**Semester 2**	**NQF Level: 5**
Title**: Financial Accounting – Basic Concepts, Accounting Systems and Elementary Financial Reporting**		
Module outcomes: On completion of the module, the student should be able to demonstrate: • integrated knowledge of the basic transactions of the accounting cycle; • the ability to identify, evaluate and define basic elements of financial statements, within the familiar context; • the ability to gather information from source documents and communicate financial information reliably, accurately and coherently when preparing a set of basic financial		

statements; and
- acceptable behaviour within the academic environment, inclusive of adherence to rules on plagiarism and copyright principles.

Module code: ACCF121	**Semester 2**	**NQF Level: 5**

Title: **Financial accounting: Elementary financial reporting, partnerships and companies**

Module outcomes:

On completion of the module, the student should demonstrate:
- an integrated knowledge of different entity forms;
- the ability to identify and evaluate elements of financial statements within an unfamiliar context;
- the ability to communicate financial information reliably, accurately and coherently when preparing a set of financial statements including selected basic disclosures in the notes to the financial statements;
- acceptable behaviour within the academic environment, inclusive of adherence to rules on plagiarism and copyright principles.

Module code: ACCS111	**Semester 2**	**NQF Level: 5**

Title: **Financial Accounting (Special) – Basic Concepts, Accounting Cycle and Accounting Systems**

Module outcomes:

On completing the module the student should be able:
- to explain the purpose and function of accounting;
- to record transactions in journals, ledger accounts and control accounts;
- to design an accounting system for a specific enterprise;
- to compile financial statements for a sole proprietor of an enterprise.

Module code: ACCS121	**Semester 2**	**NQF Level: 5**

Title: **Financial Accounting (Special) – Bank Reconciliation, Elementary Financial Reporting and Analysis and Interpretation of Financial Statements**

Module outcomes:

On completing the module the student should be able:
- to record transactions in the cash receipts and payment journal and to compile a bank reconciliation statement;
- to compile the statement of comprehensive income (income statement), statement of financial position (balance sheet) and statement of change in equity for a sole trader in a generally accepted format;
- to identify financial ratios and to be able to explain and apply their purpose in analysing and interpreting the liquidity, profitability and solvency of a sole trader.

Module code: FINM221	Semester 2	NQF Level: 6
Title**: Financial Management: Introduction**		
Module outcomes: On completing this module you should be able: • Understand the role of financial management and the financial manager in a business organisation and identify the primary goal of financial management • Understand the concept of the time value of money and perform calculations • Understand the relationship between risk and return and evaluate the risk and return of organisations based on the necessary calculations. • Understand the basic accounting statements and concepts and perform an evaluation of financial performance, using financial statement analysis to assess the current financial condition of the firm. • Demonstrate a knowledge of the characteristics of the principle forms of finance used by companies and the ways in which they may be issued • Demonstrate a basic knowledge of the characteristics of financial instruments and how they can be applied by companies to hedge against risk. • Demonstrate a complete and systematic knowledge of the factors to be considered by a company when deciding on its capital structure • Demonstrate the skills to calculate the cost of the different sources of finance and the weighted average cost of capital of a company. • Understand and apply the various techniques in evaluating capital investment projects.		

N.15.3.2 ACADEMIC LITERACY

Module code: AGLE111	Semester 1	NQF Level: 5
Title: **Introduction to Academic Literacy**		
Module outcomes: On completion of this module the student should be able to: • demonstrate basic knowledge of learning strategies, academic vocabulary and register as well as the reading and writing of academic texts in order to function effectively in the academic environment; • communicate effectively orally and in writing in an appropriate manner in an academic environment; • understand, interpret, and evaluate basic academic texts and write appropriate academic genres in a coherent manner by making use of accurate and appropriate academic conventions; • listen, speak, read and write accurately, fluently and appropriately in an ethical framework.		
Module code: AGLE121	**Semester 2**	**NQF Level: 5**
Title: **Academic Literacy**		
Module outcomes: On completion of this module, students should be able to: • demonstrate fundamental knowledge of appropriate computer programs, as well as apply learning, listening, reading and writing strategies, use academic language register and read and write academic texts, in order to function effectively in the academic environment; • as an individual and a member of a group communicate effectively orally and in writing in an ethically responsible and acceptable manner in an academic environment; • as an individual and a member of a group find and collect scientific knowledge in a variety of study fields, analyse, interpret, and evaluate texts, and in a coherent manner synthesise and propose solutions in appropriate academic genres by making use of linguistic conventions used in formal language registers.		

N.15.3.3 BIOCHEMISTRY

Module code: BCHN213	**Semester 1**	**NQF Level: 6**
Title: **Introductory Biochemistry**		
Module outcomes: After completion of the BCHN213 module, the student should: • demonstrate detailed knowledge on the flow of genetic information in the biosphere, including the structure and synthesis of nucleic acids and proteins • be able to evaluate and apply selected biochemical analytical techniques to investigate nucleic acids and proteins. • be able to solve selected biochemical analytical problems. • evaluate, interpret and present data generated with selected biochemical analytical methods. • demonstrate an understanding of the ethical and professional conduct required of a biochemist.		
Module code: BCHN222	**Semester 2**	**NQF Level: 6**
Title: **Metabolism**		
Module outcomes: After completion of the BCHN222 module, the student should demonstrate: • integrated knowledge of the core reactions of metabolism to form the basis to accumulate specialized knowledge in any of the biological sciences like microbiology, zoology, botany and physiology; • proficient knowledge to evaluate the contribution of food groups to energy productive metabolism under normal and abnormal conditions; • proficient knowledge to be able to predict the effect of an inherited or a induced change in the activity of an enzyme and the effect it would have on a metabolic pathway and eventually the total metabolism and; • proficient skills to compile a testing regime to test the change in the metabolic profile using initial simple screening tests followed by more complex diagnostic tests; • the ability to demarcate the results of an abnormal metabolic profile according to known diagnostic profiles of abnormalities and which and how confirmation analyses could be done in selected cases; • to have the ability to write a report as if in an advisory position (e.g. doctor / pharmacists / biochemist dietician) to explain abnormal results in layman's terms so that it can be understood, without having any background knowledge of the abnormality; • and understanding of the safety, ethical and professional conduct required of a professional analytical biochemist.		
Module code: BCHS316	**Semester 1**	**NQF Level: 7**
Title: Enzymology		
Module outcomes: After completion of the BCHS316 module, the student should demonstrate: • detailed knowledge and understanding of the following key areas of enzymology: ➢ the history, nomenclature and structure-function relationship of enzymes; ➢ the concepts of catalysis and kinetics of single- and multi-substrate enzyme-catalysed reactions; ➢ enzyme inhibition and its relevance; ➢ the characteristics of allosteric enzymes, sigmoidal behaviour of enzymes. • an integrated knowledge of how these concepts play a role in metabolism. • the skills to independently gather knowledge of these concepts using all available sources.		

- detailed knowledge and understanding of the various experimental approaches to enzyme kinetics, the ability to theoretically solve enzyme kinetics problems and critically evaluate the methods used for solving these problems.
- skills related to experimental practice, under appropriate supervision, by following the necessary procedures and methods to effectively execute and complete enzyme kinetics experiments, effectively report on the experimental findings, and to deduce conclusions accurately.
- an understanding of the ethical and professional conduct required of a biochemist and the ethical issues that arises from work where enzymology is applied.

Module code: BCHS317	**Semester 1**	**NQF Level: 7**

Title: **Molecular Biology**

Module outcomes:

After completion of the BCHS317 module, the student should demonstrate:

- detailed knowledge and understanding of the following key areas of biochemistry: 1) the genome structure of eukaryotes; 2) the unlocking of genetic information in eukaryotic cells ; 3) the regulation of unlocking of genetic information in eukaryotic cells; 4) the fundamentals and applications of recombinant DNA technology
- an integrated knowledge of how these concepts play a role in biochemistry and biotechnology
- detailed knowledge and understanding of the various experimental methods and approaches in molecular biology, the ability to theoretically solve biological problems and critically evaluate the methods used for solving these problems
- skills related to experimental practice, under appropriate supervision, by following the necessary procedures and methods to effectively execute and complete experiments to obtain, manipulate and transfer genetic material between organisms, determine the methylation status of genomic DNA and the ability to effectively interpret, report on the experimental findings, and to deduce conclusions accurately.
- an understanding of the ethical and professional conduct required of a biochemist and the ethical issues that arises from work where biochemistry and molecular biology is applied.

Module code: BCHS321	**Semester 2**	**NQF Level: 7**

Title: **Analytical Biochemistry**

Module outcomes:

After completion of the BCHS321 module, the student should be able to demonstrate:

- he/she has detailed knowledge to (i) use important characteristics of proteins for the process of protein isolation and characterization and isolation efficacy evaluation, (ii) understand the concept of chromatographic separation and to demonstrate how knowledge of chemical characteristics of unknown compounds can be applied to predict chromatographic elution order of complex biological mixtures under specific chromatographic conditions, (iii) apply knowledge of centrifugation techniques to separate cell organelles and more specifically to progress to the level of protein separation by applying certain concepts of centrifugation, (iv) basic functioning of mass spectrometry, description of specific ionization techniques, application in the analytical environment and the types of molecules which can be analysed with mass spectrometry and the application of mass spectrometry to identify and quantify unknown metabolites. (v) application of electrophoresis techniques for the separation and identification of biological molecules, (vi) Evaluation and selection of the most suitable analytical technique for a specific technique based on detailed knowledge of analytical biochemistry;
- he/she has problem solving skills with regard to the application of analytical techniques in practice. This includes the interpretation of data on qualitative and quantitative level and the ability to critically evaluate the results;
- he/she can apply the concept of good laboratory practice in the experimental process,

in data generation and communication of results with good supportive arguments;
- he/she can independently use additional sources of knowledge and information like scientific publications, books and the internet to evaluate results critically;
- he/she is familiar with the implication of ethics and professional practice in the application of analytical biochemistry.

Module code: BCHS322	Semester 2	NQF Level: 7

Title: **Biochemistry Research Project**

Module outcomes:

After completion of the module BCHS322, the student should demonstrate:

- sufficient knowledge of the integrated theoretic and practical principles and considerations for planning and carrying out a research project in Biochemistry;
- the ability to assimilate multiple sources of knowledge such as books, journals and the internet on particular topics within the field of Biochemistry, and critically evaluate, review and integrate this knowledge to prepare a literature study and motivate a research proposal;
- integrated knowledge and understanding of the theoretical basis and applications of appropriate analytical equipment and methods that are used in the projects
- the ability to design project-oriented experiments, identify appropriate methods and perform experiments and carry out a small research project in group context, under appropriate supervision;
- the ability to critically evaluate, interpret, present and communicate results of experiments in the form of preparing and presenting a research poster
- the ability to identify ethical issues in biological research and have an understanding of professional conduct required of a professional biochemist.

N.15.3.4 BUSINESS MATHEMATICS AND INFORMATICS

Module code: BWIA111	Semester 1	NQF Level: 5

Title: **Introduction to Financial Mathematics**

At the end of this module, the student will have acquired knowledge and insight into the calculation of interest, time value of money, present and future values, nominal and effective interest rates and annuities and loans.

In this module, the student acquires skills to handle vaguely defined problems and to integrate concepts from the financial-economic world that can be quantified with the aid of mathematical models and solved by means of computer spreadsheet-based implementation.

Specific attention is given to playing off simulation versus the analytical, as well as to discrete versus stochastic modelling of such problems.

Module code: BWIA121	Semester 2	NQF Level: 5

Title: **Introduction to Actuarial Science**

Module outcomes:

On completion of the module the student will demonstrate a knowledge and understanding of:

(i) the calculation of interest;
(ii) time value of money;
(iii) present and future values;
(iv) nominal and effective rates;
(v) annuities;
(vi) loans;
(vii) using a generalised cash flow model to describe financial transactions;
(viii) taking into account the time value of money using the concepts of compound interest and discounting;
(ix) showing how interest rates or discount rates may be expressed in terms of different time periods;

(x) real and money interest rates;
(xi) calculating the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation;
(xii) the definitions and use of more important compound interest functions including annuities certain;
(xiii) life insurance and specifically about general life insurance products and their associated risks;
(xiv) general/short-term insurance and specifically about general short-term insurance products and their associated risks;
(xv) medical care and specifically about medical aid funds and medical insurance and their associated risks; and
(xvi) banking and financial institutions and their associated risks.

The first 6 concepts ((i) to (vi)) are presented in the form of a self-created project.
In this module, the student acquires skills to handle vaguely defined problems and to integrate concepts from the financial-economic world that can be quantified with the aid of mathematical models and solved by means of computer spreadsheet-based implementation.
Specific attention is given to playing off simulation versus the analytical, as well as to discrete versus stochastic modelling of such problems.

Module code: BWIA271	**Year module**	**NQF Level: 6**

Title: **Financial Mathematics (A201/CT1)**

Module outcomes:
On completion of the module the student will demonstrate a sound knowledge and understanding of:
(i) using a generalised cash flow model to describe financial transactions.
(ii) taking into account the time value of money using the concepts of compound interest and discounting.
(iii) showing how interest rates or discount rates may be expressed in terms of different time periods.
(iv) real and money interest rates.
(v) calculating the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
(vi) the definitions and use of more important compound interest functions including annuities certain.
(vii) the definition of an equation of value.
(viii) describing how a loan may be repaid by regular instalments of interest and capital.
(ix) using discounted cash flow techniques in investment project appraisal.
(x) describing the investment and risk characteristics of the following types of asset available for investment purposes:
  (a) fixed interest government borrowings
  (b) fixed interest borrowing by other bodies
  (c) shares and other equity-type finance
  (d) derivatives
(xi) analysing elementary compound interest problems.
(xii) calculating the delivery price and the value of a forward contract using arbitrage free pricing methods.
(xiii) the term structure of interest rates.
(xiv) simple stochastic models for investment returns.

The student will also as an individual or as a member of a group demonstrate the ability to:

(i) solve well-defined but unfamiliar problems using correct procedures and appropriate evidence
(ii) perform a critical analysis and synthesis of information
(iii) present information using basic information technology
(iv) present and communicate information reliably and coherently, using academic/professional discourse conventions and formats appropriately through integrated assessment of objectives (i) to (xiv) in the form of project(s).

Module code: BWIA314	**Semester 1**	**NQF Level: 7**

Title: **Models: Stochastic Processes (A202/CT4)**

Module outcomes:
On completion of the module the student will demonstrate a well-rounded and systematic knowledge and coherent and critical understanding of:
(i) the principles of actuarial modelling.
(ii) the general principles of stochastic processes, and their classification into different types.
(iii) the definition and application of a Markov chain.
(iv) the definition and application of a Markov process.

The student will also as an individual or as a member of a group demonstrate the ability to:
(a) deal with unfamiliar concrete and abstract problems and issues using evidence-based solutions and theory-driven arguments
(b) use well-developed information retrieval skills
(c) perform a critical analysis and synthesis of quantitative and/or qualitative data
(d) use appropriate IT skills to present results using prescribed formats
(e) present and communicate information and their own ideas and opinions in well-structured arguments
(f) show an awareness of audience and using academic/professional discourse appropriately through integrated assessment of objectives (i) to (xi) in the form of project(s).

Module code: BWIA313	**Semester 1**	**NQF Level: 7**

Title: **Actuarial Statistical Models (A204/CT6)**

Module outcomes:
On completion of the module the student will demonstrate a well-rounded and systematic knowledge and coherent and critical understanding of:
(i) the concepts of decision theory and the application of them;
(ii) the calculation of probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements;
(iii) the fundamental concepts of Bayesian statistics and using these concepts to calculate Bayesian estimators;
(iv) the concept and general properties of stationary, I(0), and integrated, I(1), univariate time series;
(v) the concept of a stationary random series;
(vi) the concept of a filter applied to a stationary random series;
(vii) the notation for backwards shift operator, backwards difference operator, and the concept of roots of the characteristic equation of time series;
(viii) the concepts and basic properties of autoregressive (AR), moving average (MA), autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) time series; and
(ix) the concept and properties of discrete random walks and random walks with normally distributed increments, both with and without drift.
(x) the construction of risk models involving frequency and severity distributions and the calculation of the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements;

(xi) the concept of ruin for a risk model. This will include the calculation of the adjustment coefficient and being able to state Lundberg's inequality. This also include the effect on the probability of ruin of changing parameter values and of simple reinsurance arrangements; andthe concepts of decision theory and the application of them;

(xii) techniques for analysing a delay (or run-off) triangle and projecting the ultimate position through applying the techniques;

(xiii) the fundamental concepts of a generalised linear model (GLM) and describing how a GLM may be applied.

(xiv) the basic concept of a multivariate autoregressive model.

The student will also as an individual or as a member of a group demonstrate the ability to:

(a) deal with unfamiliar concrete and abstract problems and issues using evidence-based solutions and theory-driven arguments use well-developed information retrieval skills;

(b) perform a critical analysis and synthesis of quantitative and/or qualitative data;

(c) perform a critical analysis and synthesis of quantitative and/or qualitative Data;

(d) use appropriate IT skills to present results using prescribed formats

(e) present and communicate information and their own ideas and opinions in well-structured arguments;

(f) show an awareness of audience and using academic/professional discourse appropriately through integrated assessment of objectives (i) to (xxiv) in the form of project(s).

Module code BWIA324	**Semester 2**	**NQF Level: 7**

Title: **Survival Models (A202/CT4)**

Module outcomes:

On completion of the module the student will demonstrate a well-rounded and systematic knowledge and coherent and critical understanding of:

(i) the concept of survival models.

(ii) the estimation procedures for lifetime distributions.

(iii) the derivation of maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.

(iv) the Binomial model of mortality inclusive of the derivation of a maximum likelihood estimator for the probability of death and the comparison of the Binomial model with the multiple state models.

(v) how to estimate transition intensities depending on age, exactly or using the census approximation.

(vi) how to test crude estimates for consistency with a standard table or a set of graduated estimates.

(vii) the process of graduation.

The student will also as an individual or as a member of a group demonstrate the ability to:

(a) deal with unfamiliar concrete and abstract problems and issues using evidence-based solutions and theory-driven arguments

(b) use well-developed information retrieval skills

(c) perform a critical analysis and synthesis of quantitative and/or qualitative data

(d) use appropriate IT skills to present results using prescribed formats

(e) present and communicate information and their own ideas and opinions in well-structured arguments

(f) show an awareness of audience and using academic/professional discourse appropriately through integrated assessment of objectives (i) to (vii) in the form of

project(s).

Module code: BWIA371	Year Module	NQF Level: 7

Title: **Contingencies (A203/CT5)**

Module outcomes:

On completion of the module the student will demonstrate a well-rounded and systematic knowledge and coherent and critical understanding of:

(i) simple assurance and annuity contracts, and the developing of formulae for the means and variances of the present values of the payments under these contracts, assuming constant deterministic interest.

(ii) practical methods of evaluating expected values and variances of the contracts defined in objective (i).

(iii) using ultimate or select mortality to calculate net premiums and net premium reserves of simple insurance contracts.

(iv) the calculation, using ultimate or select mortality, of net premiums and net premium reserves for increasing and decreasing benefits and annuities.

(v) the calculation of gross premiums and reserves of assurance and annuity contracts.

(vi) straightforward functions involving two lives.

(vii) methods which can be used to model cash flows contingent upon competing risks.

(viii) the technique of discounted emerging costs, for use in pricing, reserving, and assessing profitability.

(ix) the principal forms of heterogeneity within a population and the ways i which selection can occur.

The student will also as an individual or as a member of a group demonstrate the ability to:

(a) deal with unfamiliar concrete and abstract problems and issues using evidence-based solutions and theory-driven arguments

(b) use well-developed information retrieval skills

(c) perform a critical analysis and synthesis of quantitative and/or qualitative data

(d) use appropriate IT skills to present results using prescribed formats

(e) present and communicate information and their own ideas and opinions i well-structured arguments

(f) show an awareness of audience and using academic/professional discourse appropriately through integrated assessment of objectives (i) to (ix) in the form of project(s).

Module code: BWIN321	Semester 2	NQF Level: 7
Title: **BMI Project: Capital Markets Modelling and Analysis**		

Module outcomes:

After completion of the module the student should:

- demonstrate a well-rounded and systematic knowledge and coherent and critical understanding of and insight into the mathematical modelling and analysis of financial instruments;
- be able to derive and apply mathematical formulas to price and hedge linear claims such as futures contracts and swaps as well as derive and apply binomial pricing of options;
- be able to use the MS Excel software package (or SAS/IML) to practically implement basic numerical procedures to price vanilla options using binomial trees;
- as an individual or as a member of a group demonstrate the ability to plan and conduct research according to standard protocol and to employ appropriate processes, procedures and techniques to solve problems in the field of capital markets modelling and analyses, communicate results effectively, orally and in writing, and to make use of appropriate technologies in all communications. Act ethically sound in dealing with issues and people.

N.15.3.5 CHEMISTRY

Module code: CHEM111	Semester 1	NQF Level: 5
Title: **Introductory Inorganic and Physical Chemistry**		

Module outcomes:

After completion of the module CHEM111, the student should demonstrate:

- fundamental knowledge and insight of the properties of substances and compounds, inter molecular interaction, aqueous solutions, chemical equilibria, acids and bases, precipitation and electron transfer reactions. They should be able to apply this knowledge to write down and name chemical formula;
- the ability to balance chemical reactions, use and apply stoichiometric and other calculations to find an unknown quantity;
- the ability to recognize and apply tendencies from the periodic table (main group elements);
- the ability to apply laboratory technique and safety rules;
- the ability to explain chemical phenomena, do calculations connected with the phenomena, report results scientifically and to better understand the applications of scientific results in industry and the environment.
- the ability to manage chemical reactions by calculating the enthalpy of reactions, determining the rate of reactions, equilibrium constants, and other aspects of aqueous equilibria such as buffer solutions and solubility products.

Module code: CHEM121	Semester 2	NQF Level: 5
Title: **Introductory Organic Chemistry**		

Module outcomes:

On successful completion of this module the student should be able to demonstrate the following:

- Knowledge and **informed understanding** of the concepts underpinning the subthemes of atomic structure, chemical bonding, molecular geometry, organic nomenclature, and intermolecular forces as well as the most important classes of organic compounds, including alkanes, alkenes, benzenes, haloalkanes, alcohols, amines, ethers, carboxylic acids, acyl halides, anhydrides, esters and amides.
- An ability to evaluate the structures of organic compounds and thereby identify suitable synthesis procedures with a **limited number of steps**..

- Conduct in the academic environment that adheres to the rules as stipulated by the North-West University code of conduct.
- Utilisation of **basic research skills**, such as sourcing and verifying information from various sources and using this information to construct a coherent body of knowledge. Communicate these discipline-specific ideas in writing in an accurate and coherent way while showing respect for conventions around copyright and plagiarism.
- The ability to apply the green chemistry approach to organic chemistry and to show the relation between our approach to chemistry and the long-term survival of the human race.
- The ability to manage his or her learning and implement the discipline-specific learning strategies given in the CHEM 121 study guide to improve learning problems.
- The ability to work in a group and make appropriate contributions to successfully complete one or more practical session and thereby taking co-responsibility for the attainment of the outcome by the group.

Module code: CHEN211	**Semester 1**	**NQF Level: 6**

Title: **Analytical Methods II**

Module outcomes:

After completion of the CHEN212 module, the student should demonstrate:

- integrated knowledge of the basic theories underlying types of errors occurring during chemical analyses, statistics applied on analytical results, taking and preparing samples, quality control, acid-base and complexometric titrations, gravimetry, surface characterisation techniques, atomic spectroscopy, liquid extraction, ion exchange and chromatography;
- appropriate laboratory skills in order to conduct measurements associated with all of the above-mentioned theoretical aspects;
- the ability to demarcate and effectively solve problems associated with the theoretical and practical (experimental) aspects;
- an understanding of the safety, ethical and professional conduct required of a professional analytical chemist.

Module code: CHEN212	**Semester 1**	**NQF Level: 6**

Title: **Physical Chemistry II**

Module outcomes:

After completion of the CHEN212 module, the student should demonstrate:

- integrated knowledge of the theories underlying the thermodynamic and kinetic approaches through which chemical reactions in Physical Chemistry are studied;
- detailed knowledge of the fundamental laws of thermodynamics and the ability to theoretically calculate thermodynamic quantities, as well as to interpret and critically evaluate these values in terms of process characteristics;
- detailed knowledge of kinetic quantities measured and calculated, and interpreting kinetic quantities in terms of the reaction mechanism;
- knowledge of experimental methods and techniques typically utilized to determine thermodynamic and kinetic quantities, as well as the ability to effectively use appropriate laboratory skills in order to conduct these measurements;
- the ability to demarcate and effectively solve complex problems related to thermodynamic and kinetic studies in Physical Chemistry, and to apply experimental measurements with theory-driven arguments;
- the ability to critically judge the ethical/professional conduct of others within different professional/ academic environments in chemistry, and to effect change in conduct where necessary.

Module code: CHEN213	Semester 1	NQF Level: 6

Title: **Organic Chemistry II Pharmacy/Biological Sciences**

Module outcomes:

After completion of module CHEN213, the student should demonstrate:

- detailed knowledge and a clear understanding of i) factors influencing electron density and reactivity of organic molecules and ii) aromatic, heterocyclic and polyfunctional organic molecules, their properties and reactivity.
- critical understanding of the principles of aromaticity applied to aromatic and heterocyclic compounds, knowledge of classic reactions of aromatic and heterocyclic compounds and the ability to explain reactivity trends.
- critical understanding of polyfunctional organic molecules, their reactivity and mechanistic aspects.
- ability to select, implement and evaluate the correct mechanism to demonstrate the possible progression of specific aromatic and polyfunctional reactions.
- the ability to effectively use appropriate laboratory skills to synthesize and purify selected aromatic and polyfunctional compounds.
- understanding of the ethical and environmental impact that chemistry has on society.

Module code: CHEN222	Semester 2	NQF Level: 6

Title: **Inorganic Chemistry II**

Module outcomes:

After completion of the module CHEN222, the student should demonstrate:

- detailed knowledge and a clear understanding of models used to present structure and bonding of atoms and molecules as well as the reaction properties pertaining to the chemistry of the main group elements;
- the ability to derive chemical and atomic properties, as well as to predict important chemical reactions of main group elements from basic principles;
- detailed knowledge of intermolecular forces in solutions and the ability to reproduce the properties, forms of bonding and reactions of s-block and p-block elements;
- the ability to effectively use appropriate laboratory skills and master practical techniques to synthesize and purify specific inorganic compounds of the main group elements;
- the ability to solve a multi-step reaction using suitable reagents and products to ensure the manufacturing of the desired compound, while planning and executing a work schedule;
- a sense of responsibility for fellow humans and the environment in scientific investigations while acting responsible and in accordance with the code of conduct relevant to chemistry.

Module code: CHEN223	Semester 2	NQF Level: 6

Title: **Organic Chemistry II**

Module outcomes:

After completion of the module CHEN223, the student should demonstrate:

- detailed knowledge and a clear understanding of models used to present atoms and molecules as well as the properties, reactions and mechanisms pertaining to aromatic chemistry;
- a clear understanding of prevalent schools of thought that determined the progress within the field of molecular models;
- the ability to select, implement and evaluate the correct mechanism to demonstrate the possible progression of specific aromatic based reactions;
- the ability to effectively use appropriate laboratory skills to synthesize and purify specific compounds;
- the ability to solve a multi-step reaction using suitable reagents and products to ensure the manufacture of the desired compound.

- have a sense of responsibility for fellow humans and the environment in scientific investigations while acting in accordance with the code of conduct relevant to chemistry.

Module code: CHEM311	**Semester 1**	**NQF Level: 7**

Title: **Analytical Methods III**

Module outcomes:

After completion of the module CHEM311, the student should be able:

- to demonstrate integrated knowledge regarding molecular spectroscopic techniques, separation-, thermal-, and electrochemical methods ;
- to derive the structure and properties of chemical substances from experimental measurements;
- to demonstrate and understanding of analytical techniques generally used in characterising chemical compounds; and
- to select and apply a range of analytical techniques to execute chemical analyses, and evaluate, critically reflect on and address the results in a justifiable manner by applying evidence-based and theory-driven arguments;
- be able to address his/her learning needs in a self-addressed manner;
- to demonstrate the ability to take decisions and act ethically and professionally within a supported environment.

Module code: CHEN312	**Semester 1**	**NQF Level: 7**

Title: **Physical Chemistry III**

Module outcomes:

After completion of the CHEN312 module, the student should demonstrate:

- knowledge, insight and understanding to (i) perform calculations based on introductory quantum chemical principles, (ii) explain the origin of vibration, rotation and vibration-rotation spectra, and to calculate molecular quantities and spectroscopic constants from these spectra, (iii) calculate thermodynamic quantities for real (non-ideal) gases by using tabled data in equations based on deviations from ideal gas behaviour, (iv) utilise the Debye-Hückel and related theories to determine thermodynamic quantities for real (non-ideal) solutions, and (v) determine kinetic quantities and activation parameters for reactions of a more complex nature both numerically and graphically;
- an ability to critically interrogate multiple sources of knowledge such as textbooks and the internet within the field of physical chemistry, with specific reference to the above-mentioned topics, so as to critically review and evaluate that knowledge with a view of obtaining a deeper understanding and appreciation of theory and practice;
- skills related to experimental practice, under appropriate supervision, by following the necessary procedures and methods to effectively execute and complete experiments (related to the above-mentioned topics), effectively report on the experimental findings, and extract relevant conclusions as requested;
- problem solving skills related to the interface between theory and application and to analyse and critically reflect on the outcome/result; and
- an understanding of the ethical and professional conduct required of a professional chemist and the ethical application of physical chemistry.

Module code: CHEN321	**Semester 2**	**NQF Level: 7**

Title: **Inorganic Chemistry III**

Module outcomes:

On successful completion of CHEN321 the student should be able to demonstrate the following:

- integrated knowledge and the ability to apply and evaluate models used to present structure and bonding of atoms and molecules as well as the reaction properties pertaining to the chemistry of the transition metals, actinides and lanthanides;
- the ability to select, evaluate and apply different chemical and atomic properties, as well

as to predict important chemical reactions of transition metals, actinides and lanthanides from basic principles, the use of Pourbaix diagrams and Ellingham diagrams;
- the ability to identify, analyse and critically reflect on complex discipline-specific problems and to suggest evidence-based solutions through theory-driven arguments;
- the ability to effectively use appropriate laboratory skills and practical techniques to synthesize and purify specific transition metal complexes and oxides;
- the ability to solve a multi-step reaction using suitable reagents and products to ensure the manufacturing of the desired compound, while planning and executing a work schedule;
- the ability to manage experimental work in an unfamiliar context in order to solve a contextual problem;
- produce accurate and coherent written accounts of gathered information with an understanding of and respect for intellectual property conventions, copyright and rules on plagiarism.

Module code: CHEN322	**Semester 2**	**NQF Level: 7**

Title: **Organic Chemistry III**

Module outcomes:
- After completion of the module CHEN322, the student should demonstrate:
- integrated knowledge and understanding of the theory of the following: aromatic heterocyclic chemistry, stereochemistry, chemistry of the carbonyl compound and rearrangement reactions;
- an ability to assimilate multiple sources of knowledge such as books, general scientific journals and the internet within the field of organic chemistry, and critically evaluate and review that knowledge to deepen the understanding of organic chemistry;
- supervised experimental skills by performing a number of synthesis and analytical tasks, to effectively execute a planned research design, communicate findings and conclusions by means of a written report in a scientific manner;
- the ability to identify, demarcate, analyse, critically reflect on and effectively solve problems in organic chemistry by using appropriate methods;
- an understanding of the ethical and professional conduct required of a professional chemist.

N.15.3.6 ZOOLOGY

Module code: DRKS111	**Semester 1**	**NQF Level: 5**

Title: **Invertebrates**

Module outcomes:
On completion of the module the student should be able to demonstrate:
- A basic knowledge and informed understanding of the systematics and classification of animals, form and function of animals in general and of invertebrates in particular, as well as being able to identify and classify these animals and indicate phylogenetic relationships.
- An ability to distinguish between examples of invertebrates and to sort them in taxonomic and phylogenetic frameworks.
- The ability to differentiate between animals based on their hierarchical organisation, complexity and body plan as well as apply this to demonstrate relationships between groups of invertebrates/taxa.
- The ability to explain what a species is and give an overview of the different species concepts.
- An awareness of the economic importance of invertebrates as a source of food, as parasites of humans, animals and plants, or as biological or mechanical carriers of pathogens.
- The ability to report on their skills in respect of the use of microscopes, dichotomous

keys and the accessing of sources; with a respect for conventions around intellectual property, copyright and plagiarism.
- The ability to account for the role of humans in conservation of the environment and in particular invertebrate biodiversity.

Module code: DRKS121	**Semester 2**	**NQF Level: 5**

Title: **Chordates**

Module outcomes:

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

- An informed understanding of the different aspects of form and function of deuterostome animals , and southern African chordate diversity.
- Ability to select and apply basic processes of analysis, synthesis and evaluation to unlock existing and additional knowledge.
- Ability to work with a microscope and obtain in-focus images at a required magnification.
- The skill and ability to interpret a microscope image and prepare annotated drawings.
- The ability to report on their skills in respect of field identification guides and keys to identify chordates to the required taxonomic level.
- The ability to account for the role of humans in conservation of the environment and in particular higher invertebrate and Chordate biodiversity.
- Awareness of ethical issues related to the use and study of higher invertebrates and Chordata.

Module code: DRKN211	**Semester 1**	**NQF Level: 6**

Title: **Developmental Biology**

Module outcomes:

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

- A detailed knowledge of chordate embryology, the principles of evolutionary theory and basic cytogenetics as well as understand the origin and development of knowledge within the field of embryology, evolutionary theory and cytogenetics.
- An ability to evaluate, select and apply appropriate methods, procedures and techniques in processes of investigation chordate embryology; investigating opinions, approaches and principles of evolutionary theory; and understand applications in the field of cytogenetics.
- An ability to identify and evaluate problems in unfamiliar contexts, gathering evidence appropriate to the field of developmental biology.
- An understanding of the ethical implications of aspects typical of the field of developmental biology, such as research on foetuses, abortion, the extent of genetic manipulation of man and animal and the relationship between religion and evolution as well as an taking responsibility of their own actions pertaining a scientist-in-training: integrity in all aspects of their studies.
- An ability to evaluate different sources of information and to present and communicate complex information reliably and coherently.
- An understanding of the relationships between systems of developmental biology.
- An ability to evaluate his/her own performance against given criteria.

Module code: DRKS221	**Semester 2**	**NQF Level: 6**

Title: **Comparative Animal Physiology**

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

- A focussed knowledge of the fundamental theory of Animal Physiology.
- An understanding of the crucial relationships between environment, form and function and its influence on the physiology of animals.
- The ability to use figures, tables and graphs to explain and supplement various aspects of Animal Physiology.
- The ability to identify key differences in certain physiological processes among animals from different modes of life (aquatic vs. terrestrial).

- Awareness of the scope of ethical and value systems when studying physiological processes in animals.
- The ability to follow instructions to perform experimentation on animals or animal systems to demonstrate a particular physiological process.

Module code: DRKS311	**Semester 1**	**NQF Level: 7**

Title: **Ecology**

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

- Demonstrate how knowledge and theories within the field of aquatic and terrestrial ecology relate to knowledge within other fields with a view to understand the interrelatedness thereof.
- Integrate knowledge of the principles of aquatic and terrestrial ecology and be able to evaluate knowledge and explanations provided in the field of ecology.
- Identify the basic research methodologies relevant to terrestrial and aquatic ecology, select appropriate methods and apply a range of methods used in ecological studies.
- Demonstrate an advanced ability to effectively apply practical skills in research projects to survey and critique aquatic and terrestrial ecosystem health and diversity with a view to suggest interventions and improvements in management systems.
- Analyse and evaluate academic literature to demarcate a researchable problem within the field of ecology and specify an appropriate scientific method that can be used to address the identified problem.
- Reflect on the values, ethical conduct and justifiability of decisions appropriate to ecological studies.
- Produce and communicate accurately and coherently both verbally and in written reports on academic principles in ecology and on ecological research projects.

Third year Zoology students registered for DRKS311 and DRTS311 must attend a compulsory field trip during March/April (that can include the recess time). The report generated from results obtained during the field trip will contribute to the participation mark. No excuses for absence from the field trip will be accepted, except in the event of illness in which case a medical certificate must be presented.

Module code: DRKN321	**Semester 2**	**NQF Level: 7**

Title: **Animal Parasitology**

After completion of this module, the student is expected to demonstrate the following:

- Integrated knowledge and understanding of, as well as an ability to correctly evaluate and apply concepts, facts and principles to different areas of specialization including the classification, life cycles, biology, pathogenesis, epidemiology immunology, diagnosis and treatment in the field of parasitology and an understanding of how the knowledge relates to other fields or practices such as hygiene with a view to control pathogenesis caused by the parasites
- Understanding of contested knowledge with regard to epidemiology within the field of parasitology and a critical evaluation of the applicability of aforementioned principles and theories to this field.
- Ability to select, evaluate and apply a range of different but appropriate theories and scientific methods of enquiry (qualitative, as well as quantitative), to do focused research and resolve problems that will effect change within practice of parasitology.
- Reflection on all values, ethical conduct and justifiable decision making when people are in involved studies regarding parasitology.

Module code: DRKS322	Semester 2	NQF Level: 7

Title: **Ethology**

After completion of the DRKS322 module, the student should demonstrate:

- An integrated knowledge and critical understanding of ethology and associated theories.
- The ability to locate and interrogate multiple sources of knowledge related to ethology.
- The ability to evaluate and contextualize the knowledge and accompanying insights, as well as integrating this with the field project.
- The ability to correctly select and apply knowledge and skills to make use of appropriate methods and techniques relevant to ethology.
- The ability to initiate, plan, develop and execute a project on the behavior of any wild animal, and integrate the data and observations with the relevant ethological theories.
- Presentation skills by presenting and discussing research.
- The ability to identify and formulate the ethical considerations of working and research on wild animal behaviour.

Module code: DRTS311	Semester 1	NQF Level: 7

Title: **Ecology: Tourism**

On completion of the module the student will be able to:

- Demonstrate how knowledge and theories within the field of aquatic and terrestrial ecology relate to knowledge within other fields with a view to understand the interrelatedness thereof.
- Integrate knowledge of the principles of aquatic and terrestrial ecology and be able to evaluate knowledge and explanations provided in the field of ecology.
- Identify the basic research methodologies relevant to terrestrial and aquatic ecology, select appropriate methods and apply a range of methods used in ecological studies.
- Demonstrate an advanced ability to effectively apply practical skills in research projects to survey and critique aquatic and terrestrial ecosystem health and diversity with a view to suggest interventions and improvements in management systems.
- Analyse and evaluate academic literature to demarcate a researchable problem within the field of ecology and specify an appropriate scientific method that can be used to address the identified problem.
- Reflect on the values, ethical conduct and justifiability of decisions appropriate to ecological studies.
- Produce and communicate accurately and coherently both verbally and in written reports on academic principles in ecology and on ecological research projects.

Third year Zoology students registered for DRKS311 and DRTS311 must attend a compulsory field trip during March/April (that can include the recess time). The report generated from results obtained during the field trip will contribute to the participation mark. No excuses for absence from the field trip will be accepted, except in the event of illness in which case a medical certificate must be presented.

N.15.3.7 ECONOMICS

Module code: ECON111	**Semester 1**	**NQF Level: 5**
Title**: Introduction to Economics**		
Module outcomes: On completing this module you should: • be able to demonstrate fundamental knowledge and insight into the basic functioning of the economy and its different components, the economic problem of scarcity, limited resources and unlimited needs, the way in which the different economic systems try to solve this problem and the ways in which fiscal, monetary and other policy measures are applied to reach specific economic objectives; • have skills as an individual and/or as a member of a group to interpret and analyse the behaviour of the most important economic agents, such as consumers and producers; • have skills as an individual and as a member of a group to interpret and analyse the economic data of the fiscal, monetary and other types of policy in South Africa; • have the ability to identify, evaluate and solve clear-cut routines and new economic problems (such as unemployment and high inflation rates) in the South African context by means of proven methods, procedures and techniques; • have the ability to collect information from given sources, to select information suitable to the task, to analyse, synthesise and evaluate that information, and to communicate the results and/or proposals in an ethically healthy manner in writing and in an oral demonstration by means of appropriate information technology.		
Module code: ECON121	**Semester 2**	**NQF Level: 5**
Title: **Basic Micro- and Macroeconomics**		
Module outcomes: On completing this module you should be able to demonstrate: • fundamental knowledge and insight into the principles and theories on which microeconomics, macroeconomics and the Simple Macroeconomic Model are based and also have the ability to apply concepts and terminology in answering well-defined problems and case studies; • fundamental knowledge of the interaction between and interdependence of economic participants and economic indicators; • skills to analyse and evaluate case studies, examples and problems of certain macro- and microeconomic phenomena, with reference to demand, supply, equilibrium, consumption, production, price elasticity and various forms of competition; • fundamental understanding of the causes of inflation, unemployment and economic growth and knowledge to recommend policies in this regard; • skills to apply the Simple Macroeconomic Model in economic analyses and predictions; • information gathering and processing skills for writing assignments within the context of micro- and macroeconomics, individually and in groups.		

Module code: ECON211	Semester 1	NQF Level: 6
Title**: Macroeconomics**		
Module outcomes: On completing this module you should be able: • to analyse the interrelationships in macroeconomics between different economic variables in an open economy; • to evaluate the effect of various policy steps on the functioning of the economy in the long and short run; • to identify different policy measures to identify macroeconomic problems; • to explain how these measures may be applied.		

N.15.3.8 ECONOMICS: RISK MANAGEMENT

Module code: EKRP211	Semester 1	NQF Level: 6
Title: **Introduction to risk management**		
Module outcomes: After completion of this module, the student should be able to: • demonstrate a clear understanding of what risk entails and how to manage risk strategically in a corporate environment in South Africa; • explain why risk management plays an important role in the business environment; • identify and distinguish between various types of risks; • demonstrate both theoretical knowledge and practical application of the risk management process, i.e. the identification, evaluation and control of risk in a variety of scenarios; and • demonstrate a clear understanding of the various forms of risk financing strategies, the cost associated with the different strategies and the appropriateness thereof for different risks.		
Module code: EKRP221	**Semester 2**	**NQF Level: 6**
Title: **Investment management**		
Module outcomes: After completion of this module, the student should be able to: • demonstrate a solid knowledge of the general principles of investment management; • explain the required rate of return as investment criterion; • discuss the fundamental principles of investment in terms of risk/return and the time value of money; • explain diversification; • discuss and analyse the investment management process; • discuss the organisation and functioning of security markets; • distinguish between and evaluate the different investment theories; • discuss valuation principles and practices in investment management; • explain and discuss fundamental analysis; and • discuss portfolio management and portfolio evaluation from the perspective of the investment manager.		
Module code: EKRP311	**Semester 1**	**NQF Level: 7**
Title: **Bank Risk Management**		
Module outcomes: On completing this module you should be able: • to demonstrate a sound and systematic knowledge and understanding of how the		

Assets and Liabilities Committee (ALCO) manage their assets and liabilities to address banking risks, the role that the management of these financial assets and liabilities play in the South African economy, as well as to address the financial and other related risks in a financial institution;

- to demonstrate well developed skills to solve problems by strategic management of the process of minimising financial risks; of maximising the interest income and equity of financial institutions, and show thorough understanding of the regulatory environment in which banks operate;
- to use individual and group methods to communicate information effectively, coherently and in appropriate format.

Module code: EKRP321	**Semester 2**	**NQF Level: 7**

Title: **Financial Markets**

Module outcomes:

On completing this module you should be able:

- to demonstrate a well-rounded and systematic knowledge and understanding of the mechanics of the South African Money and Capital Markets, including SAFEX and the Bond Exchange (the Johannesburg Stock Exchange and shares were covered in EKRP211), and demonstrate an understanding of and the ability to use the mechanics of the products and instruments, including derivatives used in these markets and the regulatory environment;
- to demonstrate the ability to work as an analyst, a market dealer, stock broker and back office official in the banking and treasury environment;
- in unfamiliar concrete and abstract scenarios, to apply basic portfolio management using the products and instruments of the above mentioned markets;
- to work in groups and/or as an individual and to communicate information effectively in an ethically sound manner, using appropriate information technology.

N.15.3.9 PHYSIOLOGY

Module code: FLGX113	**Semester 1**	**NQF Level: 5**

Title: **Introductory Physiology**

Module outcomes:

On completing the module, the student will have basic knowledge regarding the structural and chemical composition of the human body, the cell structure, different membrane transport systems, homeostatic control systems, enzyme functioning, membrane potentials and cellular communication as a foundation for further studies in Physiology. The student will also be familiar with and be able to use relevant subject terminology.

Module code: FLGX123	**Semester 2**	**NQF Level: 5**

Title: **Membrane and Muscle Physiology**

Module outcomes:

On completing the module, the student must:

- have in-depth knowledge of the biophysical (potential differences, load, current) flow and biochemical character (chemical composition of ion channels, conformation changes of channel proteins, ligand receptor interactions) of membrane physiology;
- have in-depth knowledge of the importance of membrane physiology in controlling physiological functions through change in membrane permeability;
- have basic knowledge regarding cellular communication and information transfer as a necessary foundation for further studies;
- be able to demonstrate fundamental knowledge of the functional anatomy of muscle tissue, the molecular mechanism of contraction, the processes associated with excitation contraction coupling and neuromuscular junction, as well as to discuss applications of these, for example to food poisoning;

understand and be able to apply the principles of muscle mechanics, for example in using exercise apparatus;

- be able to describe and apply the energy metabolism of muscle contraction, for example in exercise;
- be able to distinguish between skeletal muscle, smooth muscle and heart muscle, and indicate the practical advantages of the differences;
- be able to discuss the control and coordination of motor movement, using effective examples as illustrations;
- demonstrate the ability to identify and analyse the causes and consequences of muscle defects, such as Myastenia Gravis, muscular dystrophy, rigor mortis, hypertrophy and atrophy.

Module code: FLGX213	**Semester 1**	**NQF Level: 6**

Title: **Endocrine System and Digestion**

Module outcomes:

On completing the module , the student must:

- demonstrate knowledge of the properties and functioning of hormones and endocrine glands; demonstrate insight into the chemical classes of hormones using examples, and physiological functions of hormones in every class; be able to apply hormones as chemical messengers in homeostatic control mechanisms; be able to demonstrate fundamental knowledge of hormone synthesis, secretion and the control of secretion, transport, metabolism, mechanisms of hormonal functioning and the hypothalamus-thyroid control system; be able to apply knowledge of endocrinology to explain endocrine abnormalities, such as among others diabetes mellitus and hypo- or hyperthyroidism;
- be able to demonstrate fundamental knowledge of the functional anatomy, design, function and control (neural and hormonal) of the digestive tract and associated organs; be able to demonstrate the ability to identify and analyse the causes and consequences of defects of the digestive tract.

Module code: FLGX223	**Semester 2**	**NQF Level: 6**

Title: **Physiological Defence Mechanisms**

Module outcomes:

On completing the module, the student should:

- know and use the relevant subject terminology, demonstrate an in-depth knowledge of the defence mechanisms of the body, including the role of the skin as the first defence line, the non-specific and specific defence mechanisms of the body, as well as how the body fights the penetration of viruses, bacteria and also the formation of cancer cells;
- have knowledge of the coagulation of blood and the mechanism to limit the loss of blood (blood loss may threaten the survival of the body);
- be able to motivate the value of knowledge of the physiological defence mechanisms for human health and to argue and solve the relevant physiological defence mechanism problems in an integrated way.

Module code: FLGX224	**Semester 2**	**NQF Level: 6**

Title: **Metabolism**

Module outcomes:

On completing the module the student must:

- discuss the role of Adenosinetriphosphate (ATP), energy sources and metabolic tempo;
- be able to draw and explain diagrams and schematic representations of the most important metabolic pathways, such as glycogenesis, glycogenolysis, Krebs Cycle and oxidative phosphorylation;
- be able to communicate aspects of carbohydrate, lipid and protein metabolism;

- to be able to discuss the properties, causes and consequences of metabolic defects, like ketosis and atherosclerosis.

N.15.3.10 PHYSICS

Module code: FSKS111	**Semester 1**	**NQF Level: 5**
Title: **Mechanics, Oscillations, Waves and Theory of Heat**		
Module outcomes: **Knowledge:** At the end of this module, students will have formal mathematical knowledge of fundamental concepts like force, work, energy and momentum, elasticity, simple harmonic motion, waves, hydrostatics, hydrodynamics and theory of heat. **Skills:** For the first time, students are introduced to differential and integral calculus in natural science problems, and using these, they will have the skills at the end of the module to describe certain sections of the theory and to solve a variety of problems of the above-mentioned topics. In the accompanying practical sessions, students develop skills in measuring, processing and reporting natural science processes selected from an area wider than Physics only.		
Module code: FSKS113	**Semester 1**	**NQF Level: 5**
Title: **Physics for Biology I**		
Module outcomes: **Knowledge:** Knowledge and insight in how physics occurs in natural science phenomena that are selected mainly from biological sciences by explaining and discussing topics such as kinematics, Newtonian laws of motion, torques, work, energy, and power, with applications to the human body, fluid mechanics, pressure, surface tension, viscosity, with applications to the flow of blood, theory of heat, and thermodynamics; **Skills:** Skills in measuring, processing and reporting natural science processes.		
Module code: FSKS121	**Semester 2**	**NQF Level: 5**
Title: **Electricity, Magnetism, Optics, Atomic and Nuclear Physics**		
Module outcomes: **Knowledge:** Students acquire a formal mathematical knowledge of electricity and magnetism, optics and topics from atomic and nuclear physics, such as introductory quantum theory, quantum theory of radiation, atomic spectra, X-rays, de Broglie waves, and radioactivity. **Skills:** Students develop skills to describe physical processes and natural science problems by means of differential and integral calculus and to solve a variety of problems in the above-mentioned topics. In the accompanying practical sessions, they develop their skills in measuring, processing, and reporting on natural science processes.		
Module code: FSKS123	**Semester 2**	**NQF Level: 5**
Title: **Physics for Biology II**		
Module outcomes: **Knowledge:** Knowledge and insight in how physics occurs in natural science phenomena so that he/she can explain and discuss electrostatics, electric potential, electric circuits, magnetism and electromagnetic waves, with applications to apparatus used in biological sciences, as well as waves, sound, optics and nuclear physics;		

Skills:

Skills to solve problems in measuring, processing and reporting natural science processes.

Module code: FSKS211	**Semester 1**	**NQF Level: 6**

Title: **Electricity and Magnetism**

Module outcomes:

Knowledge:

At the end of this module, the students will have been introduced comprehensively to the experimental laws of electrostatics and magnetostatics in vacuum and matter, and to introductory electrodynamics.

Skills:

Students learn to apply the laws to a variety of problems by calculating electrostatic potentials and fields and magnetostatic fields. In the practical sessions, they apply new knowledge to measure some of these phenomena, to investigate the laws governing them and to analyse and present their results and reports by means of computer methods.

Module code: FSKS212	**Semester 1**	**NQF Level: 6**

Title: **Optics**

Module outcomes:

Knowledge:

At the end of this module, students will have acquired a formal mathematical knowledge of optics by having studied the topics of wave theory, interference, diffraction, and polarisation of light, as well as laser physics.

Skills:

In the accompanying practical sessions, students describe and measure a number of concepts and phenomena in geometrical optics, and they investigate certain laws governing these phenomena. They do this using, amongst other apparatus, the optical telescope at Nooitgedacht. They use graphical modelling and presentation of the data to deliver an electronic (computer-generated) report on their observations.

Module code: FSKS221	**Semester 2**	**NQF Level: 6**

Title: **Special Relativity**

Module outcomes:

Knowledge:

At the end of this module students will have acquired a good insight into the meaning and historical development of the special relativity theory by having studied the nature and consequences of the Michelson-Morley experiment, why and in what way the Lorentz transformations were introduced, and how Einstein interpreted and used these in terms of his two postulates of special relativity. Students also have been introduced to the concepts and application of length contraction, time dilatation, Minkowski's space-time intervals, spectral shifts, Hubble's law, relativistic energy, and its four-vector applications.

Skills:

In the theory, the emphasis is on formal and conceptual knowledge and applications. In the accompanying practical sessions, the emphasis is on the correct written and oral presentation of experimental results and project reports. Skills in using computer graphic software and word processing are acquired.

Module code: FSKS222	**Semester 2**	**NQF Level: 6**

Title: **Introductory Quantum Physics**

Module outcomes:

Knowledge:

At the end of this module, students will have been introduced to the extension of classical physics for the first time by having been exposed to energy quantisation for a few phenomena with reference to Planck's postulate. The phenomena include

blackbodies, the photoelectric effect, the Compton effect and X-rays. Students also will have been exposed to Bohr's quantisation principles to develop the first workable model for the hydrogen atom.

Skills:

In the practical sessions, a few quantum mechanical phenomena are investigated. Specialised computer software is used for presenting data in a computerised report.

Module code: FSKS311	**Semester 1**	**NQF Level: 7**

Title: **Electromagnetism**

Module outcomes:

Knowledge:

In this module, which follows on FSKS211, the Maxwell equations are derived for vacuum and matter. By means of these equations, all electromagnetic phenomena can be described and explained mathematically. Students master solutions to these equations in vacuum, non-conductors, and conductors, including waveguides and optical fibres.

Skills:

In the practical sessions, some of the aspects of electromagnetism are investigated experimentally. Students learn, for example, how to use an oscilloscope and other basic measuring apparatus.

Module code: FSKS312	**Semester 1**	**NQF Level: 7**

Title: **Wave Mechanics**

Module outcomes:

Knowledge:

At the end of this module, students will have been introduced to the first principles of quantum physics in the form of wave mechanics as replacement of Newtonian mechanics.

Skills:

Students learn to do basic quantum mechanical calculations and to solve applicable differential equations. In the practical sessions, they study quantum mechanical phenomena and report on these by means of computerised reports.

Module code: FSKS321	**Semester 2**	**NQF Level: 7**

Title: **Thermodynamics**

Module outcomes:

Knowledge:

After the introduction in FSKS111, students receive a formal education in the following topics: the zeroth, first, second, and third laws of thermodynamics. The concepts of entropy, Tds-equations, Helmholtz and Gibbs functions, potential functions, equilibrium, and phase transitions are introduced by a simple statistical description of an isolated system with emphasis on the example of an ideal gas.

Skills:

Students learn how to develop and present abstract theory and to apply thermodynamic principles to systems, like the atmosphere, and to certain cyclic processes like those of heat engines and refrigerators. Great emphasis is placed on problem solving as the outstanding method to apply physics practically. In the practical sessions accurate measurements are made on pulsating stars, students learn how to measure heat capacity and they gain experience in applying their thermodynamic knowledge to astrophysical problems.

Module code: FSKS322	**Semester 2**	**NQF Level: 7**

Title: **Nuclear Physics and Elementary Particles**

Module outcomes:

Knowledge:

The course follows directly on FSKS312, which deals with introductory wave mechanics. At the end of FSKS322 students have knowledge of nuclear structures

and reactions, nuclear decay and models, nuclear models, groups of elementary particles, laws of conservation and the standard quark model for elementary particles.

Skills:

In the theory, emphasis is placed on formal and conceptual knowledge and applications thereof. In the practical sessions, a talk on a popular topic is required, and projects on the contents of the course are discussed. Great emphasis is placed on the correct written and oral presentation of project reports. The use of computer graphic software and word processing is learnt.

Module code: FSKS323	**Semester 2**	**NQF Level: 7**

Title: **Astro- and Space Physics**

Module outcomes:

Knowledge:

At the end of this course, students will have been introduced to distances, positions, motion, luminosity, temperature, mass, and colour of stars and the significance of these properties. Further topics are the Sun and heliosphere as prototypical stellar environment, magnetic fields of stars and planets, pulsating stars, and stellar explosions. Also of importance are the motions and acceleration of charged particles in astrospheres, as well as in astrophysical shocks.

Skills:

In the practical sessions, skills are acquired in photometric and spectral measurements using the optical telescope at Nooitgedacht.

N.15.3.11 GEOGRAPHY

Module code: GGFS112	**Semester 1**	**NQF Level: 5**

Title**: Introductory to Physical Geography**

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

1. a basic knowledge and informed understanding of systems in climatology and geomorphology;
2. appreciate the interactions between subsystems that include:
   a) in climatology: the earth's radiation balance, the climate system, southern hemisphere and southern African synoptic scale circulation.;
   b) in geomorphology: earth materials and tectonic plates; weathering and mass wasting; karst, fluvial, arid, coastal and glacial processes and landforms.
3. the ability to explain climatic and geomorphological processes that are important in the southern African context;
4. the ability to report on their skills in respect of identifying atmospheric circulation and geomorphological processes and landforms;
5. appropriate practical skills including map reading, basic aerial photo interpretation and visual representation of geographical data.

Module code: GGFS121	**Semester 2**	**NQF Level: 5**

Title: **Introduction to Human Geography**

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

1. integrated knowledge of the main areas of Human Geography, including an understanding of the key terms, concept, facts, principles, rules and theories of Human Geography.
2. an ability to identify, evaluate and solve defined, routine and new problems within a familiar context, and to apply solutions based on relevant evidence and procedures or other forms of explanation appropriate to Human Geography.
3. an ability to gather information from a range of sources, including oral, written or symbolic texts, to select information appropriate to the task, and to apply basic processes of analysis, synthesis and evaluation on that information in the field of Human Geography.

4. an ability to communicate information reliably, accurately and coherently, using conventions appropriate to the context, either in writing, verbally or in practical demonstration, including an understanding of and respect for conventions around intellectual property, copyright and plagiarism in the field of Human Geography.
5. an ability to operate in a range of familiar and new contexts, demonstrating an understanding of different kinds of systems, their constituent parts and the relationships amongst these parts, and to understand how actions on one geographical scale can impact on other scales within the same system in Human Geography.
6. the ability to engage statistically with geographical data, to interpret the data spatially, and to present it in a comprehensible and coherent format.

Module code: GGFS212	**Semester 1**	**NQF Level: 6**

Title: **Physical Geography**

On completing the module, the student should have in-depth knowledge and understanding of earth and atmospheric processes and their South African context. In particular students should be able to demonstrate:

- in-depth knowledge and understanding of South African geomorphology, including controls on landforms, examples of fluvial, sedimentary, arid and coastal geomorphology, the relationship between landscapes, mankind and environmental change;
- in-depth knowledge and understanding of South African weather and climate, including typical synoptic conditions, weather forecasting, cloud and precipitation processes;
- detailed knowledge and critical understanding of the use of observations and tools to forecast the weather, including synoptic charts, basic meteorological instrumentation, adiabatic maps like tephigrams, meteorological satellites, weather radar and the output of numerical weather models;
- demonstrate skills to interpret data from basic meteorological instrumentation and meteorological satellites by carrying out weather measurements and processing and evaluating the data; by constructing and interpreting tephigrams and performing and interpreting computer-assisted statistical operations, individually but also as member of a group;
- the ability to identify and effectively implement acceptable information gathering techniques to do research on South African climatological and geomorphological problems of limited scope, and to communicate possible solutions orally or in writing.

Module code: GGFS222	**Semester 2**	**NQF Level: 6**

Title**: Human Geography**

At the end of the module the student should be able to demonstrate:

- Detailed knowledge of the main areas of Human Geography, including an understanding of and an ability to apply the key terms, concepts, facts, principles, rules an theories of Human Geography; and demonstrate knowledge of an area or areas of specialisation and how that knowledge relates to other fields, disciplines or practices.
- An understanding of different forms of knowledge, schools of thought and forms of explanation typical within the field of Human Geography, and an awareness of knowledge production processes.
- An ability to evaluate, select and apply appropriate methods, procedures and techniques such as remote sensing techniques in processes of investigation or application within the context of Human Geography.
- An ability to identify, evaluate and solve problems in unfamiliar contexts, gathering evidence and applying solutions based on evidence and procedures

appropriate to the field of Human Geography.

- An ability to evaluate different sources of information, to select information appropriate to the task, and to apply well-developed processes of analysis, synthesis and evaluation on that information.
- An ability to present and communicate complex information reliably and coherently, using appropriate academic and professional or occupational conventions, formats and technologies within the field of Human Geography.
- An ability to work effectively individually and in a team or group, and to take responsibility for his or her own decisions and actions with an understanding of the ethical implications of decisions and actions.

Module code: GGFS312	**Semester 1**	**NQF Level: 7**

Title: **GIS and Remote Sensing**

At the end of the module the student should be able to demonstrate:

- An integrated knowledge of and engagement in Geographical Information Systems (GIS), Geographic Information Science (GISc) and Remote Sensing (RS) and a critical understanding and application of theories and techniques relevant to GIS, GISc and RS.
- Skills in collecting, managing and applying basic analyses to geographical data by making use of appropriate GIS and image processing software
- The ability to select, apply and critically review the effectiveness of spatial data for use in spatial analysis and mapmaking.
- Critical understanding of how spatial analysis aids in management decisions
- The ability to analyse, select and effectively apply scientific research methods to address spatial problems and communicate the research findings in an academically appropriate format.

Module code: GGFS322	**Semester 2**	**NQF Level: 7**

Title: **Applied Geography**

At the end of the module the student should be able to demonstrate:

- Integrated and systematic knowledge pertaining to the different components comprising the field of Geography, and insight into the manner and extent to which these different component parts interact with one another and impact on one another.
- The ability to relate and contextualise theoretical concepts to real world scenarios and problems.
- The ability to think spatially and holistically.
- The ability, as an individual and/or as a member of a group, to identify, describe and characterise problems in the field of Geography, to research relevant literature, collect and interpret data, analyse, evaluate and synthesise information and come to a meaningful conclusion, and communicate findings to peers orally and in written reports for a research project of appropriate scope.
- The ability to reflect on the values, ethical conduct and justifiability of decisions appropriate to the practice of Geography.

N.15.3.12 GEOLOGY

Module code: GLGN112	**Semester 1**	**NQF Level: 5**

Title: **Geology and the Environment**

On completion of the module, the student should be able to demonstrate:
1 (a) a fundamental knowledge base and informed understanding of the internal- and external geo-processes;
(b) be aware of how scientific knowledge and theories are developed through the

scientific method;
2. the ability to describe and identify the most common rock-forming minerals and rocks according to standard methods / description criteria;
3. the skills required to identify and analyse geological problems or potential problems and to propose and apply solutions in the light of theory-driven arguments;
4. the ability to gather research and current information by undertaking literary searches (internet, books and magazines), select information appropriate to the task and communicate information accurately and coherently, demonstrating respect for intellectual property and an understanding of plagiarism;
5. the ability to operate as part of a group/pair and to make appropriate contributions to successfully complete a task related to the identification of minerals and rocks, taking co-responsibility for learning progress and outcome realization of the group/pair;
6. the ability to assess his or her performance within a structured learning process and to take appropriate action based on feedback from tests and assignments; and
7. be aware of the ethics associated with geology, such as the exploitation of mineral deposits at the expense of the preservation of geo- and biodiversity.

Module code: GLGN122	**Semester 2**	**NQF Level: 5**

Title: **South African Geology**

On completion of the module, the student is expected to demonstrate the following:
1. a fundamental knowledge base and informed understanding of the concept of geologic time, stratigraphic principles relevant to relative dating of rocks, theories relevant to the field of absolute dating of minerals and rocks, the development of the geologic time scale, and the application of the principles in the framework of South African stratigraphic units, as well as the fundamental concepts of crystallography and mineralogy;
2. the ability to describe and interpret geologic structures depicted on geologic maps, as well as the symmetry content of crystal models according to standard methods and description criteria;
3. the skills required to identify and analyse geological problems or potential problems and to propose and apply solutions in the light of theory-driven arguments;
4. the ability to gather research and current information by undertaking literary searches (internet, textbooks and journals), select information appropriate to the task and communicate information accurately,and coherently, demonstrating respect for intellectual property and an understanding of plagiarism;
5. the ability to operate as part of a pair and make appropriate contributions to successfully complete a task related to practical work, taking co-responsibility for learning progress and outcome realization of the pair;
6. the ability to assess his or her performance within a structured learning process and to take appropriate action based on feedback from tests and assignments;
7. be aware of the ethics associated with geology, such as the exploitation of mineral and rock occurrences of value for geo-conservation purposes.

Module code: GLGN211	**Semester 1**	**NQF Level: 6**

Title**: Mineralogy en Igneous Petrology**

On completion of this module, the student should be able to demonstrate:
• detailed knowledge and understanding of: a variety of rock-forming and economic minerals, as well as a variety of igneous rock associations and associated rock-forming processes; the chemical, structural and optical aspects of various minerals and igneous rocks, accompanying analysis techniques, and the graphical representation thereof; the identification and systematic description of the major rock-forming minerals and most common igneous rocks;
• the skill required to analyse, synthesise and evaluate tendencies in changes with regard to the structure and composition of minerals and rocks; identification and systematic classification of rocks and minerals;
• the skill required to apply the investigation method of polarising petrographic microscopy, in order to identify and classify minerals and rocks in thin sections; analyse proposed

models for the origin of particular igneous rock associations;
• the ability to conduct accurate and reliable literary searches, to analyse, interpret and synthesise the information and to use it to make proposals to solve problems in both familiar and new contexts;
• the ability to coherently communicate reporting, either individually or in group context, verbally, written or in digital format, to a group of peer learners with the help of IT; and
• ethical consciousness and accountability with regard to the collection of rock material for geological investigation, use of appropriate analytical techniques, presentation of geological data, the interpretation thereof, and reporting in written format according to scientific / academic standards with the understanding of intellectual property, copyright and rules on plagiarism.

Module code: GLGN221	**Semester 2**	**NQF Level: 6**

Title**: Sedimentology, Structural Geology and Neotectonics**

On completion of the module, the student should be able to demonstrate:
1. (a) detailed knowledge and understanding of - (a) key terms, concepts, facts, principles, rules, theories, etc. within the fields of sedimentology, structural geology, and neotectonics;
(b) how knowledge of sedimentology, structural geology, and neotectonics relates to applicable knowledge within the field of environmental geology; and (c) the origin and development of knowledge within the fields of structural geology and sedimentology results in critical understanding of schools of thought, within the field of geology and environmental applications;
2. the ability to select, evaluate and effectively implement/apply, with discernment, those standard procedures/rules/methods/formulas/skills etc. to solve fundamental problems in a defined environment in die field of sedimetology and structural geology, with a view to conceptualize areas of interest;
3. ability to distinguish and solve sedimentological and structural problems in unfamiliar contexts and to apply the solutions to support progress/development in the practice of environmental geology, in order to integrate the relationship between structural and sedimentological setting, resources and associated environmental impacts;
4. understand the ethical implications of decisions, actions and practices specifically relevant to field and practical sessions, in accordance with the rules of practice;
5. (a) the ability to gather discipline-specific information, methods and techniques from credible and relevant discipline-related scientific sources; analyse, evaluate and synthesize the information and apply your conclusions/research to a given context in the fields of structural geology and sedimentology;
(b) accurate and coherent written and verbal communication of theoretical information/tasks/projects etc. with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism;
6. act as group member and a group leader and contribute appropriate information/skills to successfully complete a task/project/profile etc., measuring the success of the task completion against given criteria, taking co-responsibility for learning progress and outcome realization of the group; and
7. monitor own learning progress and apply relevant learning strategies and known and new resources to successfully realize all outcomes of this module.

Module code: GLGN311	**Semester 1**	**NQF Level: 7**

Title: **Metamorphic Petrology and Geochemistry**

On completion of the module, the student is expected to demonstrate the following:
1) integrated knowledge and understanding of, as well as ability to correctly evaluate and apply concepts and principles to different areas of specialization within the fields of metamorphic petrology and geochemistry and an understanding of how that knowledge relates to these fields;
2) understanding of contested knowledge within the field of metamorphic petrology and geochemistry, and a critical evaluation of the applicability of aforementioned concepts and principles to the field of metamorphic petrology and geochemistry;

3) ability to select, evaluate and apply a range of different but appropriate theories and scientific methods of research;
4) reflection of all values, and ethical conduct and justifiable decision making appropriate to the practice of research in the fields of metamorphism and geochemistry of rocks;
5) ability to identify, analyse, and critically reflect on and address complex metamorphic and geochemical problems and apply evidence-based solutions with theory-based arguments, and communicate in an accurate and coherent manner, written and verbal, with understanding of and respect to intellectual property conventions, copyright and rules on plagiarism; and
6) management of a group in an unfamiliar context in order to solve a contextual problem (explain type), monitoring the progress of the group and taking responsibility for task outcomes and application of appropriate resources as necessary.

Module code: GLGN321	**Semester 2**	**NQF Level: 7**

Title**: Hydrogeology**

On completion of the module, the student should be able to demonstrate:
1. integrated knowledge and understanding of, as well as an ability to correctly evaluate and apply principles of hydrogeology and engineering geology to different areas of specialization within the field of environmental geology, and an understanding of how that knowledge relates to other fields or practices within other disciplines with a view to access and solve environmental problems;
2. ability to select, evaluate and apply a range of different but appropriate procedures/rules/methods/formulas/theories and scientific methods of enquiry to do focused research and resolve problems that will effect change within practice;
3. ability to identify, analyse, critically reflect on and address complex groundwater and engineering geology problems and apply evidence-based/practice-driven/proven solutions with theoretically-driven arguments;
4. (a) reflection of all values, ethical conduct and justifiable decision making processes appropriate to the practice of hydrogeology, engineering geology, and geophysics; and
(b) understanding of the ethical implications of decisions, actions and practices specifically relevant to field and practical sessions, in accordance with the rules of practice;
5. accurate and coherent written and verbal communication of projects with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism;
6. management of a group in an unfamiliar context in order to solve a contextual problem (explain type), monitoring the progress of the group and taking responsibility for task outcomes and application of appropriate resources where appropriate; and
7. take full responsibility for own learning needs, monitoring of own learning progress and application of relevant learning strategies and management of all resources to successfully realize all outcomes of this module.

N.15.3.13 SOIL SCIENCE

Module code: GDKN121	**Semester 2**	**NQF Level: 5**

Title: **Introduction to Soil Science**

On completion of the module, the student should be able to demonstrate:
1. an informed understanding of pedogenesis, soil forming factors and basic fundamental principles in soil science;
2. the skill to differentiate, identify and classify soil horisons and soil forms within the contexts of South African soils and the standard South African classification procedures;
3. the ability to demonstrate the relation between the various soil components and how the interaction between these components affects general soil health and performance;
4. the ability to gather research and current information by undertaking literary searches (internet, books and magazines), select information appropriate to tasks and communicate information accurately and coherently while demonstrating respect for intellectual property

and an understanding of plagiarism;
5. the ability to assess his or her performance within a structured learning program and to take appropriate action based on feedback from tests and assignments; and
6. be aware of his/her personal ethical framework.

Module code: GDKN211	**Semester 1**	**NQF Level: 6**

Title: **Advanced Soil Science**

Detailed knowledge of: soil mineralogy, soil chemistry, plant nutrition and soil physics. Understanding of and an ability to apply key terms, concepts, facts, principles, rules and theories of soil science.
Evaluate, select and apply appropriate soil chemical procedures to solve soil environmental problems.
Identify and solve problems related to soil as a three-phase system.
Evaluate soil analytical data and use that information to make fertilizer recommendations. Present and communicate the fertilizer recommendations made to the interested party in an academic and professional format.
Make decisions and act appropriately in soil related matters with an understanding of the relationships between soil mineralogy, soil chemistry and soil physics.
Work effectively in a team or group, and to take responsibility for his or her decisions and actions and the decisions and actions of others within well-defined contexts, including the responsibility for the use of soil as an important resource.

Module code: GDKN221	**Semester 2**	**NQF Level: 6**

Title**: Soil Degradation and Rehabilitation**

On completion of this module, you should be able to demonstrate the following:
• To distinguish between natural and anthropogenic soil degradation in terms of origins and factors that lead to soil degradation.
• Identify soil pollution on the basis of physical and chemical analysis and determine what types of analyses are applicable in the case of field investigations.
• Explain the impact of pollution and degradation on the chemical, physical and mechanical properties and general land uses of soils.
• Use remote sensing techniques to identify soil degradation.
• Remedial measures to avoid soil degradation, and to recover degraded soil.
• Identify and/or develop potential rehabilitation programs, describe the implications of soil degradation and pollution with reference to practical field observations.
• Development of sustainable land use management systems.
• Development of Environmental Risk analysis for different land uses.
• Do practical soil surveys in the field with an emphasis on identifying soil degradation and pollution and risk management.

N.15.3.14 INFORMATION TECNOLOGY

Module code: ITRW112	**Semester 1**	**NQF Level: 5**

Title: **Introduction to Computers and Programming**

Module outcomes:
On completing this module, the students should be able to demonstrate fundamental knowledge of the different components of a computer and an information system, as well as programming languages and their uses. Furthermore, the student should be able to demonstrate the manipulation of spreadsheets by applying knowledge of tables, computations, transfer of data between different applications, functions and graphic presentations; to demonstrate the ability to solve problems by designing and implementing structured programming, by using data manipulation and data presentations and applying 'GUI' event-driven approaches in the development environment of a spreadsheet; to demonstrate insight into ethical issues related to the wider IT business and an awareness of the risks and dangers that threaten the business; to demonstrate the ability to communicate

in writing by compiling a report after having completed a project.		
Module code: ITRW115	**Semester 1**	**NQF Level: 5**
Title: **Programming for Engineers I C++**		
Module outcomes: After successfully completing the module the student ought to have knowledge of and insight in the basic structure, data types, and functions, including structured problem solving and debugging, testing and execution of applications of the programming language C++. The student will have to demonstrate that he/she can apply the acquired the knowledge and insight to solve elementary problems in engineering, develop an algorithm to solve problems, codify the algorithm in C++, and to debug and test it on the computer.		
Module code: ITRW123	**Semester 2**	**NQF Level: 5**
Title: **Graphic Interface Programming I**		
Module outcomes: On completing the module, the student should demonstrate knowledge to be able to write a computer program that requires certain fundamental theoretical prescience have been mastered; demonstrate the ability to solve simple problems by applying fundamental theoretical prescience; demonstrate sufficient fundamental knowledge of and insight into the graphic interface environment to develop computerised systems in a visual object-based computer language; demonstrate the ability to implement repetitive, conditional and sequential structures, as well as aspects like graphic interface design, event-driven programming, procedural and object-based programming.		
Module code: ITRW124	**Semester 2**	**NQF Level: 5**
Title: **Programming I**		
Module outcomes: On completing this module the student should be able to demonstrate fundamental knowledge of the basic structures, data types, methods, classes and objects of an object-based programming language, and their use; to demonstrate the ability to solve unknown problems by designing and implementing object-based programming, debugging, testing and carrying out applications; to demonstrate insight into ethical issues that are related to the wider IT business and to be aware of the risks and dangers that threaten the business.		
Module code: ITRW126	**Semester 2**	**NQF Level: 5**
Title: **Programming for Engineers (Visual Basic)**		
On completing this module students should be able to • demonstrate knowledge requiring the mastering of certain prior theoretical insights to write computer programs; • solve simple problems by the application of prior theoretical knowledge; • demonstrate that he/she has sufficient knowledge of and insight into the graphical interface environment to develop computerized systems in a visual object-oriented computer language; • demonstrate the ability to understand and implement conditional, repetition and sequential structures; and • have mastered aspects such as graphical interface design, event-driven programming, and procedural programming.		
Assessment criteria: The student demonstrates that the outcomes have been mastered if he/she • can show that he/she can practically apply the theory of graphical interface programming by solving given problems; and • can facilitate problem solving by the design and development of computer applications with emphasis on user-friendly interfaces.		

Module code: ITRW211	Semester 1	NQF Level: 6
Title: **Graphical Interface programming II**		
Module outcomes: Upon successful completion of the module the students will be able to: 1. Describe multi-threading, string handling, file handling databases, data structures and collections as well as demonstrate an informed understanding of the theory van graphic-interface programming. 2. Design systems that are industry-directed and user-friendly and comply with professional and ethical codes of behaviour; 3. Identify problem, analyse and evaluate them critically and propose solutions through the design and development of computer applications with the emphasis on user-friendly interfaces; and 4. Demonstrate the ability to communicate/demonstrate solutions/programs coherently and reliably, in a group of individually through making use of appropriate academic/professional oral and written argumentation (which includes source code commenting).		
Module code: ITRW212	**Semester 1**	**NQF Level: 6**
Title: **Programming II**		
Module outcomes: On completing this module students should have the ability to demonstrate an in-depth knowledge of search, sorting and recursive methods, as well as the use of an object-based programming language and concepts to solve basic problems; to apply in-depth knowledge of other numeric systems, like the binary numeric system, in order to carry out basic computations; to demonstrate skills in solving problems that require file management and exception handling by means of an object-based programming language; to demonstrate the ability to identify, analyse and solve problems by writing a structured, object-based program.		
Module code: ITRW213	**Semester 1**	**NQF Level: 6**
Title: **Systems Analysis I**		
Module outcomes: Upon successful completion of the module the students will be able to: 1. Describe and apply the phases and techniques of the system development life cycle when an IT project is developed up to the design phase, 2. Run a project successfully in group context through the phases of the system life cycle and to present the project report orally and on an ongoing basis to compile documents about the project up to the design phase, 3. Act responsibly and professionally when designing and presenting their IT projects.		
Module code: ITRW214	**Semester 1**	**NQF Level: 6**
Title: **Decision support systems I**		
Module outcomes: At the end of this module the student ought to have acquired basic knowledge and insight into: • decision-making, construction of decision-making systems, • formulating simple linear models (break-even analysis, linear programming) and • their solution with the aid of spreadsheets; carrying out sensitivity analysis and • solving specific problems (transportation and assignment problems and networks). The above techniques will be used in modelling and solving simple operational problems.		
Module code: ITRW222	**Semester 2**	**NQF Level: 6**
Title: **Data Structures and Algorithms**		
Module outcomes: On completing this module successfully, students should be able to demonstrate in-depth knowledge and understanding of data structures (vectors, matrices, switched lists, stacks		

and queues) and the complexity of algorithms by setting up and manipulating data structures, to use object-orientated methods to create abstract data types for the above mentioned data structures and to solve different data handling problems.

Module code: ITRW225	**Semester 2**	**NQF Level: 6**

Title: **Analysis and Design II**

Module outcomes:

Upon successful completion of the module the students will be able to:

1. Discuss and understand the phases and techniques of the system developments life cycle when an IT project is being developed;
2. Run a project successfully (in group context) through the phases of the system life cycle and to submit the project and to compile relevant documentation on it on an ongoing basis; and
3. Act responsibly and professionally when their IT projects are developed and presented.

Module code: ITRW311	**Semester 1**	**NQF Level: 7**

Title: **Databases I**

Module outcomes:

On completing the module, the student should be able to demonstrate well-rounded and systematic knowledge and insight into entity relationship modelling; normalising of database tables and the ability to write and apply SQL and PL/SQL expressions and procedures in designing databases and retrieving information in order to solve unfamiliar concrete and abstract problems in the database environment.

Module code: ITRW313	**Semester 1**	**NQF Level: 7**

Title: **Expert Systems**

Module outcomes:

Upon successful completion of the module the students will be able to:

1. Demonstrate fundamental knowledge of expert systems;
2. Represent and apply theoretical concepts of knowledge-based systems;
3. Apply the basic techniques to practical problems; and
4. Create and demonstrate a practical working knowledge-based expert system that integrates with existing technology.

Module code: ITRW315	**Semester 1**	**NQF Level: 7**

Title: **Communication Skills**

Module outcomes:

Upon successful completion of the module the students will be able to:

1. demonstrate basic knowledge and insight of a principle-based value system according to which he / she can set personal objectives;
2. express themself on the importance of proven skill in good interpersonal relationships and conflict management techniques;
3. function effectively in groups;
4. behave ethically correct;
5. have mastered the basic communication skills of writing and presentation techniques; and
6. write correctly structured reports.

Module code: ITRW316	**Semester 1**	**NQF Level: 7**

Title: **Operating Systems**

Module outcomes:

On completing this module, the student should be able to demonstrate well-rounded and systematic knowledge of and insight into the principles according to which operating systems work, as well as the ways in which they are implemented; to demonstrate the ability to install operating systems on a computer; to demonstrate the ability to use Linux instructions and utility programs in carrying out assignments.

Module code: ITRW317	Semester 1	NQF Level: 7
Title: **Artificial Intelligence**		
Module outcomes: Upon successful completion of the module the students will be able to: 1. Explain that Artificial Intelligence is a full branch of Computer Science, constructed on scientific principles; 2. Define Artificial Intelligence and to comment on the definition; 3. Describe the foundations and fields of application of the subject; 4. Use Propositional Logic and Predicate Logic for the portrayal of problems in Artificial Intelligence; 5. Set up condition spaces of problems for use by search processes; 6. Use various uninformed and also informed search methods and to apply these to practical problems.		
Module code: ITRW321	**Semester 2**	**NQF Level: 7**
Title: **Databases II**		
Module outcomes: On completing this module, the student should have a well-rounded and systematic knowledge and insight into transaction management; should have the ability to apply control of simultaneous use, distributed database management systems and database administration to the administration of databases in order to solve, as an individual and as a member of a group, unfamiliar concrete and abstract computer problems in the database environment.		
Module code: ITRW322	**Semester 2**	**NQF Level: 7**
Title: **Computer Networks**		
Module outcomes: On completing this module students should be able to demonstrate well-rounded and systematic knowledge and insight into the operation of examples of networks, different frames of reference for networks, as well as the network protocols that play a role at the different levels of the frames of reference; to complete, as an individual and as a member of a group, a project that has basic network capabilities.		
Module code: ITRW324	**Semester 2**	**NQF Level: 7**
Title: **IT Developments**		
Module outcomes: Students have achieved the outcomes if they are able to: 1. Analyse given problems. 2. Search for literature on, and possible solutions for given problems. 3. Propose possible solutions and choose an appropriate solution. 4. Design and implement the chosen solution using appropriate technology. 5. Write a project report and present the project. 6. Work as an individual and as a group.		
Module code: ITRW325	**Semester 2**	**NQF Level: 7**
Title: **Decision Support Systems II**		
Module outcomes: Upon successful completion of the module the students will be able to: 1. Identify the problem (or model type) based on a problem specification given; 2. Solve given problems in each of the (sub)fields of study by hand and/or by utilizing available software; 3. Interpret/explain the solution to the problem (as for management); 4. Construct/develop a DSS based on a given Case Study (Project).		

N.15.3.15 MICROBIOLOGY

Module code: MKBN121	**Semester 2**	**NQF Level: 5**
Title: **Introductory Microbiology for Nursing**		
After completion of the module, the student should be able to: • give an overview of prokaryotic and eukaryotic cell structure and function, microbial diversity and the control of microorganisms through physical methods and chemical agents; • describe and compare prokaryotic and eukaryotic cell structure and function; • discuss various aspects regarding infectious diseases caused by the most important bacteria, fungi, viruses and protozoa and other selected parasites; • demonstrate expertise with regard to specific and non-specific mechanisms surrounding the host's protection against infectious diseases.		
Module code: MKBN211	**Semester 1**	**NQF Level: 6**
Title: **Introductory Microbiology**		
At the end of the module the student should be able to: • Demonstrate detailed knowledge of development, scope and contribution of Microbiology as a discipline; basic concepts in Microbiology and characteristics of different types of microorganisms. • Demonstrate an understanding of and ability to apply and demonstrate basic practical skills in the laboratory that are associated with Microbiology. • Identify, evaluate and solve problems in unfamiliar contexts by gathering evidence and applying solutions based on evidence and procedures appropriate to Microbiology. • Communicate complex information reliably and coherently using appropriate academic formats relevant to the field of Microbiology. • Demonstrate an ability to evaluate performance against given criteria and identify and address own task-specific learning needs. • Work effectively in a group and to take responsibility for own decisions and actions as well as those of group members in a defined context, including the ethical use of resources.		
Module code: MKBS221	**Semester 2**	**NQF Level: 6**
Title**: Introductory Microbial Genetics, Virology and Immunology**		
At the end of the module the student should be able to: • Demonstrate detailed knowledge of microbial genetics. • Give an overview of the diversity of eukaryotic viruses and explain the reproduction of RNA and DNA viruses respectively. • Discuss the various components of nonspecific and specific immunity and display profound understanding of the interactive nature thereof. • Have knowledge of basic molecular biology techniques. • Identify, analyse and solve problems in the field of microbial genetics. • Demonstrate skills with regards to the application of elementary research techniques, working in groups, writing of reports and analyse and solve problems by means of case studies in the field of microbial genetics. • Display coherent understanding of the ethical implications of microbial genetics and maintain strict ethical codes under all circumstances.		
Module code: MKBS313	**Semester 1**	**NQF Level: 7**
Title: **Microbial Physiology**		
At the end of the module the student should be able to: • Demonstrate an integrated knowledge and clear understanding of the diversity of microbial physiology (metabolism) and the impacts and applications thereof. • Be able to implement appropriate methods and procedures to apply principles from		

microbial physiology (metabolism) to characterise, identify and study microorganisms.

- Demonstrate an advanced ability to effectively identify and analyse complex problems, use practical skills mastered in the module and apply principles of microbial physiology (metabolism) to support evidence-based solutions and theory-driven arguments. 4. Obtain, manage and process information gathered from literature or through experimentation. This includes being able to independently validate the reliability of information or data. Students should also be able to communicate information and research findings in well-formulated arguments in written and oral reports.
- Interpret and manage tasks related to microbial physiology (metabolism). This include monitoring the progress of teams and taking responsibility for task outcomes.
- Effectively identify, evaluate and address his/her learning needs in a self-directed manner, and to facilitate collaborative learning processes.
- Demonstrate the ability to take full responsibility for his or her work, including acting professionally and ethically when working with microorganisms, always maintaining an awareness of public and/or environmental safety.

Module code: MKBS314	**Semester 1**	**NQF Level: 7**

Title: **Recombinant DNA Technology and Industrial Microbiology**

At the end of the module the student should be able to:

- Demonstrate an integrated knowledge and clear understanding of recombinant DNA technology and industrial microbiology as well as the impacts and applications thereof in society.
- Be able to implement appropriate methods and procedures to (i) apply principles from recombinant DNA technology and industrial microbiology to identify, characterise and study microorganisms used in laboratory and industrial settings; (ii) use methods and national standards to critically describe and evaluate the application of microbiology in water and waste-water treatment processes.
- Demonstrate an advanced ability to effectively identify and analyse complex problems, use practical skills mastered in the module and apply principles of recombinant DNA technology and industrial microbiology to support evidence-based solutions and theory-driven arguments.
- Demonstrate the ability to obtain, manage and process information gathered form literature or through experimentation. This includes being able to independently validate the reliability of information or data. Students should also be able to communicate information and research findings in well-formulated arguments in written and oral reports.
- Interpret and manage tasks related to recombinant DNA technology and industrial microbiology in unfamiliar environments. This includes monitoring the progress of teams and taking responsibility for task outcomes.
- Effectively identify, evaluate and address his/her learning needs in a self-directed manner, and to facilitate collaborative learning processes.
- Demonstrate the ability to take full responsibility for his or her work, including acting professionally and ethically when working with microorganisms, always maintaining an awareness of public and/or environmental safety.

Module code: MKBS325	**Semester 2**	**NQF Level: 7**

Title: **Diversity and Ecology of Microorganisms**

At the end of the module the student should be able to:

- Demonstrate an integrated knowledge and clear understanding of diversity in the microbial kingdom and explain how this relates to humans and the environment.
- Implement standard methods and procedures to evaluate microbial diversity and to study microbial ecology; use practical skills mastered in the module to determine microbial diversity using taxonomic procedures and to study the effect of the environment on microorganisms.
- Effectively identify and analyse complex problems and apply evidence-based solutions

and theory-driven arguments.

- Demonstrate the ability to obtain, manage and process information gathered from literature or through experimentation. This includes being able to independently validate the reliability of information or data.
- Be able to interpret and manage tasks related to microbial diversity and ecology in unfamiliar environments, including monitoring the progress of teams and taking responsibility for task outcomes.
- Effectively identify, evaluate and address his/her learning needs in a self-directed manner, and to facilitate collaborative learning processes.
- Demonstrate the ability to take full responsibility for his or her work, including acting professionally and ethically when working with microorganisms, always maintaining an awareness of public and/or environmental safety.

Module code: MKBX213	**Semester 1**	**NQF Level: 6**

Title: **Microbiology for Food and Nutrition**

After completion of the module, the student should be able to:

- demonstrate knowledge concerning microbiological aspects of laboratory techniques, preparation and storage of food and microbiological food safety in a selective way;
- apply basic laboratory techniques used in microbiological laboratories;
- demonstrate competency with regard to elementary research techniques, group work, writing of reports and problem solving by means of case studies;
- maintain strict ethical principles in all circumstances and show respect for life throughout.

Module code: MKPN111	**Semester 1**	**NQF-level: 5**

Title: **Microbiology for Pharmacy**

After completion of the module, the student should be able to:

- provide an overview of prokaryotic and eukaryotic cell structures and function, microbial diversity and the control of microorganisms through physical methods and chemical substances;
- demonstrate expertise with regard to microbial pathogenicity and epidemiology as well as the specific and non-specific mechanisms of the host's defense against infectious diseases;
- discuss clinical syndromes of specific microbial infectious diseases,
- discuss diagnosis, prevention and treatment of specific microbial infectious diseases.

N.15.3.16 BOTANY

Module code: PLKS111	**Semester 1**	**NQF Level: 5**

Title: **Plant structure and function**

After completion of the PLKS111 module, the student should demonstrate:

- fundamental knowledge of the relevance of plants to life on earth and how plants are structurally and functionally adapted.
- ability to select, distinguish and organize standard methods and procedures to identify basic plant structures and their respective functions.
- an ability to access and process information from different sources with a view to compare and summarise scientific information on plant uses.
- coherent understanding of the ethical implications of decisions, actions and practices pertaining to the use of plants.
- identify and apply acceptable and independent self-study methods and exhibit adherence to rules on plagiarism and copyright principles.

Module code: PLKS121	Semester 2	NQF Level: 5

Title**: Biodiversity and Environmental Botany**

After completion of the PLKS121 module, the student should demonstrate:

- Knowledge and informed understanding of key terms, principles, concepts, facts, rules and theories used in the field of Biodiversity and Environmental Botany.
- Basic knowledge and informed understanding of taxonomic principals, including evolution and classification, in order to distinguish and compare different prokaryotic organisms, algae and plants.
- The ability to apply standard methods, procedures and techniques commonly used in botanical studies to study characteristics of living organisms in order to identify, name, illustrate and classify them.
- An understanding of the ecological interactions between organisms and describe the bio-physical and socio-economic impacts on ecosystems for sustainable management and improved livelihoods.
- The ability to communicate verbally and in writing and gather information reliably and accurately from a range of sources in order to do elemental research in a scientific way by using conventional methods and basic technologies.
- An ability to monitor his/her own learning progress individually and in groups, and implement relevant learning strategies in Biodiversity and Environmental Botany.
- Ethical and professional behaviour within the academic environment, inclusive of adherence to rules on plagiarism and copyright principles.

Module code: PLKN213	Semester 1	NQF Level: 6

Title: **Plant Genomics**

After completion of the PLKN213 module, the student should demonstrate:

- have at his or her disposal detailed knowledge of the genomic structure of plant cells, plant gene expression and the regulation thereof;
- have an understanding of certain recombinant DNA technologies;
- be able to evaluate and select appropriate molecular methods for conducting investigations in plant physiology, plant systematics or plant ecology;
- be able to demonstrate limited practical molecular skills, including an understanding of the generation, presentation and interpretation of data, as well as the formulation of theories about data;
- be able to exhibit sensitivity for the role that values play in biotechnology; and
- be able to evaluate relevant ethical issues in terms of a world view.

Module code: PLKS221	Semester 2	NQF Level: 6

Title: **Flora of South Africa (Plant Systematics and Phytogeography)**

After completion of the PLKS221 module, the student should demonstrate:

- detailed knowledge of the flora of southern Africa and a clear understanding of geobotany.
- ability to evaluate and select the most appropriate methods and procedures to gather necessary evidence to identify taxonomic and phytogeographic entities.
- coherent understanding of the ethical implications of decisions, actions and practices that might impact the southern African flora.
- ability to access, process, present and communicate information on a discipline-related topic in plant diversity and distribution.
- ability to recognize major threats to southern Africa's flora, and to propose possible solutions to address and mitigate such threats.
- learning and management strategies to sustain professional development in geobotany.
- appreciation for the rich floristic diversity of southern Africa and a responsibility to develop an understanding thereof.

Module code: PLKS312	Semester 1	NQF Level: 7

Title: **Plant Physiology**

After completion of the PLKS312 module, the student should demonstrate:

- Integrate knowledge related to whole plant water relations, photosynthesis and respiration, including an understanding of the processes of photosynthesis and respiration.
- Evaluate and judge energy conservation in photosynthesis and respiration.
- Demonstrate the ability to identify, analyse and reflect on the environmental influences on whole plant water relations, photosynthesis and respiration.
- Access, evaluate and identify the scientific evidence supporting hypotheses and assumptions related to whole plant water relations, photosynthesis and respiration.
- Identify, analyse, critically reflect on, and address complex challenges related to whole plant water relations, photosynthesis and respiration and apply evidence-based solutions with theory-driven arguments.
- Demonstrate the ability to identify, evaluate and address his or her learning needs in a self-directed manner, and to facilitate collaborative learning processes.
- Demonstrate the ability to take full responsibility for his or her own work, decision making and use of resources.

Module code: PLKN323	Semester 2	NQF Level: 7

Title: **Plant Ecology**

Third year Botany students registered for PLKN323 and PLTN323 must attend a compulsory field trip during the first semester (that can include weekends and the recess time). The report generated from results obtained during the field trip will contribute to the participation mark. No excuses for absence from the field trip will be accepted, except in the event of illness in which case a medical certificate must be presented.

After completion of the PLKN323 module, the student should demonstrate:

- Integrated knowledge and clear understanding of, as well as have the ability to evaluate and apply key terminology, concepts, facts, rules and theories used in the field of basic and applied aquatic and terrestrial ecology.
- The ability to select, evaluate and apply appropriate quantitative and qualitative vegetation survey and data analysis techniques commonly used in terrestrial ecology.
- The ability to analyse and critically reflect on the ecological functioning of inland water systems with particular emphasis on interactions between physical, chemical and biological variables.
- The ability to access, analyse and evaluate current research and scientific methods to be able to do focused research and resolve problems within the fields of aquatic and terrestrial ecology.
- The ability to reflect on the values, ethical conduct and justifiability of decisions appropriate to the practice of Plant Ecology in aquatic and terrestrial environments.
- Full responsibility for his/her own learning needs, monitoring of own learning progress and application of relevant learning strategies and management of all resources to successfully realise all outcomes of this module.
- Accurate and coherent written and verbal communication with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism.

A research project must be completed under the supervision of a study leader during the year. The mark for this project will contribute towards the participation mark for this module.

Module code: PLTN323	Semester 2	NQF Level: 7
Title: **Plant Ecology: Tourism**		
Third year Botany students registered for PLKN323 and PLTN323 must attend a compulsory field trip during the first semester (that can include weekends and the recess time). The report generated from results obtained during the field trip will contribute to the participation mark. No excuses for absence from the field trip will be accepted, except in the event of illness in which case a medical certificate must be presented. On completing the module the student should be able to apply basic ecological principles; to discuss ecological interactions and examples thereof; to understand and apply basic principles with regard to plant growth dynamics and landscape ecology; to discuss resource conservation and utilisation, and the influence of aspects such as ecosystem management, degradation, restoration and rehabilitation, and urbanisation on resource conservation and utilisation, as specific case studies, also in the tourism industry; to integrate knowledge of the influence people and changing environmental conditions have on ecosystems; to master various data collecting techniques and apply multiple data analytical procedures on environmental data; to explain the water situation over a wide range in South Africa and the importance of utilising inland water as a limited resource, as well as to discuss the influence of human beings on water quality and the utilisation of inland waters, also in the tourism industry. A research project must be completed under the supervision of a study leader this year. The mark for this project will contribute towards the participation mark for this module.		

N.15.3.17 URBAN AND REGIONAL PLANNING

Module code: SBES111	Semester 1	NQF Level: 5
Title**: Historical development of Civilizations**		
On completing the module, the student should be able to demonstrate fundamental knowledge and insight into the settlement, origin and development of cities of different historical civilizations; to demonstrate skills, an individual and as a member of a group, in collecting, reading, interpreting, synthesising and presenting scientific information orally/in writing; the ability to act ethically in presenting his/her knowledge of the historical facts of planning cities and regions.		
Module code: SBES121	**Semester 2**	**NQF Level: 5**
Title**: Urban morphology**		
On completing the module, the student should be able to demonstrate fundamental knowledge and insight into the implementation of the different manifestations of garden cities, as well as the ability to evaluate their value and impact; to demonstrate fundamental knowledge and understanding of the different modern and post-modern models, including those that apply to South Africa; to demonstrate skills, as an individual and as a member of a group, in collecting, reading, interpreting, synthesising and presenting appropriate scientific information orally/in writing; the ability to act ethically in presenting his/her knowledge of historical facts in planning cities and regions.		
Module code: SBSS211	**Semester 1**	**NQF Level: 6**
Title: **Planning approaches and practice**		
On completing the module, the student should be able to demonstrate in-depth knowledge and informed understanding of different types of layout, the layout process and qualitative and quantitative principles of planning layout and design, and to demonstrate the ability to apply this knowledge and understanding in analysing, evaluating and improving specific sites and layouts; to demonstrate the ability, as an individual and as member of a group, to analyse unfamiliar and somewhat complex problems of layout and design, to identify variables and formulate proposals to solve the problem/problems; to demonstrate the ability to communicate information and proposals regarding design orally, in writing and by means of drawing techniques in a coherent and trustworthy manner, using information technology where appropriate; to demonstrate the ability to approach layouts and design		

in an ethical and responsible manner, taking into consideration the specific needs of the community and the necessity of environmental conservation.		
Module code: SBRS211	**Semester 1**	**NQF Level: 6**
Title: **Introduction to regional planning**		
On completing the module, the student should be able to: • Demonstrate in-depth knowledge and insight into the nature and characteristics of forces that determine urban morphology; • Demonstrate skills in distinguishing independently underlying relations between forces that determine the forms and morphology of cities and regions; and, • With a view to develop a project on spatial systems, to demonstrate skills, as an individual and as a member of a group, in identifying and applying forces that dictate urban settlement patterns and forces that lead to the establishment and development of service areas.		
Module code: SBSL221	**Semester 2**	**NQF Level: 6**
Title: **Urban Design**		
On completing the module, the student should be able to demonstrate an in-depth knowledge and informed understanding of basic principles of urban design, the origin of urban design, what it comprises, paradigm shifts in urban design theory and the challenges posed to urban design by the development of cities; to demonstrate the ability to find creative solutions to existing or new urban spaces by means of urban design precedents in order to transform these spaces into quality places for people, taking into consideration the environment; to demonstrate the ability to discover creative design solutions, independently as an individual and in close association with a group, and to communicate these solutions visually and orally to an audience.		
Module code: SBRS221	**Semester 2**	**NQF Level: 6**
Title: **Regional Plans**		
On completing the module, the student should be able to demonstrate in-depth knowledge and understanding of the different regional planning approaches in the world, of the physical and socio-economic characteristics and requirements of metropolises and world cities, and of the processes that led to the formation of structural elements in metropolises and regions; to demonstrate skills, as an individual and in close association with a group, to apply planning policy and instruments in solving well-formulated, but unfamiliar problems regarding metropolitan formation; to demonstrate the ability to conduct research, to collect and interpret appropriate information and present it in the form of a report.		
Module code: SBRS311	**Semester 1**	**NQF Level: 7**
Title: **Regional Economics**		
• Demonstrate knowledge and understanding of economic development, economic sectors, sustainable development and government policies in the South African context; • Investigate, analyse and evaluate the above concepts in terms of each one's role in regional economy; • Crytically analise the current government policy and identify and evaluate problems within this policy and findings to communicate creatively; • Collecting Information on regional economy, evaluate and manage to offer creative solutions to problems in a responsible way and to substantiate.		
Module code: SBSS321	**Semester 1**	**NQF Level: 7**
Title: **Transportation planning and systems**		
Upon completion of this module, you should: - Demonstrate rounded and systematic knowledge of intracity transportation and traffic flow arising therefrom; traffic planning process and appropriate planning principles as well as the Integrated Transport Plan; - Demonstrate skills that planning principles are adhered to apply them in the planning of the network component of the urban transport system to solve transportation problems		

that have been identified;
- Capacity to identify traffic problems at national, provincial and municipal level, analyse, and on the basis of relevant planning principles, do traffic planning, to set up these plans with a computer, can submit a business plan, evaluate the plans and make adjustments;
- As an individual and a group make solutions in an ethical and responsible manner to a group of peers and professionals.

Module code: SBRS321	**Semester 2**	**NQF Level: 7**

Title: **Regional development and analysis**

The student has achieved the outcomes if he/she:
• Demonstrate integrated knowledge and understanding of the latest trends in urban systems and planning approaches to regional systems in developed and developing countries;
• Apply appropriate techniques to scientifically determine the rankings of cities in a region;
• To critically investigate planning regions and point out differences and declared it;
• To identify alternatives analysis procedures and select logical solutions and calculations;
• Communicate appropriate solutions pertaining to regional development problems in different ways.
• Demonstrate the ability to collect information on regional development, evaluate, manage and apply to get creative solutions to problems in responsible ways.

Module code: SBSS311	**Semester 1**	**NQF Level: 7**

Title: **Commercial planning and development**

After completion of the module the student should:
• Demonstrate integrated knowledge of the development and design of the various formal and informal business sectors in towns and cities;
• Demonstrate integrated knowledge and understanding of theories, policies, planning principles and measures that apply to commercial planning and development of industrial areas, retail and wholesale areas, walkways, office development in towns, cities and dwelling areas;
• Identify complex problems regarding interpretation of areas, analyse, solve and address with sufficient evidence from the theory and practice;
• Identify factors that promote retail areas, shopping centers, office developments and various wholesale areas, analyse and critically reflect upon;
• Demonstrate skills to ethically and responsibly present ideas and solutions in a professional manner to an audience of professional Urban and Regional Planners and peers in writing and verbally.

Module code: SBES421	**Semester 2**	**NQF Level: 8**

Title: **Strategic and project management for planners**

Upon completion of this module the student should:
• Demonstrate knowledge and involvement of the planning and professional practice, the requirements set for the registered urban and regional by professional endorphins (SACPLAN) and ethics and beroepsnormatiewe principles contained in the code of professional conduct, apply;
• Demonstrate skills to collect, evaluate and manage creative suggestions to communicate graphically in reports and orally on the basis of appropriate IT;
• Demonstrate skills to develop as part of a multi-disciplinary team and also as a leader, project planning and management, and business plans and monitor human resource management and financial planning.

Module code: SBRS411	**Semester 1**	**NQF Level: 8**

Title: **Regional analysis and application**

After completing this module you should be able to:

- Interpret and evaluate knowledge of the principles and ideas of national policy and legislation of regional planning and development; and to compare international policies and practices to make inputs in the formulation of South

African regional policy;

- To evaluate the contents of spatial development patterns for all the spheres of authorities in order to make proposals for improvement based on ethical and theoretical foundations.
- Understand the role of planning policy and planning instruments in the realisation of regional planning initiatives in South Africa; and
- To illustrate knowledge and understanding of (i) the role of different aspects of globalisation in contemporary urban environments, (ii) different forms of urban development patterns based on different development pulses on migration; (iii) factors that have impacts on migration patterns in developed and developing worlds.

Module code: SBES321	**Semester 2**	**NQF Level: 7**

Title: **Engineering for Planning**

On completing the module, the student should be able to demonstrate knowledge and understanding of policy and legislation that guide engineering services; to demonstrate skills in undertaking the planning of engineering services such as water supply, sewage systems, electricity supply and designing streets for vehicles, bicycles and pedestrians in town layouts; to demonstrate the ability to do cost accounting based on the theoretical knowledge acquired in the module; to demonstrate the development of the ability, as an individual or as a member of a team, to undertake the provision and planning of engineering services in town layouts and development, to gather, analyse, evaluate, and synthesise information with a view to formulate practical proposals to ensure the cost effectiveness and functionality in planning of project; to demonstrate the ability to write a report on practical, integrated planning and design of engineering services and to communicate it to those concerned.

Module code: SBSL412	**Semester 1**	**NQF Level: 8**

Title: **Land Use Management and Residential Development**

Upon completion of this module the student should demonstrate: comprehensive knowledge of residential types and development, the principles and processes of statutory planning, including zoning and land use management; subdivision of land and township development, explain and discuss; have the skills to use planning tools to undertake spatial residential development and land use management professionally and ethically; be competent to plan a quality residential development and sustainable land use and development; be competent to promote urban density by residential development to research within the framework of differentiation and affordability, process information, to interpret and present sustainable development verbally and in writing.

Module code: SBSS412	**Semester 1**	**NQF Level: 8**

Title: **Integrated housing development**

On completion of this module, you must be able to:

- Explain and criticise the different theoretical points of departure in housing;
- Demonstrate basic knowledge and understanding of theoretical points of departure in housing;
- Motivate and defend the role of housing policy in the planning system;
- Demonstrate extensive and systematic knowledge and understanding of the role of housing policy in the planning system;
- Do a critical analysis and evaluation of international and national housing policy and legislation, as well as case studies from practice;
- Display an ability to do research regarding a housing issue independently in a particular context and to formulate sustainable and creative strategic spatial solutions for the issue; and
- Develop the skills required to communicate proposals regarding housing problems both visually and orally to an audience.

Module code: SBSS471	Semester 1 & 2	NQF Level: 8
Title: **Research project**		
On completing the module, the student should be able to demonstrate knowledge and understanding of the influence of globalisation on the urban environment in the developed and developing world; to demonstrate skills to apply theory and theoretical principles in practice to solve unfamiliar problems regarding migration and urban development in a global context; to research the causes and implications of migration and urban development as found in different situations in a global context, to analyse and interpret information and present proposals based on applicable theories and principles with a view to sustainable development in an economic and social context.		
Module code: SSBP221	**Semester 1**	**NQF Level: 6**
Title: **Private law for planners**		
After completion of this module the student should be in a position to achieve the following outcomes, namely: • General background to the law in general as well as the South African legal system; • Knowledge of the constitutional dispensation in South Africa, as well as the role and place of the Bill of Human Rights; • Understand Planning Law as a section of the South African legal system • Basic knowledge of the most important planning legislation; • Understand the place and function of planning law; • Understand the role and function of environmental law; • Understand the basic principles relating to ownership. Servitudes and contracts; • Understand and have knowledge of the most important planning legislation and case law relating to planning issues and to utilise this in practise and interpret the implications thereof.		
Module code: SSBP421	**Semester 2**	**NQF Level: 8**
Title: **Planning practice**		
Upon completion of this module, the student should: • Demonstrate in depth knowledge and understanding of the principles of planning policy and legislation and to apply them in the preparation, presentation and defense of development proposals; • Communicate suggestions on high level in written statutory planning applications and public participation on the basis of public participation plans and professional oral presentations, demonstrrte knowledge and skills of the principles according to professional practice.		
Module code: SECO321	**Semester 2**	**NQF Level: 7**
Title: **Urban ecology for planners**		
After completion of the SECO321 module, the student should demonstrate: • Integrated knowledge and critical understanding of, as well as an ability to correctly evaluate and apply basic ecological principles, urban areas as unique ecosystems and the historical development of the discipline of urban ecology relevant to planning and design of urban areas. • Coherent understanding of the multiple sources of ecological knowledge (e.g. abiotic aspects such as climate, water, soil and biotic aspects such as producers, consumers and decomposers and the ecosystem services they provide) and to critically evaluate how this knowledge can be integrated in ecological planning and design. • The ability to select, evaluate and apply different existing approaches and methods in ecological planning and design of urban areas addressing the issues of sustainability and resilience. • The ability to analyse and evaluate academic literature to demarcate a researchable problem in ecological planning and design and specify an appropriate method that can		

be used to address the identified problem.

- The ability to identify, analyse and critically reflect on and address complex ecological issues in urban planning and design using arguments from current research with particular emphasis on the development of sustainable and resilient urban areas.
- Accurate and coherent written and verbal communication with understanding of and respect for intellectual property conventions, copyright and rules on plagiarism.
- The ability to reflect on the values, ethical conduct and justifiability of decisions appropriate to the practice of responsible urban ecological planning and design.

N.15.3.18 STATISTICS

Module code: STTN111	**Semester 1**	**NQF Level: 5**

Title: **Descriptive Statistics**

Module outcomes:

A student who has completed this module should be able to demonstrate the following knowledge:

Fundamental knowledge of the most important elementary statistical techniques used every day, such as sampling methods, determining sample size, graphical representation of data, descriptive measures of locality and scattering, least squares line fitting, predictions by means of least squares line fitting, correlation coefficients, time series data and movement components in order to predict future outcomes, practical considerations with regard to questionnaires and sampling sizes; fundamental knowledge of probabilities and probability distributions, the central limit theorem, for large sample sizes the estimation of population parameters by means of point and interval estimation, to demonstrate problem solving skills by solving familiar and unfamiliar problems; to implement the acquired knowledge to problems involving the above-mentioned skills and techniques.

Module code: STTN115	**Semester 1**	**NQF Level: 5**

Title: **Descriptive Statistics and Inference**

Module outcomes:

On completion of the module the learner should be able to:

- Demonstrate fundamental knowledge and understanding of the most important elementary statistical techniques that are used daily, such as sampling methods, graphical representation of data, descriptive measures of location and spread, least squares line fitting, prediction from least squares lines, the coefficient of correlation, multiple regression, time series data, movement components to predict future outcomes, practical considerations regarding sample surveys and sample sizes. Also demonstrate knowledge and understanding of the normal and t probability distributions, the central limit theorem, estimation of population parameters by the use of point and interval estimation, hypothesis testing for population means and proportions for one and two samples (parametric and non-parametric).
- Demonstrate skills to use statistical knowledge and techniques to solve known and unknown real world problems and to communicate methods, solutions and conclusions as an individual and/or part of a group, orally and in writing in an ethical, responsible and acceptable way.

Module code: STTN121	**Semester 2**	**NQF Level: 5**

Title: **Introductory Statistical Inference**

Module outcomes:

A student who has completed this module should be able to demonstrate the following:

Fundamental knowledge of probabilities and probability distributions, the central limit theorem, estimation of population parameters by means of point and interval estimation, hypothesis testing for population averages and proportions for one and two samples, one

way analysis of variance (ANOVA) and categorical data analysis, contingency tables and basic tests on categorical data; problem solving skills by analyzing familiar and unfamiliar problems, using acquired knowledge to solve simple probability problems, applying the knowledge gained above on data where applicable.

Module code: STTN122	**Semester 2**	**NQF Level: 5**

Title: **Introductory Statistics**

Module outcomes:

At the end of the module the student should demonstrate knowledge of the following concepts and the ability to apply it as described below:

i. statistical techniques used everyday, for example sampling methods, graphical representation of data and descriptive measures of locality and scattering;
ii. fitting linear regression curves to bivariate data and using the least squares method;
iii. making simple predictions by using appropriate curves, as well as by interpreting the correlation coefficient;
iv. handling time series data and calculating movement components in order to predict future outcomes;
v. carrying out simple probability calculations and using probability distributions;
vi. th**e** central limit theorem and applying it to practical problems;
vii. estimating p**o**pulation parameters by means of point and interval estimation;
viii. hypot**h**etical testing for population averages and population proporti**o**ns in one or two sampling cases.
ix. to identify the presence and applicability of the above statistical concepts in a practical situation, as well as to perform statistical methods using manual analysis or statistical software.

Module code: STTN124	**Semester 2**	**NQF Level: 5**

Title: **Practical Statistics**

Module outcomes:

At the end of the module the student should be able to demonstrate knowledge of the following concepts and to apply them as described below

i. correlation and its interpretation, the method of least squares fitting to a regression function, prediction by means of a regression function, multiple linear regression and selection of predictors;
ii. basic factor analysis and the interpretation of its results, interpretation of factor matrices and construct validity;
iii. the hypothesis testing procedure, probability calculations, the central limit theorem, level of significance and p values;
iv. one-way ANOVA testing procedures, the interpretation of results;
v. practical significance of effect sizes of differences in averages and proportions for one and two populations;
vi. categorical data analysis by means of contingency tables, chi-squared tests and independence tests;
vii. distribution-free methods: the difference between parametric and nonparametric methods of inference, as well as deciding which method to use in a specific situation.
viii. to identify the presence and applicability of statistical concepts in a practical situation, as well as to perform statistical methods using manual analysis or statistical software.

Module code: STTN125	**Semester 2**	**NQF Level: 5**

Title: **Introductory Probability Theory**

Module outcomes:

On completion of the module the learner should be able to

- demonstrate knowledge and understanding of

- concepts such as the sample space, events, probability measures, counting methods, random outcomes of events and the independence of events;
- important probability theorems such as the law of total probability and the theorem of Bayes;
- random variables, distribution functions and mass function, discrete random variables and the following distributions: binomial, geometric, negative binomial, hyper geometric, and Poisson as well as exponential, gamma and normal distributions and the functions of these variables;
- one way analysis of variance (ANOVA) and apply it to practical problems with the use of computer output.

- demonstrate skills to use statistical knowledge and techniques to solve known and unknown real world problems and to communicate methods, solutions and conclusions as an individual and/or part of a group, orally and in writing in an ethical, responsible and acceptable way.

Module code: STTN215	**Semester 1**	**NQF Level: 6**

Title: **Probability and Sampling Theory**

Module outcomes:

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

- demonstrate knowledge of:
  - the probability structure of two or more random variables as well as their joint distributions;
  - copulas and their properties;
  - conditional distributions and the application of probability calculations on conditional distributions;
  - order statistics and the application thereof;
  - the expected value and variance of all the important discrete and continuous random variables that were discussed in earlier work;
  - the covariance and correlation of two random variables, in addition to conditional expected values and moment generating functions;
  - two of the most important theorems of Probability theory, the so-called Law of Large Numbers and the Central Limit Theorem.
  - distributions derived from the normal distribution;
  - various sampling methods, such as simple random sampling and stratified sampling, and their properties.
- demonstrate problem solving skills by analysing problems that had been previously encountered and problems that are new and unfamiliar.
- use the computer language SAS (PROC IML) to apply these concepts practically.

Module code: STTN225	**Semester 2**	**NQF Level: 6**

Title: **Statistical Inference and Data Analysis**

Module outcomes:

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

- demonstrate fundamental knowledge of the following statistical concepts: method of moments and the method of maximum likelihood to estimate parameters, efficiency of an estimator, sufficient statistics, the testing of hypotheses, the duality of confidence intervals and hypothesis testing, informal techniques for assessing goodness of fit, methods for summarizing data, measures of location and spread, density estimation, and the bootstrap.
- demonstrate problem solving skills by analysing familiar and unfamiliar problems, estimating parameters by means of the method of moments and maximum likelihood, determining if an estimator is efficient and finding sufficient statistics in a variety of problems.
- demonstrate the ability to construct complete and sufficient statistics, use the Neyman-Pearson paradigm to perform a hypothesis test, apply the connection between

hypothesis testing and confidence intervals in the context of estimation, make conclusions using descriptive statistics, apply methods for summarizing data, calculate measures of location and spread, be able to use the bootstrap to (a) construct confidence intervals for a parameter and (b) estimate the variability of an estimator.

- apply these concepts to real-world data.
- use the computer language SAS (PROC IML) to apply these concepts practically.

Module code: STTN315	**Semester 1**	**NQF Level: 7**

Title**: Statistical Inference and Time Series Analysis**

Module outcomes:

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

- demonstrate knowledge of:
  - inference concerning two independent samples (both parametric and non-parametric inference);
  - inference concerning two dependent or paired samples (both parametric and non-parametric inference) ;
  - the practical considerations of the experimental designs when conducting experiments with two independent or dependent samples;
  - the basic analyses and inferences applied to categorical data;
  - autoregressive (AR), moving average (MA), autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) time series models;
  - the process of identification, estimation and diagnosis of a time series;
  - forecasting techniques using simple extrapolation and moving average models as well as applying smoothing techniques;
  - the basic functionality of the computer package SAS (this includes reading in data sets, manipulating data sets, and the use of various SAS procedures to analyse data);
- demonstrate problem solving skills by analysing problems that had been previously encountered and problems that are new and unfamiliar.
- use the computer package SAS and R to apply all these concepts practically.

Module code: STTK214	**Semester 1**	**NQF Level: 6**

Title: **Statistics for Life Sciences'**

Module outcomes

On completion of the module the learner should be able to:

- Demonstrate knowledge and the ability to effectively apply the following:
  - the most important statistical techniques that are used daily, such as sampling methods, graphical representation of data, descriptive measures of location and spread;
  - linear regression curves to bivariate data using the least squares technique;
  - simple predictions by means of the fitted curve, and interpretation of the coefficient of correlation;
  - time series data and the calculation of the movement components to predict future outcomes;
  - simple probability calculations and probability distributions;
  - the central limit theorem and the application of the theorem to practical problems;
  - estimating population parameters by using point and interval estimation;
  - hypothesis testing for population means and population proportions for one and two samples;
  - one way and two way ANOVA;
  - chi squared test for independence; and
  - principle component analysis.

- Recognise the presence and applicability of statistical concepts in a practical situation and perform statistical methods to summarise, understand and analyse data sets by using statistical computer software.
- Identify the appropriate statistical technique applicable to the problem presented.

Module code: STTK321	**Semester 2**	**NQF Level: 7**

Title: **Linear Models**

Module outcomes:
A student having completed this module should be able to demonstrate an understanding of simple and multiple linear regression; understanding of the reasons for assumptions in the regression model and the derivation of the distributions of test statistics used in the inference that relates to linear regression models; to demonstrate the ability to derive the least squares and maximum acceptability parameters in a linear regression model; the ability to describe the linear regression model in matrix and vector notation; to demonstrate the ability to diagnose any deviation from the assumptions and to apply remedial measures to rectify the deviations. He/she should demonstrate an understanding of the concepts of simultaneous interference as applied in linear regression models; should demonstrate the ability to describe how qualitative and quantitative predictor variables are handled within the frame of linear regression. He/she should demonstrate an understanding of the fundamental concepts of non-linear regression; the ability to describe the process of estimating parameters in non-linear regression models; the ability to describe the following models: logistic regression models and Poisson regression models; an understanding of the way in which these models relate to the general linear model; the ability to perform inferences that are associated with these models; the ability to implement linear regression models using simple calculations and computer software; the ability to diagnose models practically by applying diagnostic steps as discussed in the theory and to apply remedial measures in a practical context; and the ability to implement non-linear regression models using simple calculations and computer software.

Module code: STTK322	**Semester 2**	**NQF Level: 7**

Title: **Statistics Project**

Module outcomes:
A student having completed this module should be able to demonstrate the ability to carry out a successful statistical project, from design to analysis; to identify appropriate models for a given data system and to use SAS or R to implement the appropriate model; to identify the previously learnt theory on basic statistical analysis with the practical nature of the project and to apply the techniques; to compile appropriate documentation for the project; to develop skills in oral presentation to present the project in a professional set-up; to demonstrate the necessary computer skills needed to handle statistical analysis by means of SAS and R, but also to handle a greater variety of problems; to carry out computer-based simulations with the aid of SAS and R.

N.15.3.19 APPLIED MATHEMATICS

Module code: TGWN121	**Semester 2**	**NQF Level: 5**

Title: **Statics and Mathematical Modelling**

Module outcomes:
On completing this module, the students should be able to do the following: demonstrate fundamental knowledge of geometric vectors and their operational rules, vectors, forces, components, scalar and vector product, Cartesian forms, resultant of two- and three-dimensional systems of force through a point, the principle of transmissibility, moments, couples, reduction of systems of forces to a single force and a single couple, equilibrium in a plane and equilibrium in space, friction and moments rotating about axes, the modelling process, geometric similarity and proportionalities, dimensional analysis and the theorem of Buckingham; to demonstrate problem solving skills by analysing familiar and unfamiliar

problems, by using knowledge of techniques to determine resultants of different types of systems of force, by solving equilibrium problems in two and three dimensions, by forming and solving models by means of proportionality relations and dimensional analysis, by fitting models to data and by solving simple differential equations.

Module code: TGWN122	**Semester 2**	**NQF Level: 5**

Title**: Mathematical Modelling and Vector Algebra**

Module outcomes:
On completing this module, students should be able to do the following: demonstrate fundamental knowledge of the steps in the mathematical modelling process, geometric similarity, proportionalities, interpolation and fitting of a curve to data by means of least squares, the die L_1 norm and the Tsjebisjeff norm, dimensional analysis, the theorem of Buckingham, differential equations, separable differential equations, initial conditions, model ling of growth processes, including Malthus and logistic growth, cooling problems, mixing problems and chemical reactions, geometric vectors, operations with them and use of them, and applications of them to forces and equilibrium problems; demonstrate problem solving skills by analysing familiar and unfamiliar problems, using knowledge of techniques to build mathematical models, solve separable differential equations, fit models to data, modelling by means of dimensional analysis; building models using separable differential equations and modelling and solving geometrical and statics problems by means of vectors.

Module code: TGWN211	**Semester 1**	**NQF Level: 6**

Title: **Dynamics I**

Module outcomes:
On completing this module, students should be able to do the following: demonstrate fundamental knowledge of kinematics and kinetics of a single particle, a system of particles and a rigid body, all moving along a straight line or a curved trajectory; demonstrate problem solving skills by analysing familiar and unfamiliar problems and using knowledge of kinematics and kinetics to calculate time duration, displacements, velocities, accelerations, forces, word done, energy, momentum, impulse, moment of inertia, angular impulse and angular momentum.

Module code: TGWN213	**Semester 1**	**NQF Level: 6**

Title: **Differential Equations**

Module outcomes:
On completing this module students should be able to do the following:

- demonstrate fundamental knowledge of ordinary differential equations and standard methods of solution amongst others separation of variables, variation of parameters and the Laplace transform;

solve suitable unknown ordinary differential equations, initial value problems and systems using the standard methods above and elementary numerical algorithms utilizing MATLAB or other computer software; model real phenomena

Module code: TGWN221	**Semester 2**	**NQF Level: 6**

Title**: Dynamics II**

Module outcomes:
On completing this module students should be able to do the following: demonstrate fundamental knowledge of the theory of flexible cables, internal forces and deformation of simple beams, kinetics of rigid bodies and the motion of satellites and planets; demonstrate problem solving skills by solving familiar and unfamiliar problems involving deformations in beams and cables and motion of rigid bodies acted on by forces, and determining the orbits and positions of satellites.

Module code: TGWN223	Semester 2	NQF Level: 6
Title: **Numerical Analysis**		
Module outcomes: On completing this module the student should be able to do the following: • demonstrate fundamental knowledge and insight into the theory of basic numerical methods for general occurring mathematical problems, amongst which are the solving of non-linear equations, determining interpolation polynomials and the numerical determining of definite integrals, • demonstrate problem solving skills by solving non-linear equations through iteration techniques, determining the interpolation polynomials of Lagrange and Newton, determining definite integrals by means of the trapezium method, Simpson's rule, Romberg integration and Gauss quadrature, and the computer application of these techniques, and the methods of Heun and Runge Kutta for the solution of single or systems of differential equations, and be able to apply these techniques computationally • show a fondness for this field of study and demonstrate insight into the relation between reality and abstraction, model and solution.		
Module code: TGWN311	**Semester 1**	**NQF Level: 7**
Title: **Partial Differential Equations**		
Module outcomes: On completing this module the student should be able to do the following: demonstrate fundamental knowledge of real-life problems where the mathematical model led to partial differential equations and the analytical solving of partial differential equations such as the wave, heat and potential equation and the electric charge problem, Fourier series, orthogonal functions and polynomial methods and the Sturm-Liousvile problem; demonstrate problem solving skills by analysing familiar and unfamiliar problems, applying knowledge of techniques that are used to solve differential equations with methods using power series, to determine Fourier series and chandelling standard problems with the Fourier method.		
Module code: TGWN312	**Semester 1**	**NQF Level: 7**
Title: **Partial Differential Equations (Numerical)**		
Module outcomes: On completing this module the student should be able to do the following: demonstrate fundamental knowledge and insight into the discretisation of ordinary and partial linear differential equations, the special properties of tridiagonal matrices, calculation problems caused by ill-conditioned and sparse systems of linear equations, convergence properties of iterative methods of systems of linear equations and stability properties of numerical methods, solving parabolic, elliptical and hyperbolic differential equations numerically, performing iterative methods with MATLAB on a computer; demonstrate problem solving skills in numerically solving, by means of finite difference methods, two point boundary value problems, the heat equation, the potential equation and the wave equation with the finite difference methods and in implementing these by computer; show a fondness of this field of study and demonstrate insight into the relation between reality and abstraction, model and solution; reveal a Christian or alternative perspective on the subject.		
Module code: TGWN321	**Semester 2**	**NQF Level: 7**
Title: **Dynamics III**		
Module outcomes: On completing this module the student should be able to do the following: demonstrate fundamental knowledge and insight into the kinematics and kinetics of a rigid body in space, the Lagrange formulation for dynamics and the basis of variation calculus; demonstrate skills		

in solving problems describing motion and the constraints on motion, modelling the three-dimensional motion of a rigid body, stationary curves for functionals formed by integrals.		
Module code: TGWN322	**Semester 2**	**NQF Level: 7**
Title: **Optimisation**		
Module outcomes: On completing this module, students should be able to do the following: demonstrate fundamental knowledge of analytical and numerical optimisation techniques for functions of one or more variables, including problems with restrictions on unevenness and evenness; demonstrate problem solving skills by applying a variety of mathematical optimisation techniques to familiar and unfamiliar unrestricted and restricted problems and implementing these techniques by computer with MATLAB as computer language.		

N.15.3.20 MATHEMATICS

Module code: WISN111	**Semester 1**	**NQF Level: 5**
Title: **Introductory Algebra and Analysis I**		
Module outcomes: On completing this module students ought to be able to do the following: demonstrate fundamental knowledge of the concept of functions, absolute value function, circle measure and inverse functions, trigonometric and inverse trigonometric functions, exponential and logarithmic functions, limits, continuity, differentiability and indefinite integrals of all the above mentioned functions, l'Hospital's rule and its applications, the natural number system including mathematical induction, the integer number system including the division and Euclidian algorithms and their applications, rational and irrational numbers, the real number system, and the complex number system including De Moivre's theorem and its applications; demonstrate problem solving skills by analysing familiar and unfamiliar problems, using the knowledge of techniques to calculate the domain and range, limits, continuity, derivatives and indefinite integrals of all the above mentioned functions, calculate limits using l'Hospital's rule, prove theorems with mathematical induction, determine greatest common dividers and use it to solve Diophantine equations, and perform operations with complex numbers.		
Module code: WISN112/WISN123	**Semester 1**	**NQF Level: 5**
Title: **Mathematical Techniques**		
Module outcomes: At the end of this module students have mastered the following topics at an introductory level: the concept of a mathematical function elucidated from examples that include exponential and logarithmic functions; the concepts differentiation and integration; a method to solve systems of linear equations; matrix algebra; linear programming problems in two variables; analysis of the rate of change of mathematical functions by using differentiation to investigate the characteristics of the function. The student has acquired skills to recognise the presence and applicability of mathematical concepts in an economic situation and to construct a mathematical model of the problem situation in order to reach a solution by applying differentiation techniques, arithmetic techniques or linear algebra. Furthermore, the student have to be able to do simple and compound interest calculations, be able to do simple and complex annuity calculations, evaluate the number of payments, final payment and outstanding balance, be able to take the interest rate and changes in sinking funds in consideration.		
Module code: WISN113	**Semester 1**	**NQF Level: 5**
Title: **Basic Mathematical Techniques**		
Module outcomes: At the end of this module, students have mastered the following topics at an introductory level: the concept of a mathematical function elucidated from examples that include exponential and logarithmic functions, the concept of differentiation, a method to solve sets		

of linear equations, matrix algebra, linear programming problems in two variables, analysis of the rate of change of mathematical functions by using differentiation to investigate the characteristics of the function. The student acquires skills to recognise the presence and applicability of mathematical concepts in a scientific situation and to construct a mathematical model of the problem situation in order to reach a solution by applying differentiation techniques, arithmetic techniques or linear algebra.

Module code: WISN121	**Semester 2**	**NQF Level: 5**

Title**: Introductory Algebra and Analysis II**

Module outcomes:

After completion of this module students ought to be able to do the following: demonstrate fundamental knowledge of vectors in three dimensional space, their properties and applications, polynomials in one variable including the factor theorem, the remainder theorem, synthetic division and Euclidean algorithm, rational functions including partial fractions, permutation, combinations, the binomial theorem, the use of derivatives in optimisation and curve sketching, Taylor series including the basic theorems on the convergence of series, the fundamental theorems of differential and integral calculus, Riemann sums, the basic properties and applications of the definite integral, advanced integral techniques, hyperbolic and inverse hyperbolic functions, and applications of integration to surfaces, lengths and volumes; demonstrate problem solving skills by analysing familiar and unfamiliar problems, using knowledge of techniques to describe three dimensional spaces, to calculate dot, cross and triple products and use it to solve a variety of problems, determine roots and greatest common dividers of polynomials, decompose rational functions into partial fractions, determine the number of arrangements and selections from a set, do binomial expansions, sketch functions, formulate optimisation problems mathematically and use knowledge of derivatives to solve them, calculate Taylor series and judge its convergence, determine Riemann sums, determine definite integrals, and calculate surfaces, lengths and volumes.

Module code: WISN211	**Semester 1**	**NQF Level: 6**

Title**: Analysis III**

Module outcomes:

On completing this module, students should be able to do the following: demonstrate a thorough knowledge and insight into all the aspects of the differential calculus of multivariate functions: partial and directional derivatives, the gradient function, optimisation problems, including Lagrange's method, the theory of multiple integrals to calculate partial derivatives, directional derivatives and gradients, and double and triple integrals; demonstrate problem solving skills by analysing familiar and unfamiliar problems, using knowledge of techniques to solve practical problems modelled with multivariate functions. Students should demonstrate the ability to use the geometric and physical meaning of the above-mentioned concepts to abstract the underlying mathematical structure of applied problems and to interpret the significance of the mathematical solution.

Module code: WISN212	**Semester 1**	**NQF Level: 6**

Title: **Linear Algebra I**

Module outcomes:

On completing this module students should be able to do the following: demonstrate a thorough knowledge and insight into the solvability of systems of linear equations; the basic properties of Euclidean spaces and linear transformations, interdependency of general vector space concepts; determinants; demonstrate the ability to determine eigenvalues and eigenvectors; demonstrate problem solving skills by analysing familiar and unfamiliar problems, using knowledge of techniques to solve systems of linear equations in the context of a vector space; to perform matrix operations; to determine bases for subspaces; interpretation of the results of systems of linear equations.

Module code: WISN223	Semester 2	NQF Level: 6
Title**: Discrete Mathematics**		
Module outcomes: On completing this module, students should be able to do the following: demonstrate a sound knowledge and understanding proportional- and predicate logic and logical argumentation; general proving techniques, including direct and indirect arguments and counter examples; basic notation and the properties of set theory and Boolean algebra; calculation of probabilities by basic counting techniques; properties of mathematical functions and the pigeonhole principle; the introductory graph theory; demonstrate the ability to solve well-defined, familiar and unfamiliar problems by using mathematical concepts; identify the applicability of the proportional- and predicate logic in practical situations, formulate a problem in mathematical symbols and obtain new information in the specific situation, to use suitable proving techniques in practical situations, recognise and apply the properties of set theory and Boolean algebra; basic counting and the pigeonhole principle and graph theory on practical problems; demonstrate the skills to recognise the presence and applicability of mathematical concepts in a practical situation and be able to program the concepts in the correct way.		
Module code: WISN224	**Semester 2**	**NQF Level: 6**
Title: **Analysis IV**		
Module outcomes: On completing this module, students should demonstrate an advanced knowledge and applied insight into: • Functions from R^n to R^m (vector fields), the differentiation of and chain rule for such functions, Taylor's theorem, line integrals and the Fundamental Theorem of line integrals, Green's theorem, oriented surfaces and surface integrals, rotation and divergence, the theorems of Stokes and Gauss. • Convergence criteria for sequences of real numbers (monotone convergence, Cauchy sequences, limsup=liminf), description of topological aspects in terms of sequences (Bolzano-Weierstrass property for sequences, limit and continuity of functions, properties of continuous functions). • Convergence of series, standard convergence tests, absolute and conditional convergence, power series and convergence intervals for power series, power series representations of functions, differentiation and integration of power series, Taylor and Macluarin series (approximating functions with polynomials).		
Module code: WISN225	**Semester 2**	**NQF Level: 6**
Title: **Engineering Analysis**		
Module outcomes: On completing this module, students should be able to demonstrate advanced knowledge of and insight into the application of: • Vector fields, line integrals and the Fundamental Theorem of line integrals, Green's theorem, oriented surfaces and surface integrals, rotation and divergence, the theorems of Stokes and Gauss. • Convergence criteria for sequences of real numbers and the monotone convergence principle, Convergence of series, standard convergence tests, absolute and conditional convergence, introduction to power series, Taylor's theorem. • Definition of derivatives and contour integrals of complex functions, Laurent's theorem (as an extension of Taylor's theorem), algebraic manipulation of Laurent series, formal definition of the Z-transform and basic rules for Z-transforms, partial fraction method for computing inverse transforms, applications to difference equations.		

Module code: WISN226	Semester 2	NQF Level: 6
Title: **Linear Algebra II**		
On completion of this module the student should: • demonstrate a thorough knowledge of and insight into general vector spaces and bases; inner products; vector norms; linear transformations, the use of eigenvalues and eigenvectors, diagonalisation and the advanced skill to apply vector norms, orthogonalisation, symmetric matrices, quadratic forms, and matrix factorisations. • demonstrate skill in problem solving and proof techniques by analysing known and unknown problems and applications and applying the knowledge and techniques of linear algebra.		
Module code: WISN227	**Semester 2**	**NQF Level: 6**
Title: **Applied Linear Algebra**		
On completion of this module the student should: • demonstrate advanced knowledge of and insight into bases and linear independence of functions, and be able to use it in applications; • be able to use concepts like eigenvalues and eigenvectors in applications such as diagonalisation, discrete dynamical systems and systems of linear differential equations; be able to use the concepts of inner product, length and othogonality to find orthogonal bases and master their applications such as for example the least squares method and linear models; symmetric matrices and further applications; • demonstrate problem-solving skills by analysing known and unknown problems and applications and applying the knowledge and techniques of linear algebra.		
Module code: WISN312	**Semester 1**	**NQF Level: 7**
Title: **Combinatorics**		
Module outcomes: On completing this module, students should be able to do the following: demonstrate a rounded and systematic knowledge and insight into the fundamental counting principles; the binomial theorem; the pigeon hole principle; generalised permutations and arrangements; recursion relations and their solutions, and generating functions; fundamental graph theoretical concepts; partition numbers; imbedding of graphs into surfaces; concept of connectedness; Menger's theorem; independence numbers; factorisation; Hamilton cycles and Eulerian revolutions; colouring of graphs; demonstrate problem solving skills by interpreting familiar and unfamiliar combinatorial problems and using known techniques to solve them; by formulating problems in terms of graphs; by applying and calculating generating functions; by recognising classical discrete probability problems and solving them; by understanding the arguments and their motivations in proving of theorems and being able to give own formulations of them, and applying these results to solve concrete or abstract problems.		
Module code: WISN313	**Semester 1**	**NQF Level: 7**
Title: **Complex Analysis**		
Module outcomes: After completion of this module students ought to be able to do the following: • Be able to define and determine the derivatives of complex and vector functions, demonstrate knowledge of the concept of differentiability and analiticity and be familiar with its use, demonstrate knowledge of the concept of a line integral and complex contour integral, be familiar with the theorems of Cauchy and their application in computing complex contour integrals. • Be familiar with diverse consequences of Cauchy's theorem and their application, demonstrate knowledge of the theorems of Taylor and Laurent and their applications, demonstrate knowledge of singular points and residues of complex functions, be familiar with the description of singular points and the computation of residues, be familiar with Cauchy's Residue theorem and its use. Be able to solve several improper integrals and other important real integrals by means		

residue theory, be able to calculate the maxima and minima of complex functions, be able to apply these theorems in other areas.

Module code: WISN322	Semester 2	NQF Level: 7

Title: **Algebraic Structures**

Module outcomes:

On completing this module, students should be able to do the following: demonstrate a rounded and systematic knowledge and insight into general algebraic structures, for instance groups, rings and bodies, permutations, polynomials with integer coefficients and factor rings formed from polynomial rings; demonstrate skills to prove the fundamental theorems of the theory and apply the concepts amongst others to the integer numbers modulo "n" by means of logical, axiomatic arguments; to give a cyclical representation of permutations; to perform calculations with polynomials with integer coefficients (modulo n); demonstrate skills to apply the theory of factor rings formed from polynomial rings and to perform error correcting coding and decoding; to have the ability to solve in unknown contexts problems that relate to algebraic structures by applying relevant techniques.

Module code: WISN323	Semester 2	NQF Level: 7

Title**: Real Analysis**

Module outcomes:

After the completion of this module the students should be able to do the following

- demonstrate a fundamental knowledge of the theory of real numbers; the topology of finite dimensional vector spaces; compactness and connectedness; continuous and uniformly continuous functions; continuous images of compact and connected sets; convergence of sequences and Cauchy-sequences; convergence and uniform convergence of sequences of functions; Riemann- integration; differentiation of vector functions of several variables; implicit function theorem for such functions; bijections, diffeomorphisms and open mappings; extreme values with and without constraints; Lagrange's method; inequalities of Cauchy-Schwarz, Hölder and Minkowski.
- demonstrate the ability to solve problems in the area of real analysis; be able to test functions for their continuity and differentiability, be able to solve problems in integration and differentiation theory, be able to solve extreme value problems with and without constraints, be able to apply abstract mathematical theorems and concepts in related areas such as probability theory.

N.15.3.21 UNDERSTANDING THE ECONOMIC AND NATURAL WORLDS

Module code: WVES221	Semester 2	NQF Level: 6

Title: Understanding the economic world

Module outcomes:

Upon completion of this module, you should be able to:

- have a fundamental knowledge base of a selection of world views and ideologies;
- demonstrate their critical understanding through an ability to compare the nature and function, as well as different contemporary manifestations of these world views and ideologies;
- have the ability to understand the interrelatedness of phenomena such as occurs in natural and social systems, and from this vantage point, analyse and evaluate real life problems or case studies based on core issues of our time, such as poverty, constant change, human rights, HIV-AIDS, power abuse, corruption, racism, xenophobia, etc.;
- be able to articulate their personal world view and use it as a point of departure for arguing and communicating feasible solutions to core issues and problems of our time in a typical academic manner.

Module code: WVES311	Semester 1	NQF Level: 7
Title: **Business ethics**		
Module outcomes: After completion of this module you should: • Possess knowledge of ➢ selected ethical theories ➢ moral decision-making strategies ➢ selected socio-economic ethical issues ➢ selected issues and approaches with regard to business ethics ➢ the nature of organizations and management from an ethical perspective • Possess the ability and skills to apply the above knowledge to case studies • Possess the ability and skills to analyse and evaluate the abovementioned theories and issues from different philosophical and ideological perspectives.		

Module code: WVNS211	Semester 1	NQF Level: 6
Title: **Understand the natural world**		
Module outcomes: After this module has been completed successfully, it will serve the student as a fundamental source of knowledge of the nature and function of worldviews and ideologies as they have developed historically from science, from antiquity to the post-modern era. The student will also understand the relation between norms and science, the influence of science and technology on the spiritual, cultural and material worldviews of the human being, his society and environment. The student must be able to understand and discuss the essential ideas in the development of science with reference to value systems that function in his worldview.		

Module code: WVNS221	Semester 2	NQF Level: 6
Title**: Science and society**		
Module outcomes: After this module has been successfully completed, the student must be able to identify, demonstrate and react to basic issues in the contemporary discourse on science, technology and society, with special reference to science and technology systems in South Africa. The student must also be able to identify some of the most important ethical issues in the subject matter of a programme and critically react to them according to a value-based orientation from a specific worldview. He/she must be able to form a well thought-out rational standpoint on the concept of sustainable development, including its socio-economic implications. The student must be able to discuss perspectives on different thought systems, and be able to view contemporary issues in science and technology within a systems perspective.		

Original details: 11592370

2016-09-01

File reference: 7P/7.2.5/P-FNS