Part 1: Natural Sciences: Undergraduate Programmes

Dean
Professor N.J.L. Heideman
Office 9, Biology Building
Telephone Number: 051 401 2322
Fax Number: 051 401 3728
E-mail: heidemannj@ufs.ac.za
Web address: http://www.ufs.ac.za/natagri

Vice Dean
Professor R.C. Witthuhn
Office 10, Biology Building
Telephone Number: 051 401 9010
Fax Number: 051 401 3728
E-mail: witthuhnrc@ufs.ac.za

Faculty Manager
Mr J.D. Kruger
Office 11, Biology Building
Telephone Number: 051 401 3199
Fax Number: 086 665 2377
E-mail: krugerjd@ufs.ac.za

Natural Sciences (Undergraduate and Honours final-year and non-final year students)
Ms Simoné Williams / Mr Jack Mokoena
George du Toit Administration Building
Room: Glass doors – N145
Telephone Number: (051) 401 9271 / 9275
E-mail: williamssv@ufs.ac.za

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- Take note that the institutional compulsory module UFS101 will be included in ALL first year programmes.
- ALL first year students must take note that the Faculty is busy with re-curriculation and that programmes and modules might change as from 2014.

HOW TO USE THIS YEARBOOK

The yearbook of the Faculty contains information and regulations. It is the *law book* of the Faculty prescribing the rights and privileges of students and is therefore written in regulation format with regulation numbers.

It also contains useful information that will help students to plan their learning programmes optimally. It is normally not necessary to read this book from front to back, only use the parts applicable and what is needed.

The contents of the Faculty Yearbook are the following:

- The names of academic staff and programme directors can be found on page 5-8.
- The faculty regulations are very important and only comprise a few pages. It is absolutely essential that each student in the Faculty should be well acquainted with these regulations. If students are not clear on the interpretation thereof, the Faculty Manager should be consulted.
- The learning programmes and regulations for Honours, Master's and Doctor's degrees can be found in the postgraduate Natural Sciences Yearbook, Part 3.
- The MODULE CONTENT of modules can be found from page 54 of this yearbook. Students should study the MODULE CONTENT of the modules they have selected.
- The transitional regulations can be found in Annexure A on page 104.
- The prerequisites for modules can be found in Annexure B on page 105.

ACADEMIC STAFF

DEAN Professor N.J.L. Heideman
VICE-DEAN Professor R.C. Witthuhn

PROGRAMME HEAD (QWAQWA CAMPUS) Professor A.S. Luyt

PROGRAMME DIRECTORS

Programme	**Programme Director**	**Telephone**
Architecture	Mr J.I. Olivier	051 401 2658
Agricultural Sciences	Prof. J.B. van Wyk	051 401 2677
Biological Sciences:		
• Genetics, Behavioural Genetics, Forensic Genetics, Human Molecular Biology	Ms Z. Odendaal	051 401 2776
• Botany, Plant Breeding, Plant Health Ecology, Plant Pathology	Dr B. Visser	051 401 3278
• Zoology, Entomology	Prof. J.G. van As	051 401 2427
• Biochemistry	Dr A. van Tonder	051 401 2892
• Microbiology, Microbial Biotechnology	Prof. S.G. Kilian	051 401 2780
• General Biology first-year	Dr A. van Wyk	051 401 3924
Extended Programme [South Campus]	Ms R. Meintjes	051 401 2783
Building Sciences	Ms M-M Els	051 401 2257
Centre for Environmental Management	Ms M. Kemp	051 401 2683
Consumer Science	Prof. H.J.H. Steyn	051 401 2304
Computer Science and Informatics (Information Technology)	Dr A. van Biljon	051 401 2605
Geosciences:		
• Geography	Ms E. Kruger	051 401 2185
• Geology and Geohydrology	Dr H.E. Praekelt	051 401 2373
Mathematical Sciences	Prof. S.W. Schoombie	051 401 2329
Mathematical Statistics and Actuarial Science	Mr M.J. von Maltitz	051 401 2609
Physical and Chemical Sciences	Dr J.A. Venter	051 401 3336
Urban and Regional Planning	Prof. V.J. Nel	051 401 2486

(Departmental Heads / Departmental Chairpersons / Qwaqwa Subject Heads are indicated with an asterisk)

AGRICULTURAL ECONOMICS (051 401 2824)

Professor	*Prof. B.J. Willemse
Associate Professor	Prof. B. Grové
Affiliated Professors	Prof. Z.G. Alemu, Prof. A. Jooste
Senior Lecturer	Dr A.C. Geyer
Lecturers	Mr H. Jordaan, Mr D.B. Strydom, Ms N. Matthews,Ms L. Morris, Mr A.O. Ogundeji, Mr F.A. Maré, Mr J.I.F. Henning, Mr P. Mokhatla
Lecturer Units	Dr L. Terblanche
Research Associate	Dr P.R. Taljaard
Agricultural Engineering	Mr J.J. van Staden

DiMTEC (051 401 2721)

Director	*Dr A.J. Jordaan
Lecturers	Dr B. Grové, Dr L. Terblanche, Prof. G. Viljoen, Mr E. du Plessis, Prof. H. Hudson, Prof. W. Purcell, Mr C. Dreyer, Dr D. Sakulski, Dr H. Booysen, Ms A. Weyers, Dr D. Chikobvu
Junior Lecturers	Ms O. Kunguma, Ms A. Ncube, Ms J. Belle, Mr A.O. Ogundeji

ANIMAL, WILDLIFE AND GRASSLAND SCIENCES (051 401 2211)

Professors	*Prof. J.P.C. Greyling, Prof. G.N. Smit, Prof. H.A. Snyman, Prof. J.B. van Wyk, Prof. F.W.C. Neser
Professors Extraordinary	Prof. M.M. Scholtz, Prof. T.L. Nedambale, Prof. A.J. van der Zijpp, Prof. A. Maiwashe
Associate Professor	Prof. H.O. de Waal
Senior Lecturer	Dr A.M. Jooste
Lecturers	Dr M.D. Fair, Mr P.J. Malan, Mr F.H. de Witt, Mr O.B. Einkamerer, Dr G.D.J. Scholtz
Junior Lecturers	Mr M.B. Raito, Mr F. Deacon
Junior Researcher	Dr B.B. Janecke

ARCHITECTURE (051 401 2332)

Professor	Prof. W.H. Peters
Affiliated Professor	Prof. O. Joubert
Senior Lecturer	*Ms M. Bitzer, Ms P.N. Tumubweinee
Lecturers	Mr G. Bosman, Mr J.L. du Preez, Mr J.W. Ras
Junior Lecturers	Mr R. Bitzer, Mr H.B. Pretorius, Mr J.I. Olivier, Mr J.H. Nel, Mr H. Raubenheimer

CENTRE FOR MICROSCOPY (051 401 2264)

Associate Professor	Prof. P.W.J. van Wyk

CENTRE FOR ENVIRONMENTAL MANAGEMENT (051 401 2863)

Director	*Prof. M.T. Seaman
Lecturer	Ms M.F. Avenant
Affiliated Professor	Prof. A. Turton
Research Associates	Dr N.L. Avenant, Dr N.B. Collins, Mr P. Grundlingh, Dr S. Mitchell

CENTRE FOR SUSTAINABLE AGRICULTURE, RURAL DEVELOPMENT AND EXTENSION (051 401 2163)

Director	*Prof. I.B. Groenewald
Senior Researcher	Dr J.A. Van Niekerk

CHEMISTRY (051 401 9212)

Outstanding Professor	*Prof. A. Roodt
Senior Professor	Prof. A. Marston
Professors	Prof. J.C. Swarts, Prof. B.C.B. Bezuidenhoudt, Prof. J. Conradie
Senior Professor	Prof. A. Marston
Associate Professors	Prof. W. Purcell, Prof. J.H. van der Westhuizen, Prof. H.G. Visser
Affiliated Professors	Prof. D. Ferreira, Prof. H. Frank, Prof. K. Swart, Prof. T. van der Merwe, Prof. S. Otto, Prof. J.M. Botha
Affiliated Associate Professors	Prof. C. Edlin, Prof. G. Fouché, Prof. V. Maharaj, Prof. G. Steyl
Senior Lecturers	Dr S.L. Bonnet, Dr K.G. von Eschwege
Lecturer	Dr J.A. Venter, Dr E.H.G. Langner, Dr E. Erasmus, Dr L. Twigge, Dr A. Brink, Dr M. Schutte, Dr E. Fourie, Dr R. Shago, Ms A. Wilhelm-Mouton
Subject Coordinators	Dr C. Marais, Ms R. Meintjes
Qwaqwa-Campus	
Professor	Prof. A.S. Luyt
Lecurers	Mr T.A. Tsotetsi, Ms N.F. Molefe, Ms M.A. Malimabe, Ms M. Amra-Jordaan
Junior Lecturers	*Mr R.G. Moji, Mr J.S. Sefadi

CONSUMER SCIENCE

Associate Professor	*Prof. H.J.H. Steyn
Lecturers	Ms I. van der Merwe, Dr J.F. Vermaas
Junior Lecturers	Ms J.S. van Zyl, Ms P.Z. Swart

COMPUTER SCIENCE AND INFORMATICS (051 401 2754)

Professors	Prof. P.J. Blignaut, Prof. T. McDonald
Affiliated Professor	Prof. H.J. Messerschmidt
Senior Lecturers	*Dr A. van Biljon, Dr L. de Wet, Dr J.E. Kotze, Dr E. Nel, Dr T. Beelders
Lecturers	Ms E.H. Dednam, Mr A.J. Burger, Mr W. Nel, Mr R. Brown
Junior Lecturers	Ms M.J.F. Botha, Mr R.C. Fouché, Mr J. Marais, Mr B. Campbell
Qwaqwa Campus	
Lecturers	Mr R.M. Alfonsi, Ms R.D. Wario
Junior Lecturers	*Mr V.F.S. Mudavanhu, Mr B. Sebastian, Mr F.M. Radebe, Mr T. Lesesa, Mr M.B. Mase, Mr G.J. Dollman

GENETICS (051 401 2595)

Professor	*Prof. J.J. Spies, Prof. J.P. Grobler
Affiliated Professor	Prof. T.E. Turner
Affiliated Associate Professor	Prof. A. Kotzé
Lecturers	Dr K. Ehlers, Mr M.F. Maleka, Ms P. Spies
Affiliated Lecturers	Dr D.L. Dalton, Lt.-Col. A. Lucassen
Junior Lecturers	Ms Z. Odendaal, Ms L. Wessels, Ms H. van der Westhuizen, Ms S-R. Schneider

GEOGRAPHY (051 401 2255)

Professors	Prof. P.J. Holmes, Prof. G.E. Visser
Senior Lecturer	*Dr C.H. Barker
Lecturers	Ms E. Kruger, Ms T.C. Mehlomakhulu
Junior Lecturers	Ms M. Rabumbulu, Ms A. Steenekamp
Qwaqwa Campus	
Associate Professor	Prof. W.F. van Zyl
Senior Lecturers	*Dr J.H.D. Claassen, Dr G. Mukwada
Leturers	Mr A. Adjei, Ms M. Naidoo
Junior Lecturer	Mr P.S. Mahasa

GEOLOGY (051 401 2515)

Professor-researcher	*Prof. W.A. van der Westhuizen
Affiliated Professor	Prof. D.E. Miller
Associate Professors	Prof. W.P. Colliston, Prof. M. Tredoux, Prof. C.D.K. Gauert
Senior Lecturers	Dr J.O. Claassen, Dr F. Roelofse
Senior Lecturer-researcher	Dr H.E. Praekelt
Junior Lecturer	Ms H. Pretorius, Mr A.I. Odendaal

INSTITUTE FOR GROUNDWATER STUDIES (051 401 2175)

Director	*****Dr P.D. Vermeulen
Professor	Prof. G.J. van Tonder
Affiliated Associate Professors	Prof. K. Witthüser, Prof. J.L. Nieber
Lecturers/Researchers	Ms L-M. Deysel, Dr F.D. Fourie

MATHEMATICS AND APPLIED MATHEMATICS (051 401 2691)

Senior Professor	*Prof. J.H. Meyer
Professors	Prof. A.H.J.J. Cloot, Prof. S.W. Schoombie
Associate Professor	Prof. T.M. Acho
Senior Lecturers	Dr H.W. Bargenda, Ms J.S. van Niekerk
Lecturers	Ms A.F. Kleynhans, Dr S. Dorfling, Mr C. Venter
Qwaqwa Campus	
Associate Professor	Prof. J. Schröder
Lecturer	Mr S.P. Mbambo
Junior Lecturer	Ms H.C. Faber

MATHEMATICAL STATISTICS AND ACTUARIAL SCIENCE (051 401 2311)

Senior Professor	Prof. M.S. Finkelstein
Professor	*****Prof. R. Schall
Senior Lecturers	Dr J.M. van Zyl, Ms L van der Merwe, Mr F.F. Koning, Dr D. Chikobvu, Dr A. Verster
Lecturers	Mr A.M. Naudé, Mr M.J. von Maltitz, Mr S. van der Merwe, Ms E. Girmay, Ms W. Oosthuizen, Ms Z. Ludick, Mr M. Sjölander

MICROBIAL, BIOCHEMICAL AND FOOD BIOTECHNOLOGY (051 401 2396)

Division of Microbiology and Biochemistry	
Distinguished Professor	Prof. J.L.F. Kock
Professors	*Prof. J.C. du Preez, Prof. J. Albertyn, Prof. R.R. Bragg, Prof. S.G. Kilian, Prof. H-G. Patterton, Prof. M.S. Smit, Prof. E. van Heerden, Prof. B.C. Viljoen
Senior Lecturers	Dr H.G. O'Neill, Dr F.H. O'Neill, Dr D. Opperman, Dr C.H. Pohl-Albertyn, Dr A. van Tonder
Lecturer	Dr O.M. Sebolai
Junior Lecturers	Ms C.E. Boucher, Mr W.P.D. Schabort
Researcher	Ms L. Steyn
Affiliated Associate Professor	Prof. E.J. Lodolo
Division of Food Science	
Professor	Prof. G. Osthoff
Associate Professors	Prof. A. Hugo, Prof. C.J. Hugo
Senior Lecturers	Dr J. Myburgh, Dr M. de Wit
Lecturer	Dr C. Bothma

PHYSICS (051 401 2321)

Senior Professor	*Prof. H.C. Swart
Professors	Prof. P.J. Meintjes, Prof. J.J. Terblans, Prof. O.M. Ntwaeaborwa
Associate Professors	Prof. W.D. Roos, Prof. M.J.H. Hoffman
Affiliated Associate Professor	Prof. K.T. Hillie
Senior Lecturer	Dr R.E. Kroon
Lecturer	Dr B. van Soelen
Senior Researcher	Dr E Coetsee-Hugo
Qwaqwa-kampus	
Associate Professor	Prof. B.F. Dejene
Lecturers	*Dr J.J. Dolo, Mr R.O. Ocaya, Mr S.V. Motloung, Mr K.G. Tshabalala
Junior Lecturer	Mr L.F. Koao

PLANT SCIENCES (051 401 2514)

Plant Pathology	
Professors	Prof. Z.A. Pretorius, Prof. W.J. Swart, Prof. N.W. McLaren, Prof. G.J. Marais
Affiliated Associate Professor	Prof. R. Prins
Professor Extraordinary	Prof. P. Crous
Senior Lecturer	Dr M. Gryzenhout
Botany	
Associate Professor	*Prof. P.J. du Preez
Affiliated Associate Professor	Prof. M. van der Bank
Senior Lecturers	Dr G.P. Potgieter, Dr B. Visser
Lecturers	Dr M. Cawood, Dr L. Mohase, Dr M. Jackson, Ms L. Joubert
Plant Breeding	
Professor	Prof. M.T. Labuschagne
Associate Professor	Prof. L. Herselman
Affiliated Associate Professor	Prof. R. Prins, Prof. J.B.J. van Rensburg
Lecturers	Dr A. van Biljon, Dr A. Minnaar-Ontong, Dr R. van der Merwe
Qwaqwa-kampus	
Senior Lecturers	*Dr A.O.T. Ashafa, Dr E.J.J. Sieben, Dr L.V. Buwa
Lecturer	Mr R. Letsoane
Junior Lecturer	Mr T.R. Pitso

QUANTITY SURVEYING AND CONSTRUCTION MANAGEMENT (051 401 2248)

Professor	*****Prof. J.J.P. Verster, Prof. K Kajimo-Shakantu
Senior Lecturer	Mr F.H. Berry
Lecturers	Mr H.J. van Vuuren, Ms B.G. Zulch, Mr P.M. Oosthuizen, Mr C.H. van Zyl, Mr M.S. Ramabodu, Mr M Letsie, Ms E. Jacobs, Ms O.R.C. du Preez, Ms M.M. Els

SOIL, CROP AND CLIMATE SCIENCES (051 401 2212)

Professors	*Prof. C.C. du Preez, Prof. J.C. Pretorius, Prof. L.D. van Rensburg, Prof. S. Walker
Associate Professor	Prof. C.W. van Huyssteen
Affiliated Professor	Prof. C.J. Stigter
Affiliated Associate Professor	Prof. R. van Antwerpen
Senior Lecturers	Dr P.A.L. le Roux, Dr J. Allemann, Dr G.M. Ceronio, Dr G.M. Engelbrecht
Lecturers	Mr J.H. Barnard, Ms L. de Wet, Ms E. Kotzé, Mr A.S. Steyn
Research Associate	Dr J.H. van der Waals

URBAN AND REGIONAL PLANNING (051 401 2486)

Professor	*Prof. V.J. Nel
Senior Lecturer	Dr M.M. Campbell
Lecturers	Mr P.J. Potgieter, Ms E. Barclay, Mr Y. Mashalaba

ZOOLOGY AND ENTOMOLOGY (051 401 2427)

Professors	*****Prof. J.G. van As, Prof. S. v.d. M. Louw, Prof. L. Basson
Associate Professor	Prof. L.L. van As
Professors Extraordinary	Prof. G.L. Prinsloo, Prof. L.J. Fourie
Lecturers	Ms E.M.S.P. van Dalen, Mr H.J.B. Butler, Dr C.R. Haddad, Dr C. Jansen van Rensburg, Dr S Brink
Junior Lecturers	Mr V.R. Swart, Ms L. Heyns, Mr D Fourie
Qwaqwa Campus	
Senior Lecturers	*Dr M.M.O. Thekisoe, Dr A. le Roux
Lecturers	Dr P.M. Leeto, Dr J. van As, Mr E. Bredenhand
Junior Lecturers	Ms H.J.M. Matete, Ms M. van As

Degree	Minimum period of study	Abbreviation
Baccalaureus Scientiae (Extended)	4 years	BSc
Baccalaureus Scientiae	3 years	BSc

REGULATIONS

Reg. D1 - General Regulations

The general regulations of the University are, with the necessary adjustments, applicable in this Faculty (http://www.ufs.ac.za/content.aspx?id=57). These regulations can be found in the General Yearbook of the University. It is the responsibility of the student to be conversant with these regulations.

TAKE NOTE:

- Promotion of modules: Please contact the Head of Department of the specific module in the programme taken to obtain the necessary information.

- **Re-curriculation:** The combination of the 2nd and 3rdyear modules in Learning Programmes might change or rearrange due to re-curriculation during 2013.

Reg. D2 Entrance and Progress Requirements

D2.1 Faculty Entrance Requirements
For prospective students who have completed matriculation up to 2007, the following is applicable:

- Senior certificate with matriculation endorsement (matriculation exemption) or an equivalent qualification.
- A minimum M-Score of 30 plus a HG = E or SG = C in an official tuition language in grade 12.
- Mathematics HG = D or SG = B. Alternatively (for senior students) 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- Biology HG = D or SG = B or Physical Science HG = E or SG = C.
- If the modules WKS114 are included in the learning programme, Mathematics HG = D is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.

NB. Take note that the entrance requirements for programmes are listed at the beginning of each Learning Programme.

The entrance requirements are a broad indication for entrance into the Faculty of Natural and Agricultural Science.

D2.1.1 Specific programme requirements
Please note that the specific programme requirements **for prospective students who have completed the National Senior Certificate from 2008** are explained with every programme as from page 15.

The Faculty specific admission requirements for the BSc Quantity Surveying, BSc Construction Management (See Yearbook PART 2)

- **Selection**.
- A minimum AP of 30 plus a performance level 4 in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively (for senior students) a pass mark in WTW 164 or WTW194 is required.
- One of the following on performance level 4 (50%): Physical Sciences, Economics, Business Studies, Accounting.
- An AP of 34 and higher is highly recommended.

The Faculty specific admission requirements for Architecture (BArchStud) (See Yearbook PART 2)

- **Selection**.
- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively (for senior students) a pass mark in WTW164 or WTW194 is required.
- Physical Sciences on performance level 4 (50%).
- A portfolio of creative work that must be handed in during or prior to a selection interview.
- An AP of 34 and higher is highly recommended.

D2.2 Progress requirements

- Students must pass a minimum of 80 credits to be able to register for modules in a following study year of a learning programme.
- Class attendance is compulsory if students have to register for the same module for a second time and preference must be given to the module being repeated by the student if there are time table clashes.

- Students cannot register for third year modules if any first year modules are outstanding.
- Students, who could not complete the first year of study in three years, will not be allowed for re-registration to the Faculty of Natural and Agricultural Sciences.
- Students may only register for one additional 16 credit module per semester, more than the prescribed modules. This can only happen after approval which depends on the academic record of the student.

D2.3 General Requirements and Subject Requirements

- Students must comply with the requirements of the specific programme. (For programmes, see Reg. D7 and also see the specific programmes.)
- In exceptional cases of students not complying with the minimum programme and/or credit requirements, the Dean might, according to the nature of the programme, approve a deviation from the above requirements.

D2.3.1 Computer Sciences and Information Technology – IT: RIS114, BRS111 en BRS121

- Students who passed Information Technology (IT) in grade 12 on performance level 5 (60%) or passed any other substantial programming module and can deliver proof thereof can be exempted from RIS114 if a promoting test at the beginning of the semester is passed with at least 70%. The test will be of equivalent standard of the RIS114 examination.
- Computer Literacy: Unless otherwise indicated in the programme, the foundation modules BRS111 and BRS121 are compulsory and must be passed. The foundation modules represent the mastering of basic skills and must be passed before the degree can be awarded. Students, who passed grade 12 Information Technology (IT) on performance level 5 (60%), or Computer Application Technology (CAT) on performance level 6 (70%), are exempted from BRS111.
- The contents of BRS111 (Main Campus), BRC111 (South Campus) and BRS131 (Qwaqwa Campus) are the same.
- The contents of BRS121 (Main Campus) and BRS141 (Qwaqwa Campus) are the same.
- It will be expected from B.Sc. (IT) students to do at least one student assistantship in the Department of Computer Science and Informatics in the second or third year of study.

D2.3.2 Physics – FSK114/FSK124 or FSK134/FSK144 as elective

- Students who took grade 12 Mathematics and Physical Sciences and achieved performance level 6 and students who plan to continue with Physics in their second year of study, are advised to take FSK114/FSK124.
- Students who plan to study first year Physics only, are advised to take FSK134/FSK144. FSK134/FSK144 can lead to study in second-year physics if a pass mark of at least 60% was obtained for both FSK134/FSK144.
- FSK134 and FSK144 are service modules to equip students with the necessary knowledge to prepare them to apply these concepts in other disciplines.
- Students who wish to continue with Physics in their second year must enrol for FSK114 and FSK124.

D2.3.3 Chemistry

- For recognition of CEM114+CEM124/144 the modules CHE112+CHE132+CHE122+CHE142+ CHE151+CHE161 must be passed.
- CEM124 must preferably be taken by students who want to continue with Chemistry in the second year of study.
- CEM144 must preferably be taken by students who wish to take Chemistry only in the first year of study. CEM144 is a service module to equip students with the necessary knowledge to prepare them to apply these concepts in other disciplines.
- CEM144 can lead to study in second-year Chemistry if a pass mark of at least 60% was obtained for CEM144.
- As a result of laboratory space and associated laboratory safety issues, second-year student numbers will be restricted to the 70 best students [maximum for which the laboratory is designed]. Completed first-year courses, as well as previous attempts to pass CEM214 and CEM232, will be used as primary criteria to select students. Finalising of the selection process will start on 1 November.
- For all pre-graduate Chemistry modules a 70% attendance of practicals is compulsory. If not, it is incomplete.
- Students who wish to continue with Chemistry in their second year must enrol for CEM114 and CEM124.

D2.3.4 WTW114 and WTW134

- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- WTW134 – At least Grade 12 Mathematics (HG) E or SG (C) or performance level 5 or (for senior students) a pass in WTW164/WTV164 or WTW194 or WTW184 (Main Campus).

D2.3.5 Specific requirements for BSc (Geology)

- Applications to the BSc Geology programme, on the prescribed form, must reach the Registrar, Academic Student Services, University of the Free State, Bloemfontein, on or before 30 September of the year before the intended admission. A selection process takes place before admission. Students will be notified of the result as soon as examination results are available.
- A maximum number of 60 students will be admitted to the second year due to laboratory constraints. These 60 students will be admitted based on academic excellence. The same will hold for the third year where 40 students will be admitted, once again based on academic excellence.
- All mainstream Geology students will only be allowed to continue with their second year in any of the Geology learning programmes if the student;
    - Pass all the first year modules of the specific programme.
    - Obtain an average of 55% in the first year modules GLG114 and GLG124.
    - Deserving students that do not comply with these requirements may yet be admitted at the discretion of the Geology Department.

D.2.3.6 Biology – BLG114

- The minimum entrance requirements for **students out of other Faculties** who want to take BLG114 are grade 12 Life Sciences at performance level 5 or Physical Sciences at performance level 4 (50%).

D2.4 Students from other faculties

- Students in other faculties who register for subjects in the Faculty of Natural and Agricultural Sciences must comply with the minimum regulation requirements, as set out in Reg. D2 or as set out in the beginning of each Programme in the Yearbook.

D2.5 REG. A19 – repeating of a module

- Students must take note of this general regulation which only allows you to repeat a module twice.

Reg. D3 - The selection of a learning programme

D3.1 The meaning of a module code

A learning programme consists of compulsory modules as well as elective modules. A module is indicated with the code ABCxyz that means the following:

ABC Letters stating the name of the module
x A numeral stating the year level
y An odd number for the first semester and an even number for the second semester. A 0 or a 9 indicates a year module.
z This number multiplied by four indicate the number of credits.

D3.2 Procedure for the selection of a learning programme

- Select a learning programme under Reg. D7.
- Verify that all the elected modules are allowed on the **class and examination timetable**.
- Verify that the **prerequisites** prescribed for every module are met (See Reg. D4).
- Verify that the elected learning programme complies with the requirements of the qualification (See Reg. 2.1.1 and Reg. D5).

Reg. D4 - Prerequisites

Before a module can be taken, the prerequisites of the module have to be complied with, unless special permission is obtained from the Head/Chairperson of the relevant department. There are four possibilities:

Specific module prerequisites appear in the table at the end of this Yearbook.

- No prerequisite is required for the module and the module can be taken at all times.
- The minimum prerequisite applies. The requirement is a semester/year mark or an examination mark of 40% in the relevant module. It is indicated as, for example, Min. (WTW114).
- A full prerequisite applies. The requirement is a pass in the relevant module. It is indicated as WTW114, if WTW114 is the relevant module.
- A co-requisite is required. If the modules are taken for the first time, the module prescribed as co-requisite must be taken simultaneously with the relevant module. For example, to take GLG242 the prerequisites are GLG114, (with GLG244).

Reg. D5 Specific Programme requirements for the degrees BSc and BSc Four-year Curriculum (Extended Programme):

D5.1 The degree cannot be conferred if the minimum credit requirements are not met as follows:

BSc degree

- A total of at least 392 credits for the degree must be obtained over three years.
- On first year level a minimum of 120 credits must be obtained.
- At both second and third year levels a minimum of 96 credits must be obtained.
- At least 64 credits must be obtained from one discipline (field of study) on third year level, unless the specific programme requirement is different. Please note that all modules in a given discipline do not necessarily share the same code structure. E.g., MKB and IQM are all modules within the discipline of Microbiology.

BSc Four-year curriculum (Extended Programme):

- A total of 496 credits can be obtained over a period of four years. Of these a minimum of 392 degree credits must be obtained.

Recommendation:

- If a student wishes to complete the degree with **two main subjects,** at least 48 credits must be obtained for each subject on second-year level and 64 credits on third-year level.
- If a student wishes to take three full second-year subjects, each subject must have 48 credits. The total number of second-year credits will then be 144. The advantage of such an option is that students will have wider range of main subjects in the third year.
- Seen that the outcomes of programmes are based on a study period of three years, students are strongly recommended to plan to continue with an honours degree on completion of a BSc degree.

D5.2 Specific requirements for B (Consumer Science) and BSc (Home Economics)

- A total of at least 492 credits must be obtained in four years' time.

Reg. D6 – Examinations / Promotions

Contact the Head of the Department of the programme in which the module is taken to find out how the promotion of modules is handled.
For the duration of the examinations, see MODULE CONTENT. For pass requirements and other regulations concerning examinations, consult the general regulations.

Reg. D7 - Undergraduate and Post Graduate programmes

Yearbook:	Part 1	-	Natural Sciences
	Part 2	-	Building Sciences
	Part 3	-	Postgraduate programmes
	Part 4	-	Agricultural Sciences
	Part 5	-	Qwaqwa Campus programmes

Prospective postgraduate students must take notice of the following prerequisites:

Honours Degree in the subject	Prerequisite/Requirement
Actuarial Science	A candidate must have a BSc or BCom degree in Actuarial Science, as well as qualified for at least four exemptions of the subjects of the Faculty / Institute of Actuaries, of which at least one exemption has to be for CT1, CT4 or CT6.
Agrometeorology	Agrometeorology at third year level.
Biochemistry	At least 64 credits in Biochemistry at third year level. An average of 65% in undergraduate Biochemistry modules. Admission is subject to a selection process.
Behavioural Genetics	Admission is subject to selection into BScHons in Behavioural Genetics. A minimum of 60% in Genetics at third year level.
Botany	A minimum of 60% in Botany at third year level in consultation with the Departmental Chairperson.
Chemistry	To be considered for BScHons in Chemistry, a student must have a BSc degree. Other pre-requisites: (WTW114 or WTW134) + (WTW124 or WTW144). An average pass mark of 60% in (CEM314+CEM334+CEM324+CEM344).
Computer Information Systems	A minimum average of 60% is required for the four third-year computer science modules (RIS314, RIS334, RIS324, RIS344) or equivalents thereof, are required. In exceptional cases admission may be allowed in consultation with the programme director or depart-mental chairperson.
Disaster Management	At least a recognised masters' degree and some subjects in the post graduate diploma and in the masters' degree in disaster management. It also depends on the already acquired knowledge and experience in the disaster management field.
Entomology	Entomology at third year level.
Food Science	Food Science at third year level. An average of 65% in undergraduate Food Science modules. Admission is subject to a selection process.
Forensic Genetics	Admittance into BScHons in Forensic Genetics is subject to selection. A minimum of 60% in Genetics at third year level or equivalent modules.
Genetics	Admittance into BScHons in Behavioural Genetics is subject to selection. A minimum of 60% in Genetics at third year level or equivalent modules.
Geology	For admission to the Honours degree in Geology a student must achieve a combined average pass mark of 60% in four Geology modules (64 credits) at third year level (two modules in the first semester and two in the second, including GLG314 and GLG324).
Geography and Geographic Information Systems	Geography at third year level or equivalent Geography III at another university with at least 64 credits. Average of 60% in the third year.
Geohydrology	A degree in Engineering or a BSc or a BScAgric degree. An average of 60% in the final year major subjects plus Geology 1, Chemistry 1, and Mathematics 1 or Statistics 1.
Grassland Science	Grassland Science at third year level.
Home Economics	BSc Home Ec., B. Consumer Science or an equivalent qualification.
Limnology	A BSc or BScAgric degree with at least one of the following as major: Biochemistry, Chemistry, Zoology, Entomology, Physics, Soil Science, Microbiology, Botany, Mathematics. For further questions you must call the next number: 0514012863.
Actuarial Science	A candidate must have a BSc or BCom degree in Actuarial Science, as well as qualified for at least four exemptions of the subjects of the Faculty / Institute of Actuaries, of which at least one exemption has to be for CT1, CT4 or CT6.
Mathematics and Applied Mathematics	Mathematics and Applied Mathematics at third year level or equivalent modules.
Mathematical Statistics	A minimum average pass mark of 60% in (WKS314+WKS324+ WKS334+WKS344). Admission is subject to approval by the Departmental Chairperson.
Microbial Biotechnology	At least 64 credits in Biochemistry or Microbiology at third year level or else in consultation with the Departmental Chairperson. An average of 65% in undergraduate Microbiology or Biochemistry modules. Admission is subject to a selection process.
Microbiology	At least 64 credits in Microbiology at third year level. An average of 65% in undergraduate Microbiology modules. These include VWS344 and BOC314. Admission is subject to a selection process.
Physics	An average pass mark of 60% in (FSK314+FSK332+FSK352+FSK324+FSK342+ FSK362).
Plant Health	Plant Health or equivalent modules at third year level.
Plant Sciences and Plant Molecular Biology	A minimum of 60% in the appropriate Botany or equivalent modules at third year level in consultation with the Departmental Chairperson.
Polymer Science	A minimum of 60% average for all the Chemistry modules on third-year level is required
Soil Science	Soil Science at third year level.
Statistics	WTW114 and WTW124 as well as a minimum average pass mark of 60% in (STK216+STK226+STK316+STK326). Admission is subject to the approval by the Departmental Chairperson.
Wildlife	Grassland Science at third year level or equivalent modules in consultation with the Departmental Chairperson.
Zoology	Zoology at third year level.

BSc Four-year Curriculum (Extended Programme) – South Campus (4393)

The BSc Four-year Curriculum (Extended Programme) runs over a minimum of four years and is aimed to improve the throughput rate of the BSc degree. Students can only move to the mainstream on the main campus if all modules were passed on the South Campus.

***Modules with an asterisk are year modules.**

Year		Semester 1	Semester 2	Admission requirements
1		**Compulsory**	**Compulsory**	• A minimum AP of 25 plus a performance level 4 (50%) in an official tuition language. • Mathematics on performance level 3 (40%). • Life Sciences on performance level 4 (50%) or Physical Sciences on performance level 3 (40%).
	Academic language course	ALN108*		
	Life-long Learning – Natural Sciences	VBN108*		
	Mathematics	WTV154 (Mathematics on level 3) OR WTV194 (Mathematics on level 4)	WTV164	
	Chemistry	CHE112 + CHE132		
	Basic Computer Literacy	BRC111	CHE122 + CHE142	
NB	**After successful completion of ALL the modules in the <u>first year</u> of the BSc Four-year Curriculum (Extended Programme) – South Campus, the student changes to the first year mainstream modules of the learning programme of his/her choice on the main campus set out in the Faculty's Yearbook. Students must take note of the following requirements:** • **To register for CHE122 students must have passed CHE112 and CHE132.** • **To register for CHE142 students must have passed CHE112 and WTV154 or level 4 for NCS Mathematics.** • **To register for WTV164 students must have passed WTV154 or have a level 4 for NCS Mathematics.** A student must have at least 104 credits in the first year of study of which: (i) a minimum of 40 credits of the 104 credits should be **mainstream modules** [CHE122, CHE132, CHE142 and WTV164 modules], and (ii) a minimum of a further 64 credits should be **development modules** [ALN, VBN, CHE112, WTV154 and BRS modules]. Students, who could not complete the first two years of study in three years, will **not be allowed for re-registration** to the Faculty of Natural and Agricultural Sciences.			
2	In their second year of study students have to register for CHE151, CHE161, ALC208* and BRS121 as well as all the <u>first year</u> mainstream modules in the learning programme of choice as set out in the Faculty Yearbook. **Students must take note of the following requirements:** • **To register for CHE151 students must have passed CHE122 + CHE142 as well as WTV164.** • **To register for CHE161, students must have passed CHE151.** • **The modules CHE112, CHE122, CHE132, CHE142, CHE151 and CHE161 must be passed to get recognition for CEM114 and CEM124/CEM144 (See BSc mainstream learning programmes).**			
3	**Follow mainstream <u>second year</u> learning programme of choice as set out in the Faculty Yearbook.** Students must take note of the following requirement: • Students must have pass CHE151, CHE161, ALC208* and BRS121 to be allowed to change to the programme code of current study.			
4	**Follow mainstream <u>third year</u> learning programme of choice as set out in the Faculty Yearbook.**			

- Students who want to continue with Geography, should take GEO114/124
- Take note that students who want to continue with Geology should apply, on the prescribed selection form, before 31 May of the year before intended admission.
- Students who want to continue with Computer Science, should take RIS114 and RIS154, as well as RIS124 and RIS164

UPP Natural and Agricultural Sciences (South Campus - 4002)
(Chemistry / Mathematics Combination)

Students who are not successful in gaining admission to the university may follow a University Preparation Programme (UPP) to obtain access. The programme provides students with an opportunity to enjoy general-formative and vocationally-directed studies at various further and higher education institutions after successful completion of a bridging year. The University Preparation Programme also addresses, through a course in Skills and Competencies in Lifelong Learning, the student's wider needs with regards to quality of personal life, study and reading skills, self-assertiveness, problem solving, and other generic competencies. These students also attend an academic language course in English to improve their reading and writing skills for higher education purposes.

***Modules with an asterisk are year modules.**

Contact details:
051 505 1201/1362 or 051 401 2367

Year		Semester 1	Semester 2	Admission requirements
1		**Compulsory**	**Compulsory**	• National Senior Certificate (NSC) • 4 Subjects with minimum achievement level of 3 (40%) • University Free State (UFS) Minimum Admission Point of 20 • Language of instruction: (Afrikaans or English) Minimum achievement level 3 (40%) • Mathematics: Minimum achievement level 3 (40%). • Life Sciences: Minimum achievement level 3 (40%) or Physical Science: Minimum achievement level 3 (40%)
	Academic language course	ALN108*		
	Life-long Learning – Natural Sciences	VBN108*		
	Mathematics	WTV154	WTV164	
	Chemistry	CHE112 + CHE132	CHE122 + CHE142	
	Basic Computer Literacy	BRC111		
NB	**After successful completion of ALL the modules in the <u>first year</u> of the BSc Four-year Curriculum (Extended Programme) – South Campus, the student changes to the first year mainstream modules of the learning programme of his/her choice on the main campus set out in the Faculty's Yearbook. Students must take note of the following requirements:** • **To register for CHE122 students must have passed CHE112 and CHE132.** • **To register for CHE142 students must have passed CHE112 and WTV154 or level 4 for NCS Mathematics.** • **To register for WTV164 students must have passed WTV154 or have a level 4 for NCS Mathematics.** A student must have at least 104 credits in the first year of study of which: (i) a minimum of 40 credits of the 104 credits should be **mainstream modules** [CHE122, CHE132, CHE142 and WTV164 modules], and (ii) a minimum of a further 64 credits should be **development modules** [ALN, VBN, CHE112, WTV154 and BRS modules]. Students, who could not complete the first two years of study in three years, will **not be allowed for re-registration** to the Faculty of Natural and Agricultural Sciences.			
2	In their second year of study students have to register for CHE151, CHE161, ALC208* and BRS121 as well as all the <u>first year</u> mainstream modules in the learning programme of choice as set out in the Faculty Yearbook. **Students must take note of the following requirements:** • **To register for CHE151 students must have passed CHE122 + CHE142 as well as WTV164.** • **To register for CHE161, students must have passed CHE151.** • **The modules CHE112, CHE122, CHE132, CHE142, CHE151 and CHE161 must be passed to get recognition for CEM114 and CEM124/CEM144 (See BSc mainstream learning programmes).**			
3	**Follow mainstream <u>second year</u> learning programme of choice as set out in the Faculty Yearbook.** Students must take note of the following requirement: • Students must have pass CHE151, CHE161, ALC208* and BRS121 to be allowed to change to the programme code of current study.			
4	**Follow mainstream <u>third year</u> learning programme of choice as set out in the Faculty Yearbook.**			

- Students who want to continue with Geography, should take GEO114/124.
- Take note that students who want to continue with Geology should apply, on the prescribed selection form, before 31 May of the year before intended admission.
- Students who want to continue with Computer Science, should take RIS114 and RIS154, as well as RIS124 and RIS164.

General Biology First-year

The general Biology first-year is completed by biology students that enrol for all learning programmes except Behavioural Genetics who have to register according to the module composition of this learning programme.

PLEASE TAKE NOTE:
If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
WTW134 - Grade 12 Mathematics (HG) E or SG (C) or performance level 5 or (for senior students) a pass in WTW164/WTV164 or WTW184 (Main Campus).

FSK134, FSK144 and CEM144 are service modules to equip students with the necessary knowledge to prepare them to apply these concepts in other disciplines.

Students who wish to continue with Chemistry in their second year must enrol for CEM114 and CEM124.
Students who wish to continue with Physics in their second year must enrol for FSK114 and FSK124.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Biology	BLG114	BLG124+BLG144
	- Chemistry	CEM114	CEM124 or CEM144
	- Biometry		BMT124
	- Mathematics	WTW114 or WTW134	
	- Physics	FSK114 or FSK134	
	- Computer literacy	BRS111	BRS121
	Optional:		
	- Anatomy		ANA124
	- Physics		FSK124 or FSK144
	- Geography	GEO114	GEO124
	- Geology	GLG114	GLG124
	- Computer Information Systems	RIS134	RIS144
	- Psychology	PSY112+PSY152	PSY124
	- Statistics	STK114	STK124
	- Mathematics		WTW124 or WTW144

ADMISSION REQUIREMENTS

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively(senior students) a pass mark in WTW164/WTV164 is required.
- Life Sciences on performance level 5 (60%) or Physical Sciences on performance level 4 (50%).
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.

Biodiversity describes “Life on Earth”. It includes the total variety of organisms and their interaction with one another and their environment. This interaction takes place on physical, physiological and genetic levels. The study of biodiversity starts in individuals, followed by populations, species etc. Biodiversity therefore reflects the sum total of life. The survival of living cells and organisms are dependent on the flow of energy, matter and genetic information. These complex interaction occur between different molecules, macro molecules and cells. The ordered relationship among molecules therefore forms the basis of life.

Possible learning programmes in Biology are:

Behavioural Genetics (4377)
Biochemistry (4306)
Botany (4302)
Entomology (4304)
Genetics (4307)
Human Molecular Biology (4376)
Microbiology (4305)
Plant Health (4358)
Plant Molecular Biology (4308)
Zoology (4303)

Composition of a learning programme

- At first year level the modules with a credit value of at least 120 have to be passed.
- On both second and third year level, modules with a credit value of at least 96, but preferably 128 have to be passed.
- For a BSc degree modules with a total weight of at least 392 credits must be passed (384 degree credits plus BRS111 and BRS121).
- A '+' between modules indicate that all the modules must be taken. A comma between modules indicates the modules may be taken independently.
- The word 'or' between modules indicates that only one of the modules may be taken.
- Prerequisites of individual modules must always be adhered to.
- Additional modules may be taken only if the timetable allows it.

Behavioural Genetics (4377)

Behavioural Genetics is a combination of psychology and genetics. The main purpose of this subject area is to study the interaction between the environment and hereditary behavioural patterns. After completion of this study, the student will have a thorough basic knowledge of Behavioural Genetics. The student will be capable of specialising on post graduate level (up until PhD) in Behavioural Genetics, Genetics of Psychology. Post graduate training is essential in order to work as a behavioural geneticist. All postgraduate studies are subject to selection (see the Postgraduate book for more information).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Biology	BLG114	BLG124+144
	- Biometry		BMT124
	- Chemistry	CEM114	CEM124 or CEM144
	- Psychology	PSY112+PSY152	PSY124
	- Mathematics	WTW114 or WTW134	
	- Computer literacy	BRS111	BRS121
2	**Compulsory**		
	- Genetics	GEN216	GEN246
	- Psychology	PSY212+PSY232	PSY224
	Sufficient modules to obtain at least another 48 credits from:		
	- Biochemistry	BOC216	BOC226
	- Zoology	DRK252, DRK214	DRK262, DRK224
	- Entomology	ENT216	ENT226
	- Physiology	FFG216	FFG226
3	**Compulsory**		
	- Genetics	GEN334+GEN354	GEN324+GEN344
	- Psychology	PSY332+PSY312	PSY324
	Sufficient modules to obtain at least another 24 credits from:		
	- Biochemistry	BOC314, BOC334	BOC324, BOC344
	- Human molecular biology	MBG314, MBG334	MBG324, MBG344
	- Zoology	DRK314, DRK334	DRK324, DRK344
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324, ENT344
	- Physiology	FFG316+FFG332	FFG326+FFG342

Biochemistry (4306)

This learning programme is designed for students interested in biology, but with a knack for chemistry. After completion of this programme, students will be well prepared as technicians for a wide range of sectors, including medical research, agriculture as well as the food, biotechnological and chemical industries.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Biochemistry	BOC216	BOC226
	Sufficient modules to obtain at least another 80 credits from:		
	- Microbiology	MKB216	MKB226
	- Physiology	FFG216	FFG226
	- Entomology	ENT216	ENT226
	- Genetics	GEN216	GEN246
	- Botany	PLK214, PLK212	PLK224, PLK262
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Zoology	DRK252, DRK214	DRK262, DRK224
	- Food Science	VWS212, VWS232	VWS222, VWS224
	- Statistics	STK216	STK226
3	**Compulsory**		
	- Biochemistry	BOC314+BOC334	BOC324+BOC344
	Sufficient modules to obtain at least another 64 credits from:		
	- Microbiology	MKB314, MKB334	MKB324, MKB344, MKB364
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324, ENT344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Botany	PLK314, PLK334, PLK354	PLK324, PLK344
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Zoology	DRK314, DRK334	DRK324, DRK344
	- Food Science	VWS314, VWS334	VWS324, VWS344
	- Physiology	FFG316+FFG332	FFG326+FFG342
	- Statistics	STK316	STK326

Botany (4302)

Completion of this study provides the student with a fundamental knowledge of botany, including ecology of land and water ecosystems. The student can be employed as researcher/teacher/ lecturer/environmental consultant/conservationist in the environmental or agricultural sectors, education and appropriate private institutes. After completion of the third year a postgraduate study in Botany up to PhD level can be followed.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Botany	PLK214+PLK212	PLK224+PLK262
	Sufficient modules to obtain at least another 80 credits from :		
	- Biochemistry	BOC216	BOC226
	- Chemistry	CEM214, CEM232	CEM224, CEM242
	- Zoology	DRK252, DRK214	DRK262, DRK224
	- Entomology	ENT216	ENT226
	- Genetics	GEN216	GEN246
	- Geography	GEO214, GEO234	GEO224, GIS224
	- Geology	GLG212, GLG232, GLG214, GLG252, GLG202	GLG222, GLG224, GLG242, GLG244
	- Microbiology	MKB216	MKB226
3	**Compulsory**		
	- Botany	PLK314+PLK334	PLK324+PLK344
	Sufficient modules to obtain at least another 64 credits from:		
	- Biochemistry	BOC314, BOC334	BOC324, BOC344
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Zoology	DRK314, DRK334	DRK324, DRK344
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324+ENT344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Geography	GEO314, GEO334	GEO324, GIS324
	- Geology	GLG314, GLG334, GLG354, GLG374	GLG324, GLG344, GLG364, GLG384
	- Microbiology	MKB314, MKB334	MKB324, MKB344

Entomology (4304)

After completion of this learning programme, the student will be able to work as a technician within the total spectrum of the discipline of entomology. However, to become a qualified entomologist, the student is advised to follow an honours module in the fourth year. Excellent facilities for postgraduate studies up to PhD level are available.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Entomology	ENT216	ENT226
	Sufficient modules to obtain at least another 80 credits from:		
	- Agronomy and Hortology		AGR224, AGR324, HRT324
	- Biochemistry	BOC216	BOC226
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Zoology	DRK252, DRK214	DRK262, DRK224
	- Genetics	GEN216	GEN246
	- Geography	GEO214, GEO234	GEO224, GIS224
	- Geology	GLG214, GLG212, GLG232, GLG252, GLG202	GLG224, GLG222, GLG242, GLG244
	- Microbiology	MKB216	MKB226
	- Botany	PLK214, PLK212	PLK224, PLK262
	- Plant pathology, Plant breeding	PPG214	PPG324, PLT224
3	**Compulsory**		
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324+ENT344
	Sufficient modules to obtain at least another 64 credits from:		
	- Agronomy	AGR314, AGR414, AGR434	AGR424, AGR444
	- Biochemistry	BOC314, BOC334	BOC324, BOC344
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Zoology	DRK314, DRK334	DRK324, DRK344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Geography	GEO314, GEO334	GEO324, GIS324
	- Geology	GLG314, GLG334, GLG354, GLG374	GLG324, GLG344, GLG364, GLG384
	- Microbiology	MKB314, MKB334	MKB324, MKB344
	- Botany	PLK314, PLK334, PLK354	PLK324, PLK344
	- Plant pathology, Plant breeding	PPG414, PPG434, PLT314	PPG424, PPG444, PLT424

Genetics (4307)

Completion of this study provides the student with a fundamental knowledge of genetics. The student will be able to specialise at post-graduate level (up to a PhD) in population, molecular or cytogenetic fields in human, animal or plant genetics. With a three-year qualification the student will only be able to be employed as a technician in agricultural, forestry, seed, pest control and medical research institutes. All postgraduate studies are subject to selection (see the Postgraduate book for more information).

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Genetics*	GEN216	GEN246
	Sufficient modules to obtain at least another 80 credits from:		
	- Biochemistry	BOC216	BOC226
	- Zoology	DRK252, DRK214	DRK262, DRK224
	- Entomology	ENT216	ENT226
	- Physiology	FFG216	FFG226
	- Microbiology	MKB216	MKB226
	- Botany	PLK214, PLK212	PLK262, PLK224
3	**Compulsory**		
	- Genetics	GEN334+GEN354	GEN324+GEN344
	Sufficient modules to obtain at least another 64 credits from:		
	- Biochemistry	BOC334, BOC314	BOC324, BOC344
	- Human molecular biology	MBG314, MBG334	MBG324, MBG344
	- Zoology	DRK314, DRK334	DRK324, DRK344
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324+ENT344
	- Physiology	FFG316+FFG332	FFG326+FFG342
	- Microbiology	MKB314, MKB334	MKB324, MKB344
	- Botany	PLK314, PLK334, PLK354	PLK324, PLK344

Human Molecular Biology (4376)

This learning programme offers the student career opportunities in various biological research institutes, the pharmaceutical industry as well as biotechnological and training institutions whereas sound knowledge of molecular biology is required. For students interested in a career as medical scientist it is recommended that the student follows an applied honours degree during the fourth study year and adheres to the regulations of the Health Professions' Council of SA. Postgraduate study up to PhD level is possible. All postgraduate studies are subject to selection (see the Postgraduate book for more information).

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Genetics	GEN216	GEN246
	Enough modules to obtain 80 credits		
	- Biochemistry	BOC216	BOC226
	- Microbiology	MKB216	MKB226
	- Physiology	FFG216	FFG226
	- Zoology	DRK214, DRK252	DRK262, DRK224
3	**Compulsory**		
	- Human Molecular Biology*	MBG314+MBG334	MBG324+MBG344
	- Genetics	GEN334+GEN354	GEN324+GEN344

* Please consult the prerequisites at the end of the book.

Microbiology (4305)

Students will have a sound knowledge of the characteristics and application of micro-organisms. Students can be employed in the agricultural or environmental sectors, health services as well as in the food or other biotechnology related industries. They can be applied as production, laboratory or research technicians or in the purchasing, sales or marketing departments of industries. After completion of the programme the student may apply to post-graduate studies in Microbiology.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Microbiology	MKB216	MKB226
	- Biochemistry	BOC216	BOC226
	Additional modules to obtain credits can be chosen from*:		
	- Microbiology		IQM242
	- Food Science	VWS212, VWS232	VWS222, VWS224
	- Entomology	ENT216	ENT226
	- Genetics	GEN216	GEN246
	- Botany	PLK214, PLK212	PLK224, PLK262
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Zoology	DRK252, DRK214	DRK262, DRK224
	- Statistics	STK216	STK226
3	**Compulsory**		
	- Microbiology	MKB314+MKB334	MKB324
	One of the following four:		
	- Biochemistry	BOC314** (recommended)	
	- Microbiology		MKB364, MKB344
	- Food Science		VWS344**
	Sufficient modules to obtain at least another 32 credits from*:		
	- Biochemistry	BOC314, BOC334	BOC324, BOC344
	- Microbiology		MKB364, MKB344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Food Science	VWS314, VWS334	VWS324, VWS344
	- Statistics	STK316	STK326

* Take note that 392 credits are required for the degree and that the typical number of credits on each of the 2nd and 3rd year are 128.
** For purposes of credit calculation BOC314 and VWS344 are considered as Microbiology modules in this learning programme.

Plant Health (4358)

After completion of these studies, the student will have a thorough knowledge of environmental factors influencing the health of plants with emphasis on the underlying ecological principals involved. With this unique holistic approach as background, the student will be exceedingly competent in services in environmental and agricultural institutes where the conservation or cultivation of healthy plants is of vital importance. After completion of the third year and depending on which major subjects were chosen in the second year, the student can proceed with post graduate studies in Plant Health, in combination with Botany and/or Entomology up to a PhD level.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Plant pathology	PPG214+PPG334	PPG324
	Sufficient modules to obtain at least another 80 credits from:		
	- Entomology	ENT216	ENT226
	- Botany	PLK214, PLK212	PLK224, PLK262
	- Genetics	GEN216	GEN246
3	**Compulsory**		
	- Plant pathology	PPG414+PPG434	PPG424+PPG444
	Sufficient modules to obtain at least another 64 credits from:		
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324+ENT344
	- Botany	PLK314, PLK334, PLK354	PLK324, PLK344
	- Biochemistry	BOC314	
	- Genetics		GEN324

Plant Molecular Biology (4308)

After completion of this study the student will have a sound knowledge of the theoretical approaches in plant biotechnology and will be able to be taken into service by industries involved with the use of plants and plant systems in bio-processing and bio-production where they will be employed as researchers. They can also be used as production, laboratories or research assistants and will also be equipped with basic management skills.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Botany	PLK214+PLK212	PLK224+PLK262
	Sufficient modules to obtain at least another 80 credits from:		
	- Biochemistry	BOC216	BOC226
	- Chemistry	CEM232, CEM214	CEM224
	- Genetics	GEN216	GEN246
	- Microbiology	MKB216	MKB226
3	**Compulsory**		
	- Botany	PLK354	PLK324+PLK344
	- Biochemistry	BOC314	
	Sufficient modules to preferably obtain another 64 credits from:		
	- Biochemistry	BOC334	BOC324, BOC344
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Microbiology	MKB314, MKB334	MKB324, MKB344, MKB364
	- Botany	PLK314, PLK334	

Zoology (4303)

This learning programme is designed for students interested in biology with zoology as focus. After completion of the third year a student can proceed with postgraduate studies up to the PhD level.

Year		Semester 1	Semester 2
1	General Biology first-year	See p. 16	
2	**Compulsory**		
	- Zoology	DRK252+DRK214	DRK262+DRK224
	Sufficient modules to obtain at least 80 credits from:		
	- Anatomy*	ANA216	ANA226
	- Biochemistry	BOC216	BOC226
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Entomology	ENT216	ENT226
	- Genetics	GEN216	GEN246
	- Geography	GEO214, GEO234	GEO224, GIS224
	- Geology	GLG214, GLG212, GLG232, GLG252, GLG202	GLG224, GLG222, GLG242, GLG244
	- Histology*	HTG214	HTG224
	- Microbiology	MKB216	MKB226
	- Botany	PLK214, PLK212	PLK224, PLK262
3	**Compulsory**		
	- Zoology	DRK314+DRK334	DRK324+DRK344
	Sufficient modules to obtain at least 64 credits from:		
	- Anatomy*	ANA316+ANA304	ANA326
	- Biochemistry	BOC314, BOC334	BOC324, BOC344
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Entomology	ENT314+(ENT334 or ENT354)	ENT324, ENT344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Geography	GEO314, GEO334	GEO324, GIS324
	- Geology	GLG314, GLG334, GLG354, GLG374	GLG324, GLG344, GLG364, GLG384
	- Histology*	HTG304	
	- Microbiology	MKB314, MKB334	MKB324, MKB344
	- Botany	PLK314, PLK334, PLK354	PLK324, PLK344

* Students have to choose between Anatomy and Histology. They may not be taken at the same time. If a student chooses to take both, only one will be credit bearing.

This programme is designed for students with a strong mathematical inclination who would like to specialise in a mathematical discipline. The various mathematical subjects can be combined with Computer Science, Physics, Chemistry or various Biological disciplines.

Possible learning programmes in Mathematical Sciences are:
LP1: Mathematics and Applied Mathematics (4331)
LP2: Financial Mathematics (4332)
LP3: Mathematical Statistics (4333)
LP4: Economics (4396)
LP5: Risk analysis (4335)
LP6: Actuarial Science (4336)
LP7: Investment Science (4394)

Composition of a learning programme

- At first year level the modules with a credit value of at least 120 have to be passed.
- On second year level, modules with a credit value of at least 96, but preferably 128 have to be passed. On third year level the minimum credit value must be 120.
- For a BSc degree modules with a total weight of at least 392 credits must be passed (384 degree credits plus BRS111 and BRS121).
- A '+' between modules indicate that all the modules must be taken. A comma between modules indicates the modules may be taken independently.
- The word 'or' between modules indicates that only one of the modules may be taken.
- Prerequisites of individual modules must always be adhered to.
- Additional modules may be taken only if the timetable allows it.

Admission requirements for LP1-LP3 and LP5

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 7 (80%). Alternatively (senior students) a pass mark of at least 70% in WTW164/WTV164 or at least 60% in WTW184 (Main Campus) or a pass in WTW134 is required.

Admission requirements for LP4

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- If the modules WKS114 are included in the learning programme, Mathematics HG = D is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.
- If WTW134 is chosen in the first year: Grade 12 Mathematics (HG) E or SG (C) or performance level 5 or (for senior students) a pass in WTW164/WTV164 or WTW184 (Main Campus).

Admission requirements for LP6 and LP7

- A minimum AP of 34 plus a performance level 4 in an official language.
- Mathematics on performance level 7 (80%). Alternatively (for senior students) a pass mark of at least 70% in WTW164/WTV164 or at least 60% in WTW184 (Main Campus) or a pass in WTW134 is required.

Learning programme 1: Mathematics and Applied Mathematics (4331)

This learning programme is recommended for students who wish to develop a sound mathematical base for a career as scientist, mathematical analyst, financial mathematician, lecturer or teacher. Students can broaden their scientific background by combining their mathematical subjects with Physics or Chemistry or can place a higher emphasis on Mathematics modules. For a career in Applied Mathematics the student must first develop a solid mathematical background.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Mathematics	WTW114	WTW124
	- Computer literacy	BRS111	BRS121
	At least one module per semester from :		
	- Chemistry	CEM114	CEM124
	- Physics	FSK114	FSK124
	Enough modules to earn at least 120 credits on first year level.		
	Additional modules can be taken in the first and second semester		
	- Computer Information Systems	RIS114 or RIS134	(RIS124 or RIS144), RIS164
	- Mathematical Statistics	WKS114	WKS124
	- Astronomy	FSK154	FSK164
2	**Compulsory**		
	- Mathematics and Applied Mathematics	WTW214+WTW254	WTW224
	Plus at least one of the following:		
	- Mathematics and Applied Mathematics	WTW234	WTW244, WTW264
	Enough other modules to earn at least 96 credits (preferably 128) on second year level.		
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Physics	FSK232, FSK214	FSK242, FSK224
	- Business Management	EBUS61406	EBUS62406
	- Computer Information Systems	RIS214	RIS224, RIS264
	- Mathematical Statistics	WKS216	WKS226
	- Agrometeorology	LWR214, LWR314	LWR324
3	**At least four semester modules from the following eight:**		
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364, WTW384
	Enough other modules to earn at least 120 credits (preferably 128) on third year level.		
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Physics	FSK314, FSK332, FSK352	FSK324, FSK342, FSK362
	- Business Management	EBUS75407	EBUS76407
	- Computer Information Systems	RIS314, RIS334	RIS324, RIS344
	- Mathematical Statistics	WKS314, WKS334	WKS324, WKS344
	- Agrometeorology	LWR414, LWR434	LWR424, LWR444

Learning programme 2: Financial Mathematics (4332)

This interdisciplinary learning programme is aimed at students that are interested in mathematics in the financial world. Financial institutions such as banks, insurance and investment companies need well trained mathematicians with a sound base in the economic sciences. This combination of skills offers excellent career opportunities for graduates that can do mathematical analyses of financial problems. Students can decide how big emphasis they want to put on the various disciplines. Postgraduate study will enable a person to handle more complex financial models.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Mathematics	WTW114	WTW124
	- Computer literacy	BRS111	BRS121
	- Economic systems and basic micro economics	EECF61306	
	- Introduction to macro economics		EECF62306
	- Mathematical Statistics	WKS114	WKS124
	Enough other modules to earn at least 120 credits on first year level. The following is possible among others:		
	- General Management		EBUS62406
	- Computer Information Systems	RIS134	RIS144
	- Accounting	EACC61406	EACC62406
2	**Compulsory**		
	- Mathematics and Applied Mathematics	WTW214+WTW234+WTW254	WTW224+WTW244+ WTW264
	Enough modules to earn preferably another 32 credits on second year level. The following is possible among others:		
	- Actuarial Science	ATW216	ATW226
	- Micro Economics	EECS71407	
	- Macro Economics		EECS72407
	- Money and Interest Rates	EFES71407	
	- Financial Markets, Instruments and Institutions		EFES72407
	- Core Business Activities	EBUS61406	
	- General Management		EBUS62406
	- Mathematical Statistics	WKS216	WKS226
3	**At least four semester modules from the following eight:**		
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364, WTW384
	Enough other modules from the following to earn at least 120 credits (preferably 128) on third year level:		
	- International Economics	EECT71407	
	- Economic Policy in South Africa		EECT72407
	- Introductory Mathematical	EECM71407	
	- Statistics for Economics		EECM72407
	- Investment Management	EFET71407	
	- Bank Management and Financial Services		EFET72407
	- Strategic Management	EBUS75407	
	- Financial Management		EBUS76407

Learning programme 3: Mathematical Statistics (4333)

This learning programme focuses on stochastic models with various applications for Mathematical Statistics. In particular, this learning programme seeks to introduce students to the vast potential for statistical applications in commercial sciences. If a student wishes to study Mathematical Statistics and other natural science modules, these subjects can be combined within other learning programmes offered by the Faculty of Natural and Agricultural Sciences. This learning programme enables students to proceed with postgraduate study in Mathematical Statistics and thus be trained for a career as a Statistician.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Computer Information Systems	RIS114 or RIS134	RIS124 or RIS144
	- Mathematics	WTW114	WTW124
	- Mathematical Statistics	WKS114	WKS124
	- Computer literacy	BRS111	BRS121
	Enough additional modules to earn a minimum of 32 credits on first year level. The following choices are possible (amongst others):		
	- Psychology	PSY112+PSY152	PSY124
	- Economics	EECF61306	EECF62306
	- Accounting	EACC61406	EACC62406
2	**Compulsory**		
	- Mathematical Statistics	WKS216	WKS226
	- Mathematics and Applied Mathematics	WTW214+WTW254	WTW224+WTW264
	Enough additional modules to earn a minimum of 32 credits on second year level. The following choices are possible (amongst others):		
	- Psychology	PSY212+PSY232	PSY224
	- Mathematics and Applied Mathematics	WTW234	WTW244
	- Actuarial Science	ATW216	ATW226 or ATW246
	- Economics	EECS71407	EECS72407
	- Financial Economics	EFES71407	EFES72407
3	**Compulsory**		
	- Mathematical Statistics	WKS314+334	WKS324+WKS344
	Enough additional modules to earn a minimum of 64 credits on third year level. The following choices are possible (amongst others):		
	- Psychology	PSY312, PSY332	PSY324
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364, WTW384
	- Actuarial Science	ATW306, ATW316	ATW306, ATW326
	- Economics	EECT71407	EECT72407
	- Econometrics		EECM72407
	- Financial Economics	EFET71407	EFET72407
	- Financial Management		EBUS76407

Learning programme 4: Economics (4396)
(BSc with endorsement in Economics)

With core modules in Statistics, Economics and Financial Economics, and first-year level Mathematics, this BSc degree will make it possible to become an Economist, Econometrician, Statistician, Financial Economist or a Financial Advisor. Postgraduate study in Statistics, Economics, or Financial Economics is possible after this degree.

Year		Semester 1	Semester 2
1	- Mathematics	WTW114 or WTW134	WTW124 or WTW144
	- Statistics	STK114	STK124
	- Computer Information Systems	RIS134	RIS144
	- Computer literacy	BRS111	BRS121
	- Economics	EECF61306	EECF62306
	The following modules are optional if WTW234 or WTW264 is chosen in the second year of study. If the student chooses EACC60806 in the second year of study, these additional modules are compulsory:		
	- Accounting	EACC61406	EACC62406
2	- Statistics	STK216	STK226
	- Economics	EECS71407	EECS72407
	- Financial Economics	EFES71407	EFES72407
	One of the following modules:		
	- Mathematics and Applied Mathematics	WTW234	WTW264
	- Accounting	*EACC60806	*EACC60806
3	- Statistics	STK316+STK332	STK326+STK342
	- Economics	EECT71407	EECT72407
	- Financial Economics	EFES71407	EFES72407

∗ Year module

Learning programme 5: Risk analysis (4335)

This stream is specifically designed for students who want to follow the post-graduate MSc programme in Risk Analysis. Risks are analysed scientifically and the results are utilised to control crises and losses in future and to minimise the impact thereof. Areas where risk-analysis is applied include insurance, economy, property and natural resources. The programme also offers the student the opportunity to continue with normal post-graduate study in Mathematical Statistics, depending on the subjects taken in the third year.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Computer Information Systems	RIS114	RIS124, RIS164
	- Mathematics	WTW114	WTW124
	- Mathematical Statistics	WKS114	WKS124
	- Economics	EECF61306	EECF62306
	- Computer literacy	BRS111	BRS121
2	**Compulsory**		
	- Actuarial Science	ATW216	ATW226
	- Mathematical Statistics	WKS216	WKS226
	- Computer Information Systems	RIS214	RIS224
	- Mathematics and Applied Mathematics	WTW214+WTW254	WTW264
3	**Compulsory**		
	- Mathematical Statistics	WKS314+WKS334	WKS324+WKS344
	Enough modules to earn at least another 64 credits from:		
	- Actuarial Science	ATW314+ATW304	ATW304
	- Financial Economics	EFET71407	EFET72407
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364

Learning programme 6: Actuarial Science (4336)

The University of the Free State follows the learning programme of the Actuarial Society of South Africa, ASSA, where all the first technical subjects, as well as the application subjects, comply with those from the Institute of Actuaries in Britain. Students obtaining prescribed minimum standards in the UFS subjects earn exemption from ASSA and the Institute for these subjects. Subjects in which exemption is not earned must be repeated directly through ASSA or the Institute, along with other subjects for full qualification. Exemptions are recommended after completing the degree, for the subjects CT1 to CT8 from the Institute, or the A100 and A200 series from ASSA. From 2011, CA1 (A301) is also presented in the honours year.

Prospective students who would like more information regarding this programme are welcome to consult our website www.ufs.ac.za/actuarial.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Financial Management and Reporting	FBS114	FBS122
	- Economics	EECF61306	EECF62306
	- Computer Information Systems	RIS134	RIS144
	- Actuarial Science		ATW164
	- Mathematics	WTW114	WTW124
	- Mathematical Statistics	WKS114	WKS124
	- Computer literacy	BRS111	BRS121
2	**Compulsory**		
	- Actuarial Science	ATW216	ATW246
	- Economics	EECS71407	EECS72407
	- Mathematics and Applied Mathematics	WTW214+WTW254	WTW224+WTW264+WTW244
	- Mathematical Statistics	WKS216	WKS226
3	**Compulsory**		
	- Actuarial Science	ATW316+ATW306+ATW396	ATW306+ATW396
	- Mathematical Statistics	WKS314+WKS334	WKS324+WKS344

Learning programme 7: Investment Science (4394)

The investment science degree is specifically designed for students with a passion for mathematics and the workings of finance in any investment type, in particular for students who wish to eventually qualify as a Chartered Financial Analyst. The degree will provide students with a thorough grounding in mathematics (including, most importantly, financial or investment mathematics), mathematical statistics, investment strategies and practices, and economics, together with an understanding of computers, computer programming, and financial accounting. This basis allows for students to follow postgraduate degrees in investment science, mathematical statistics, or investment management (financial economics).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Financial Accounting	*EACC60806	*EACC60806
	- Economics	EECF61306	EECF62306
	- Computer Information Systems	RIS134	RIS144
	- Mathematics	WTW114	WTW124
	- Mathematical Statistics	WKS114	WKS124
	- Computer Literacy	BRS111	BRS121
	- Investment Science		ISC164
	- Financial Management and Reporting	FBS114	
2	**Compulsory**		
	- Actuarial Science	ATW216	ATW246
	- Economics	EECS71407	EECS72407
	- Mathematics and Applied Mathematics	WTW214+WTW254	WTW244+WTW264
	- Mathematical Statistics	WKS216	WKS226
3	**Compulsory**		
	- Actuarial Science	ATW396	ATW396
	- Mathematical Statistics	WKS314+WKS334	WKS324+WKS344
	- Financial Economics	EFET71407	
	- Investment Science	ISC354	
	- Financial Management		EBUS76407

∗ Year module

These learning programmes are intended for students who wish to graduate with physics and/or chemistry with combinations from other disciplines.

Possible learning programmes in Chemical and Physical Sciences are:
LP1: Physics (4342)
LP2: Chemistry (4343)
LP3: Astrophysics (4344)
LP4: Chemistry with Physics and Biology (4388)

Composition of a learning programme

- At first year level the modules with a credit value of at least 120 have to be passed.
- On both second and third year level, modules with a credit value of at least 96, but preferably 128 have to be passed.
- For a BSc degree modules with a total weight of at least 392 credits must be passed (384 degree credits plus BRS111 and BRS121).
- A '+' between modules indicate that all the modules must be taken.
- A comma between modules indicates the modules may be taken independently.
- The word 'or' between modules indicates that only one of the modules may be taken.
- Prerequisites of individual modules must always be adhered to.
- Additional modules may be taken only if the timetable allows it.

TAKE NOTE:
General Requirements for:
If the modules WKS114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.
WTW134 - Grade 12 Mathematics (HG) E or SG (C) or performance level 5 or (for senior students) a pass in WTW164/WTV164 or WTW184 (Main Campus).

FSK134, FSK144 and CEM144 are service modules to equip students with the necessary knowledge to prepare them to apply these concepts in other disciplines.

Students who wish to continue with Chemistry in their second year must enrol for CEM114 and CEM124.
Students who wish to continue with Physics in their second year must enrol for FSK114 and FSK124.

Admission requirements for LP1, LP2 and LP4:

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively (for senior students) a pass mark in WTW164/WTV164 is required.
- Life Sciences on performance level 5 (60%) or Physical Sciences on performance level 4 (50%).
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- If the modules WKS114 are included in the learning programme, Mathematics HG = D is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.

Admission requirements for LP3 (Astrophysics):

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 7 (80%). Alternatively (for senior students) a pass mark of at least 70% in WTW164/WTV164 is required.
- Life Sciences on performance level 5 (60%) or Physical Sciences on performance level 4 (50%).
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- If the modules WKS114 are included in the learning programme, Mathematics HG = D is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.

Learning programme 1: Physics (4342)

This learning programme makes provision for the student who is interested in Physics. Careers include working in industry, research laboratories and teaching at schools or universities. This programme is well suited to careers in many manufacturing industries (mining, agriculture and metallurgy) or engineering firms concerned with mechanical, civil, telecommunication and/or electronic and electrical activities. Careers in design, energy production, computer sciences, advanced instrumentation development and modelling are also possible. Postgraduate studies can be pursued in Physics provided that the necessary prerequisites are met. Combined career directions, for example combinations of Physics and law (e.g. patent lawyer) or Physics and economics directions (e.g. financial modelling or risk assessment) can also be considered after further studies in these other directions.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Physics	FSK114	FSK124
	- Mathematics	WTW114 or WTW134	WTW124 or WTW144
	- Computer Literacy	BRS111	BRS121
	Two modules per semester from:		
	- Chemistry	CEM114	CEM124
	- Computer Information Systems	RIS114 or RIS134	RIS124 or RIS144
	- Geology	GLG114	GLG124
	- Mathematical Statistics	WKS114	WKS124 or STK124
	- Astronomy	FSK154	FSK164
2	**Compulsory**		
	- Physics	FSK214+FSK232	FSK224+FSK242
	Enough modules to obtain 80credits from:		
	- Mathematics and Applied Mathematics	WTW214, WTW234, WTW254	WTW224, WTW244, WTW264
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Computer Information Systems *	RIS214	RIS224, RIS264
	- Geology	GLG212, GLG214	GLG222, GLG224
	- Mathematical Statistics	WKS216	WKS226
	- Agrometeorology	LWR214, LWR314	LWR324
3	**Compulsory**		
	- Physics	FSK314+FSK332+ FSK352	FSK324+FSK342+ FSK362
	Enough modules to obtain 64 credits from:		
	- Physics	FSK372	FSK382
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364, WTW384
	- Chemistry	CEM314, CEM334	CEM324+CEM344
	- Computer Information Systems	RIS314, RIS334	RIS324, RIS344
	- Geology	GLG314, GLG334, GLG354, GLG374	GLG324, GLG344, GLG364, GLG384
	- Mathematical Statistics	WKS314, WKS334	WKS324, WKS344
	- Agrometeorology	LWR414, LWR434	LWR424, LWR444
	Optional:		
	- Community service learning	NEC302 (year module)	

*Students who wish to complete RIS as a major subject in the third year, must complete RIS164 as an extra module.

Learning programme 2: Chemistry (4343)

This learning programme makes provision for the student who is interested in Chemistry. Careers include working in industry, research laboratories and teaching at schools or universities. This programme is well suited for careers in many manufacturing industries (food, mining) or engineering firms concerned with chemical activities. Careers in Chemistry which include natural products, structural elucidations, polymer- and/or new material development, catalysis, speed of reactions, analytical chemistry and electrochemical energy transformations may also be considered. Postgraduate studies can be pursued in Chemistry provided that the necessary prerequisites are met. Combined career directions, for example combinations of Chemistry and law (e.g. patent attorney) or Chemistry and economic directions (e.g. economic modelling or feasibility studies) can also be considered after further studies in these other directions.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Chemistry	CEM114	CEM124
	- Mathematics	WTW114 or WTW134	WTW124 or WTW144
	- Computer Literacy	BRS111	BRS121
	Two modules per semester from:		
	- Computer Information Systems	RIS114 or RIS134	RIS124 or RIS144
	- Geology	GLG114	GLG124
	- Mathematical Statistics	WKS114	WKS124 or STK124
	- Physics	FSK114 or FSK134	FSK124 or FSK144
	- Astronomy	FSK154	FSK164
2	**Compulsory**		
	- Chemistry	CEM214+CEM232	CEM224+CEM242
	Enough modules to obtain 80 credits from:		
	- Mathematics and Applied Mathematics	WTW214, WTW234, WTW254	WTW224, WTW244, WTW264
	- Computer Information Systems *	RIS214	RIS224, RIS264
	- Geology	GLG212, GLG214	GLG222, GLG224
	- Mathematical Statistics	WKS216	WKS226
	- Physics	FSK232+FSK214	FSK242+FSK224
3	**Compulsory**		
	- Chemistry	CEM314+CEM334	CEM324+CEM344
	Enough modules to obtain 64 credits from:		
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364, WTW384
	- Computer Information Systems	RIS314, RIS334	RIS324, RIS344
	- Geology	GLG314, GLG334, GLG354, GLG374	GLG324, GLG344, GLG364, GLG384
	- Mathematical Statistics	WKS314, WKS334	WKS324, WKS344
	- Physics	FSK314, FSK332, FSK352	FSK324, FSK342, FSK362
	Optional:		
	- Community service learning	NEC302 (year module)	

*Students who wish to complete RIS as a major subject in the third year, must complete RIS164 as an extra module.

Learning programme 3: Astrophysics (4344)

In this learning programme Astrophysics is presented together with Physics. During undergraduate studies, the modules in Astrophysics are resource based modules presented by the University of South Africa (UNISA) and count 12 credits each (irrespective of the last number in the code). Students who have successfully completed their studies can pursue postgraduate studies in basic Physics with Astrophysics modules which can lead to a MSc and PhD degree in Physics specialising in Astrophysics. Career possibilities include that of astronomer (astrophysicist) as well as physicist (see learning programme 1).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Astronomy	FSK154	FSK164
	- Physics	FSK114	FSK124
	- Mathematics	WTW114	WTW124
	- Computer Literacy	BRS111	BRS121
	One module per semester from:		
	- Chemistry	CEM114	CEM124
	- Computer Information Systems	RIS114 or RIS134	RIS124 or RIS144
	- Geology	GLG114	GLG124
	- Mathematical Statistics	WKS114	WKS124 or STK124
2	**Compulsory**		
	- Astronomy (year modules)	AST251, AST252, AST255	
	- Physics	FSK214+FSK232	FSK224+FSK242
	- Mathematics and Applied Mathematics		WTW244
	Enough modules to obtain 36 credits from:		
	- Mathematics and Applied Mathematics	WTW214, WTW234, WTW254	WTW224, WTW264
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Computer Information Systems	RIS214	RIS224, RIS264
	- Geology	GLG212, GLG214	GLG222, GLG224
	- Mathematical Statistics	WKS216	WKS226
3	**Compulsory**		
	- Astronomy (year modules)	AST354, AST355	
	- Physics	FSK314+FSK332+ FSK352+FSK372	FSK324+FSK342+ FSK362+FSK382
	- Mathematics and Applied Mathematics		WTW384
	Optional:		
	- Community service learning	NEC302 (year module)	

* Students choosing this learning programme must apply to UNISA during their first year and register during their second year to take the AST-modules. The module codes at UNISA differ slightly from those at the UFS as follows:

UFS	AST251	AST255	AST252	AST354	AST355
UNISA	AST2651	AST2655	AST2652	AST3763	AST3755

Learning programme 4: Chemistry with Physics and Biology (4388)

This learning programme makes provision for a student who is interested in Chemistry and the Biological Sciences where the foundation of biological systems and Chemistry is involved. It includes careers in any manufacturing industry as well as in fields such as medicine, the pharmaceutical industry, agriculture (including livestock, crops, pest control, soil and water), forestry, environmental, waste and pollution management and various careers in the marine environment. Post-graduate studies may be continued in Chemistry or any of the Biological Sciences if the necessary prerequisites are met.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Chemistry	CEM114	CEM124
	- Physics	FSK114 or FSK134	FSK124 or FSK144
	- Biology	BLG114	BLG124 or BLG144*
	- Mathematics	WTW114 or WTW134	WTW124 or WTW144
	- Computer Literacy	BRS111	BRS121
2	**Compulsory**		
	- Chemistry	CEM214+CEM232	CEM224+CEM242
	Enough modules to obtain 80 credits from:		
	- Biochemistry	BOC216	BOC226
	- Physics	FSK214, FSK232	FSK224, FSK242
	- Botany	PLK212, PLK214	PLK224, PLK262
	- Entomology	ENT216	ENT226
	- Food Science	VWS212, VWS232	VWS222, VWS224
	- Genetics	GEN216	GEN246
	- Microbiology	MKB216	MKB226
	- Physiology	FFG216	FFG226
	- Zoology	DRK252, DRK214	DRK262, DRK224
3	**Compulsory**		
	- Chemistry	CEM314+CEM334	CEM324+CEM344
	Enough modules to obtain 64 credits from:		
	- Biochemistry	BOC314, BOC334	BOC324, BOC344
	- Physics	FSK314, FSK332, FSK352	FSK324, FSK342, FSK362
	- Botany	PLK314, PLK334, PLK354	PLK324, PLK344
	- Entomology	ENT314, ENT334	ENT324, ENT344
	- Food Science	VWS314, VWS334	VWS324, VWS344
	- Genetics	GEN334, GEN354	GEN324, GEN344
	- Microbiology	MKB314, MKB334	MKB324, MKB344
	- Physiology	FFG316, FFG332	FFG326, FFG342
	- Zoology	DRK314, DRK334	DRK324, DRK344
	Optional:		
	- Community service learning	NEC302 (year module)	

* Students who wish to continue with Genetics in the second year must take both BLG124 and BLG144 to meet the necessary prerequisites.

The learning programmes in Geosciences are studies of the properties and processes in the earth and on the surface and encompass a holistic study of the human environment and accompanying interactions and relationships. The programme is aimed at students who are interested in various aspects of the environment and can lead to specialisation as environmentalists. Careers in the geosciences are divergent because all institutions that are involved with resource utilisation are legally obliged to examine the impact of their activities on the environment.

Possible learning programmes in the Geosciences are:

GEOLOGY
LP1: Geology (4361)
LP2: Geochemistry (4389)
LP3: Environmental Geology (4365)

GEOGRAPHY
LP4: Environmental Geography (4364)
LP5: Geographical Information Systems (4383)
(See learning programme 3 under Information Technology)

Composition of a learning programme
- At first year level the modules with a credit value of at least 120 (preferably 128) have to be passed.
- On both second and third year level, modules with a credit value of at least 96, but preferably 128 have to be passed.
- For a BSc degree modules with a total weight of at least 392 credits must be passed (384 degree credits plus BRS111 and BRS121).
- A '+' between modules indicate that all the modules must be taken.
- A comma between modules indicates the modules may be taken independently.
- The word 'or' between modules indicates that only one of the modules may be taken.
- Prerequisites of individual modules must always be adhered to.
- Additional modules may be taken only if the timetable allows it.

ADMISSION REQUIREMENTS FOR LP1 – LP3 [GEOLOGY]
Selection
- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively (for senior students) a pass mark in WTW164/WTV164 is required.
- Physical Sciences on performance level 4 (50%). Alternatively (for senior students) a pass mark in CHE122 and CHE142 is required.
- An AP of 34 and higher is highly recommended.

ADMISSION REQUIREMENTS FOR LP4 and LP5 [GEOGRAPHY]
- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively (for senior students) a pass mark in WTW164/WTV164 is required.
- Life Sciences on performance level 5 (60%) or Physical Sciences on performance level 4 (50%).

GEOLOGY

Learning programme 1: Geology (4361)

With completion of this learning programme to honours level you will be trained as a professional geologist with job opportunities in mining, exploration and research.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Geology	GLG114	GLG124
	- Chemistry	CEM114	
	- Computer literacy	BRS111	BRS121
	- Statistics		STK124
	One module in the first semester from:		
	- Statistics	STK114	
	- Mathematics	WTW114 or WTW134	
	One module in the first semester and two in the second semester from:		
	- Biology	BLG114	BLG124 or BLG144
	- Chemistry		CEM124 or CEM144
	- Physics	FSK114 or FSK134	FSK124 or FSK144
	- Geography	GEO114	GEO124
	- Soil Science	GKD214	
	- General Management		EBUS62406
	- Computer Information Systems	RIS134	RIS144
	- Mathematics		WTW124 or WTW144
2	**Option 1 (Geology specialisation)**		
	- Geology	GLG214+GLG212+GLG232+ GLG252+GLG202	GLG224+GLG222+GLG244+ GLG242
	- Geography		GIS224
	Modules to earn preferably another 16 credits in the first semester from the list of electives below option 2		
	Option 2 (Geology + second major)		
	- Geology	GLG214+GLG212+GLG232+ GLG252	GLG224+GLG222+GLG202, GLG244,GLG242
	Enough modules to earn at least 120 credits (preferably 128) on second year level from list of electives		
	Electives		
	- Chemistry	CEM214, CEM232	CEM224, CEM242
	- Physics	FSK214, FSK232	FSK224, FSK242
	- Geography	GEO214, GEO234	GEO224, GIS224
	- Soil Science	GKD314	GKD324
	- Entrepreneurship		EBUS74407
3	**Option 1 (Geology specialisation)**		
	- Geology	GLG314+GLG334+GLG354+ GLG374	GLG324+GLG344+GLG364+ GLG384
	Option 2 (Geology + second major)		
	- Geology	GLG314	GLG324
	- Geology (at least 32 credits)	GLG334, GLG354, GLG374	GLG344, GLG364, GLG384
	Enough modules to earn at least 120 credits(preferably 128) from:		
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Physics	FSK314, FSK332, FSK352	FSK324, FSK342, FSK362
	- Geography	GEO314, GEO334	GEO324, GIS324
	- Soil Science	GKD414, GKD434	GKD424, GKD444

Learning programme 2: Geochemistry (4389)

With completion of this learning programme to honours level you will be trained as a professional geologist/geochemist with job opportunities in mining, exploration and research.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Geology	GLG114	GLG124
	- Chemistry	CEM114	CEM124 or CEM144
	- Computer literacy	BRS111	BRS121
	- Physics	FSK114 or FSK134	
	- Mathematics	WTW114 or WTW134	WTW124 or WTW144
	- Statistics		STK124
2	**Compulsory**		
	- Geology	GLG214+GLG212+GLG232+ GLG202	GLG224+GLG222+GLG244+ GLG242
	- Chemistry	CEM214+CEM232	CEM242
	- Statistics	STK216	
3	**Compulsory**		
	- Geology	GLG314+GLG354+GLG374	GLG324+GLG364+GLG384
	- Chemistry	CEM314	
	Enough modules to earn at least another 16 credits from:		
	- Chemistry		CEM324
	- Geology		GLG344

Learning programme 3: Environmental Geology (4365)

With completion of this learning programme to honours level you will be qualified as a professional environmental geologist who is able to evaluate applicable problem areas and propose solutions.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Geology	GLG114	GLG124
	- Chemistry	CEM114	CEM124
	- General Management		EBUS62406
	- Geography	GEO114	
	- Computer literacy	BRS111	BRS121
	- Statistics		STK124
	One of the following modules in the first semester:		
	- Statistics	STK114	
	- Mathematics	WTW114 or WTW134	
2	**Compulsory**		
	- Geology	GLG214+GLG212+GLG232+ GLG252+GLG202	GLG224+GLG222+GLG244+ GLG242
	- Geography	GEO234	GIS224
3	**Compulsory**		
	- Geology	GLG314+GLG354+GLG374	GLG324+GLG364+GLG384
	- Geography	GEO334	GIS324

GEOGRAPHY

Learning programme 4: Environmental Geography (4364)

Students with a degree in environmental geography will not only understand the interaction between humans and the environment, but can also offer solutions for environmental problems which humans have to deal with in the physical as well as the cultural milieu, with the aid of applicable knowledge, skills and technology.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Geography	GEO114	GEO124
	- Business Management	EBUS51305	
	- Computer literacy	BRS111	BRS121
	- Statistics	STK114	
	Preferably enough modules to obtain 64 credits from:		
	Biology	BLG114	BLG124 or BLG144
	- Chemistry	CEM114	CEM124 or CEM144
	- Geology	GLG114	GLG124
	- Soil Science	GKD214	
	- Statistics		STK124
2	**Compulsory**		
	- Geography	GEO214+GEO234	GEO224+GIS224
	- Geology		GLG244
	- Business Management		EBUS74407
	- Communication Studies	KOM214	
	- Sociology		SOS224
	Preferably enough modules to obtain 24 credits from:		
	- Zoology	DRK214, DRK252	DRK224, DRK262
	- Geology	GLG212, GLG214, GLG232, GLG252, GLG202	GLG224, GLG222, GLG244, GLG242
	- Soil Science	GKD314	GKD324
	- Botany	PLK212, PLK214	PLK224, PLK262
	- Statistics	STK216	STK226
3	**Compulsory**		
	- Geography		GEO324
	Three of the following modules:		
	- Geography	GEO314, GEO334	GIS324, GEO344
	Preferably enough modules to obtain 64 credits from:		
	- Zoology	DRK314, DRK334	DRK324, DRK334
	- Geology	GLG314, GLG334, GLG354, GLG374	GLG314, GLG344, GLG364, GLG384
	- Soil Science	GKD414, GKD434	GKD424, GKD444
	- Botany	PLK314, PLK334	PLK324, PLK344
	- Statistics	STK316, STK332	STK326, STK342

Learning programme 5: Geographical Information Systems (4383)
The details of this learning programme appear as **Learning Programme 3** under Information Technology.

This programme delivers highly trained information technologists with technical skills in programming, system design and analysis as well as database and network management. The student will be able to render overall computer support in the industry.

Possible learning programmes in Information Technology are:

LP1: Mathematical (4381)
LP2: Industrial(4382)
LP3: Geographical Information systems (4383)
LP4: Information Systems (4395)

Composition of a learning programme

- At first year level the modules with a credit value of at least 120 have to be passed.
- On both second and third year level, modules with a credit value of at least 96, but preferably 128 have to be passed.
- For a BSc(IT) degree modules with a total weight of at least 392 credits must be passed.
- A '+' between modules indicate that all the modules must be taken.
- A comma between modules indicates the modules may be taken independently.
- The word 'or' between modules indicates that only one of the modules may be taken.
- Prerequisites of individual modules must always be adhered to.
- Additional modules may be taken only if the timetable allows it.

ADMISSION REQUIREMENTS:

Learning Programme 1:
- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 7 (80%).
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- If the modules WKS114 are included in the learning programme, Mathematics HG = D is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.
- Physical Sciences on performance level 4 (50%) or Life Sciences on performance level 5 (60%).

Learning Programme 2:
- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 5 (60%).
- Physical Sciences on performance level 4 or Life Sciences on performance level 5 (60%).

Learning Programme 3:
- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 7 (80%) for WTW114 or Mathematics on performance level 5 (60%) for WTW134.
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- Physical Sciences on performance level 4 (50%) or Life Sciences on performance level 5 (60%).

Learning Programme 4:
- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 4 (50%) to register for WTW174 or Mathematics on performance level 5 (60%) to register for WTW134.

Learning programme 1: Mathematical (4381)

The powerful combination of Computer Science with Mathematics and/or Mathematical Statistics provides the student with a solid knowledge base and excellent background for a career as information technologist. This training is directed towards careers in the IT industry as well as academicals and research institutions such as Universities, Technicons, CSIR, ARC, MINTEK, etc.

Admission requirements

- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 7 (80%).
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- If the modules WKS114 are included in the learning programme, Mathematics HG = D is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.
- Physical Sciences on performance level 4 (50%) or Life Sciences on performance level 5 (60%).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Computer Information Systems	RIS114+RIS154	RIS124+RIS164
	- Mathematics	WTW114	WTW124
	- Mathematical Statistics	WKS114	WKS124
	- Computer Literacy	BRS111	BRS121
	Optional		
	- Computer Information Systems		RIS182
2	**Compulsory**		
	- Computer Information Systems	RIS214	RIS224+ RIS264
	- Mathematics and Applied Mathematics	WTW254	
	Enough modules to earn another 64 credits from:		
	- Mathematics and Applied Mathematics	WTW214, WTW234	WTW224, WTW244, WTW264
	- Mathematical Statistics	WKS216	WKS226
	- Computer Information Systems		RIS242
3	**Compulsory**		
	- Computer Information Systems	RIS314+RIS334	RIS324+RIS344
	Enough modules to earn another 64 credits from:		
	- Mathematics and Applied Mathematics	WTW314, WTW334, WTW374	WTW324, WTW344, WTW364, WTW384
	- Mathematical Statistics	WKS314, WKS334	WKS324, WKS344

Learning programme 2: Industrial (4382)

This learning programme provides the student with the opportunity to combine Computer Science with the Physical and/or Soil Sciences. The learning programme provides the student with a wide selection of modules as preparation for a possible career as information technologist in industry, for example in the manufacturing sector.

Admission requirements

- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 5 (60%).
- Physical Sciences on performance level 4 (50%) or Life Sciences on performance level 5 (60%).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Computer Information Systems	RIS114+RIS154	RIS124+RIS164
	- Mathematics	WTW134	WTW144
	- Computer Literacy	BRS111	BRS121
	Enough modules to earn another 16 credits per semester from:		
	- Chemistry	CEM114	CEM124 of CEM144
	- Physics	FSK114 of FSK134	FSK124 of FSK144
	- Statistics	STK114	STK124
	- Computer Information Systems		RIS182
2	**Compulsory**		
	- Computer Information Systems	RIS214	RIS224+RIS264
	- Mathematics and Applied Mathematics	WTW254	
	Enough modules to earn another 64 credits from:		
	- Chemistry	CEM232, CEM214	CEM242, CEM224
	- Physics	FSK232, FSK214	FSK242, FSK224
	- Statistics	STK216	STK226
	- Mathematics and Applied Mathematics	WTW234	WTW244
	- Computer Information Systems		RIS242
3	**Compulsory**		
	- Computer Information Systems	RIS314+RIS334	RIS324+RIS344
	Enough modules to earn another 64 credits from:		
	- Chemistry	CEM314, CEM334	CEM324, CEM344
	- Physics	FSK314, FSK332, FSK352	FSK324, FSK342, FSK362
	- Statistics	STK316+STK332	STK326+STK342

Learning programme 3: Geographical Information Systems (GIS) (4383)

The connection of geographical information and computer technology simplifies the storage, processing, modelling and presentation of information and expedites decision making. A GIS scientist or technologist is prepared for a challenging career in diverse directions such as defence, planning, agriculture, tourism, the environment and resource management.

Admission requirements

- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 5 (60%) for WTW134 and WTW144.
- Mathematics on performance level 7 (80%) for WTW114 and WTW124.
- If the modules WTW114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
- Physical Sciences on performance level 4 (50%) or Life Sciences on performance level 5 (60%).

Year		Semester 1	Semester 2
1	**Compulsory** - Computer Information Systems - Mathematics - Geography - Computer Literacy **Optional** - Computer Information Systems	 RIS114+RIS154 WTW114 of WTW134 GEO114 BRS111	 RIS124+RIS164 WTW124 of WTW144 GEO124 BRS121 RIS182
2	**Compulsory** - Computer Information Systems - Geography - Mathematics and Applied Mathematics	 RIS214 GEO214+GEO234 WTW254	 RIS224+RIS264 GEO224+GIS224
3	**Compulsory** - Computer Information Systems - Geography	 RIS314+RIS334 GEO314+GEO334	 RIS324+RIS344 GEO324+GIS324

Learning programme 4: IT Information Systems (4395)

The science and commercial sectors often overlap and it is important that individuals in these two sectors understand and speak one another's language. This learning programme provides students with the opportunity to learn and to experience the best of both worlds. It is directed towards preparing a student for a career as IT manager in both the public and private sectors.

Admission requirements

- An admission point (AP) of at least 30 plus an official tuition language on performance level 4 (50%).
- Mathematics on performance level 4 (50%) to register for WTW174 or Mathematics on performance level 5 (60%) to register for WTW134.

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Computer Information Systems	RIS114+RIS154	RIS124+RIS164
	- Management/Accounting	EHRM51305 or EBUS51305	EIOP52305 or EACC62406
	- Computer Literacy	BRS111	BRS121
	- Statistics	STK114	STK124
	Enough modules to earn at least 8 credits from:		
	- Mathematics	WTW134 or WTW174	WTW144 or WTW184
	- Accounting	EACC61406	
	- Computer Information Systems		RIS182
2	**Compulsory**		
	- Computer Information Systems	RIS214	RIS224+RIS264
	- Management	EBUS61406	EBUS62406
	or	or	or
	- Statistics	STK216	STK226
	Enough modules to earn at least 12 credits per semester from:		
	- Management Accounting	ERKT61406	EMAC62406
	- Management		EBUS64406
	- Economics	EECF61306	EECF62306
3	**Compulsory**		
	- Computer Information Systems	RIS314+RIS334	RIS324+RIS344
	Enough modules to earn at least 32 credits per semester from:		
	- Management	EBUS77407, EBUS71407	EBUS74407, ETRG71407
	- Economics	EECS71406	EECS72406
	- Statistics	STK316+STK332	STK326+STK342

Prerequisite for;
ERKT61406 is EACC61406orEACC62406
ETRG71407 is EHRM51305 + EIOP52305
EECF62306 is EECF61306
EECS71406 is EECF61306
EECS72406 is EECF62306

Consumer science is a study of the need of man regarding Housing, Clothing and Food and the management of resources to satisfy these needs.

Possible learning programmes in Consumer Science are:
LP1: Consumer Science - General (4351)
LP2: Consumer Science - Food (4352)

Learning programme in Home Economics is:
LP3: Home Economics - Food (4354)

Composition of a learning programme

- For a B degree in Consumer Science and BSc (Home Economics) modules with a total credit value of at least 492 must be passed.
- A '+' between modules indicate that all the modules must be taken.
- A comma between modules indicates the modules may be taken independently.
- The word 'or' between modules indicates that only one of the modules may be taken.
- Prerequisites of individual modules must always be adhered to.
- For BSc Home Economics a minimum AP of 30 plus a performance level 4 in an official tuition language, Physical Sciences or Life Sciences and Mathematics on performance level 4 required. Alternatively a pass mark in WTW164 is required and Physical Sciences or Life Sciences on performance level 4 (50%).
- A National Senior Certificate with a minimum AP of 30 plus a performance level 4 (50%) in an official tuition language is required for B.Consumer Science.

ADMISSION REQUIREMENTS FOR LP1 and LP2

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.

ADMISSION REQUIREMENTS FOR LP3

- A minimum AP of 30 plus a performance level 4 (50%) in an official tuition language.
- Mathematics on performance level 5 (60%). Alternatively (for senior students) a pass mark in WTW164/WTV164 or WTV194 is required.
- Life Sciences on performance level 5 (60%) or Physical Sciences on performance level 4 (50%).

Learning programme 1: Consumer Science - General (4351)

After completion of this programme the student will be capable to follow a career as a Consumer Scientist, e.g. consumer consultant, designer, buyer, marketer, or quality control inspector of consumer products. The student should also be capable to advise consumers on the management of time, energy and other resources. The qualification acquired is a Baccalaureus in Consumer Science. The majors are Clothing and Food. The entrance requirements are a National Senior Certificate, AP of 30 and language of tuition (Eng. or Afr.) on achievement level 4 (50%).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Introduction to Human Resources Management/Individual differences	EHRM51305	EIOP52305
	- Clothing	KLE134	KLE144
	- Chemical principles of agriculture	LWL134	
	- General management/Management	EBUS51305	EBUS62406
	- Consumer Science		VBW124
	- Computer literacy	BRS111	
	- Advanced computer usage		BRS121
2	**Compulsory**		
	- Interiors	ITR234	ITR224
	- Clothing	KLE214	
	- Microbiology	MCB214	
	- Foods	VDS214	VDS224
	- Food Science	VWS212	VWS224
	- Personal Selling		EBUS66406
3	**Compulsory**		
	- Housing	BES314	
	- Textile Science		TSK324
	- Human Nutrition	VDG314	
	- Foods		VDS344
	- Consumer Science	VBW312	VBW324
	- Food Science or		VWS344 or
	- Microbiology		MCB224
	At least 16 credits should be on second or third-year level from the list of electives below or any module that fits on the university timetable and has not been taken in the second year.		
	- Mercantile Law	HRG204	
	- Strategic Marketing	EBUS79407	
	- Food Science	VWS314	VWS324
	- Clothing	KLE414	
4	**Compulsory**		
	- Consumer Science	VBW414+VBW432	VBW424
	At least 60 credits from the list of electives below or any module that fits on the university timetable and has not been taken in the third year.		
	Electives		
	- Consumer Science	VBW434	
	- Quantity Nutrition	VGM334	VGM344
	- Textile Science		TSK422
	- Clothing	KLE414	KLE424, KLE444
	- Strategic Management/Entrepreneurship	EBUS79407	EBUS74407
	- Food Science	VWS314, VWS434	VWS324, VWS424

Learning programme2: Consumer Science - Food (4352)

After completion of this programme the student will be capable to follow a career in foods, e.g. consumer consultant, product developer, or quality control inspector of food products. The student should also be capable to advise consumers on the management of time, energy and other resources. The qualification acquired is a Baccalaureus in Consumer Science. The majors are Foods and Food Science. The entrance requirements are a National Senior Certificate, AP of 30 and language of tuition (Eng. or Afr.) on achievement level 4 (50%).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Introduction to Human Resources Management/Individual differences	EHRM51305	EIOP52305
	- Chemical principles in agriculture	LWL134	
	- Biological principles in agriculture	LWL114	
	- Biochemical principles in agriculture		LWL144
	- General Management/Management	EBUS51305	EBUS62406
	- Consumer Science		VBW124
	- Computer literacy	BRS111	
	- Advanced computer usage		BRS121
2	**Compulsory**		
	- Microbiology	MCB214	
	- Food	VDS214	VDS224
	- Food Science	VWS212	VWS224 + VWS344
	- Agricultural Economics		LEK124
	At least 16 credits from under mentioned electives or any module which fits onto the classroom- and exam timetable.		
	- Mercantile Law	HRG204	
	- Personal Selling		EBUS66406
3	**Compulsory**		
	- Human Nutrition	VDG314	
	- Food		VDS344
	- Food Science	VWS314	VWS324
	- Consumer Science	VBW312	VBW324
	At least 32credits from under mentioned electives or any module which fits onto the classroom- and exam timetable.		
	Electives		
	- Strategic Management/Strategic Marketing	EBUS79407	EBUS74407
	- Training Management	ETRG71407	
	- Professional skills in agriculture	LWL312	
	- Food Science		VWS344
	- Industrial Quality Management		IQM242
	- Quantity nutrition	VGM334	VGM344
4	**Compulsory**		
	- Consumer Science	VBW414+VBW432	
	At least 92 credits from the under mentioned electives or any module which fits onto the classroom- and exam timetable.		
	Electives		
	- Food Science	VWS432 VWS414 VWS434	VWS222 VWS424 VWS444 VWS461

Learning programme 3: Home Economics - Food (4354)

After completion of this programme the student will be capable to follow a career in the food industry. The qualification acquired is a Baccalaureus Scientiae (Home Economics). The major subjects are Foods and Food Science. The minimum entrance requirements are AP of 30 and achievement level 4 (50%) for language of tuition, Mathematics on level 4 (50%), Physical Sciences or Life Sciences on achievement level 4 (50%).

Year		Semester 1	Semester 2
1	**Compulsory**		
	- Biology	BLG114	BLG124 or BLG144
	- Chemistry	CEM114	CEM144
	- Physics	FSK134	
	- Biometry		BMT124
	- Computer literacy	BRS111	
	- Advanced computer usage		BRS121
	At least 8 credits from the list of electives below or any relevant module that fits on the university timetable.		
	Electives		
	- General Management		EBUS62406
	- Introduction to Human Resources	EHRM51305	
	- Introduction to Individual differences		EIOP52305
	- Industrial Communication	BKO114	BKO124
	- Consumer Science		VBW124
2	**Compulsory**		
	- Biochemistry	BCC214	
	- Microbiology	MCB214	
	- Foods	VDS214	VDS224
	- Food Science	VWS212	VWS224+VWS344
	- Physiology	FFH208	
3	**Compulsory**		
	- Human Nutrition and Foods	VDG314	
	- Foods		VDS344
	- Food Science	VWS314	VWS324
	At least 56 credits from the list of electives below or any module that fits on the university timetable and has not been taken in the first or second year.		
	Electives		
	- Clothing	KLE134	
	- Strategic Marketing	EBUS79407	
	- Entrepreneurship		EBUS74407
	- Consumer Science	VBW312, VBW434	
	- Quantity nutrition	VGM334	VBW124, VBW324 VGM344
4	**Compulsory**		
	- Consumer Science	VBW432	
	- Food Science	VWS414	VWS424+VWS444
	At least 68 credits from the list below or any module that fits on the university timetable and has not been taken:		
	Electives		
	- Quantity Nutrition	VGM314	VGM324
	- Consumer Science	VBW312, VBW434	VBW324
	- Clothing	KLE214	KLE 424
	- Textile Science		TSK324, TSK424
	- Food Science	VWS434, VWS451/461	
	- Mercantile Law	HRG204	

TAKE NOTE:
Refer to the yearbook of the Faculty of Economic and Management Sciences for the MODULE CONTENT and prerequisites of the modules taken in this yearbook.

ANA124 (16 credits) – Anatomical Terminology and Basic Systemic Anatomy
(Department of Basic Medical Sciences)
Three lectures and one demonstration practical of three hours per week.
One exam paper of two hours and one practical exam of 30 minutes.
Anatomy refers to the structure of the normal human body. After completion of this module the student should have a sound knowledge of anatomical terms and a broad idea of the structures of the different body systems. This will enable the student to communicate scientifically in die medical world, and to analyse and explain certain clinical problems with an anatomical background.
Topics included are the following:
Introduction - general orientation, concepts and terminology, general overview on systems, basic principles of embryology. Surface anatomy. Musculoskeletal system - osteology, joints and muscles. Circulatory system - general circulation, foetal circulation and changes at birth, different types of blood flow, structure and orientation of the heart, blood vessels, lymphatic system. Respiratory system - path of airflow, structure and divisions of the thorax and thoracic wand, structure of the upper and lower airways. Gastro-intestinal system - overview of structure and related organs, regions of the abdominal wall, abdominal sacs, peritoneum. Genito-urinary system - overview of structures. Nervous system - composition, senses and relations with the endocrine system.

ANA216 (24 credits) – Macroscopic Anatomy of Body Regions (1)
(Department of Basic Medical Sciences)
Three lectures and ten hours of dissection / demonstration practicals per week.
Continual oral evaluation (*viva voce*), as well as one exam paper of two hours and one practical exam of 30 minutes.
Macroscopic Anatomy refers to the structures and the relations of these structures to each other as observe unaided in the human body. After completion the student should have a sound knowledge of anatomical terms and an extensive knowledge of the macroscopic structure of the mentioned body regions. Topics included in this module are:
Introduction to Anatomy: General orientation - concepts and terminology. Basic Histology. General overview of systems. Introduction to Embryology.
Upper limb: Skin, subcutaneous tissue, innervations. Pectoral girdle. Axilla. Composition and functions of the arm and hand. Blood- and nerve supply. Lymphatic drainage. Applied anatomy.
Thorax: thoracic wall and diaphragm. Pleural spaces - membranes and recesses. Lungs. Mediastinum and content - heart and large blood vessels. Blood- and nerve supply. Lymphatic drainage. Ductusthoracicus. Sympathetic trunk. Applied anatomy.
Abdomen and pelvis: General characteristics, borders, descriptive subdivisions, surface anatomy. Pelvic girdle. Anterior abdominal wall - characteristics, inguinal canal, muscles, nerve and blood supply. Abdominal cavity - general build of the alimentary canal. Blood- and nerve supply and lymphatics of abdominal organs. Posterior abdominal wall - characteristics, muscles, nerve- and blood supply. Pelvis - borders, muscles, organs, nerve- and blood supply. Perineum.
Students follow a dissection programme during which they work as a team to dissect the upper limbs, thorax, abdomen and pelvis of a human cadaver.

ANA226 (24 credits) – Macroscopic Anatomy of Body Regions (2)
(Department of Basic Medical Sciences)
Three lectures and ten hours of dissection / demonstration practicals per week.
Continual oral evaluation (*viva voce*), as well as one exam paper of two hours and one practical exam of 30 minutes.
This module is subject-wise a continuation of the module presented during the first semester. Topics included are the following:
Upper limb: Skin, subcutaneous tissue, innervations. Dermatomes, myotomes. Gluteal region and pelvic girdle. Osteology, muscle compartments, joints, triangles, superficial structures of the upper limb. Patella, popliteal fossa, knee joint. Composition, muscle compartments and functions of the lower leg and foot. Lumbar-sacral plexus. Blood- and nerve supply. Lymphatic drainage.
Head and neck region: Vertebral column. Muscles, joints and nerve supply of the back. Skull. Facial muscles - nerves and blood vessels. Muscular triangles of the neck. Upper airways - nose, mouth, tongue, pharynx, larynx, paranasal sinuses. Lymphatic drainage.
Neuro-Anatomy: Embryological development and basic concepts of the nervous system. Skull - bony parts, borders, fossae, foraminae. Vertebral column - intervertebral foraminae, meninges, venous sinuses. Spinal cord - characteristics and tracts. Brainstem - characteristics and nuclei. Cerebellum - characteristics and functional areas. Cerebrum - characteristics and functional areas. Applied anatomy of the sensory and motor nervous systems. Applied anatomy of higher brain functions. Ventricles and CSF circulation. Cranial nerves. Blood supply and venous drainage. Senses - eye, ear, vestibular apparatus, relations with the endocrine system.
Students follow a dissection programme during which they work as a team to dissect the lower limbs, vertebral column, head and neck region, and brain of a human cadaver.

ANA316 (24 credits) – Biological Anthropology
(Department of Basic Medical Sciences)
Three discussions and three hours practical per week. Study assignments.
One exam paper of three hours.
Biological Anthropology provides the student with an opportunity to explore the various disciplines in and allied to anatomy. These include human evolution, forensic anthropology, growth and development, and comparative anatomy. Special emphasis is placed on human diversity.

ANA326 (24 credits) – Embryology and Comparative Anatomy
(Department of Basic Medical Sciences)
Seminars and practical assignments of six hours per week. Study assignments.

One exam paper of three hours.
In this module human embryological development is explored and compared to that of other mammalian and vertebrate anatomical systems. It is not intended to provide the student with a comprehensive description of the whole human body. Special emphasis is placed on applied anatomy and structural variations. Limited dissection of human cadavers forms part of the module.

ANA304 (16 credits) – Applied Macroscopic Anatomy and Techniques
(Department of Basic Medical Sciences)
Two lectures and four hours practical per week. Study assignments / projects.
Continual evaluation, including evaluation of projects and multi-media presentations.
Presentation of this module is based on projects done by students working individually or as a team. It is required from students to prepare models that demonstrate clinical or comparative anatomy. Emphasis is placed on practical and legal aspects of cadaver administration, safety in the mortuary and anatomical techniques - embalming and preservation of cadavers, osteology models - preparation and skeleton articulation, land mark tagging and assembly of skeletons, museum techniques - manufacturing of display models, fibreglass reconstructions and related techniques, assembly techniques, plastination - as well as multimedia presentations.

ANTxyz – Anthropology
For MODULE CONTENT see Yearbook of the Faculty of Humanities.

ATW164 (16 credits) – Introduction to Actuarial Science
(Department of Mathematical Statistics and Actuarial Science)
Three one-hour lectures and one two-hour tutorial/practical per week.
One three-hour exam paper.
The aim of this module is to introduce the following topics to students wishing to study actuarial sciences: Professionalism in practice; the Actuarial control cycle; life insurance; life contingencies; market value adjustment compensation; pensions; general insurance; investments; health care insurance
After the successful completion of this module the student should be able to:
a) **Recount** aspects of professionalism in risk analysis and insurance businesses.
b) **Discuss** the actuarial control cycle.
c) **Outline** and **apply** topics in life insurance, contingencies, pensions, general insurance, investments and healthcare.
d) **Evaluate** MVA (Market Value Adjustment) compensation.
Prerequisites: (WTW114 or WTW134) and WKS114

ATW216 (24 credits) – Introductory Financial Mathematics
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one two-hour practical and four hours of self-study per week during the first semester.
One three-hour exam paper.
The aim of the Introductory Financial Mathematics subject is to provide grounding in financial mathematics and its applications, including, introductory interest calculations, discounting and accumulating, annuities, loans, and cash flow schemes and funds.
After the successful completion of the module the student should:
a) understand and be able to apply the concepts behind basic financial problems, cash flow models and interest rates, and
b) be able to investigate and solve problems relating to discounting and accumulating, annuities, loans and cash flow schemes (including funds), presenting the underlying assumptions and interpreting the results of the investigation.
Prerequisites: (WKS114 and 124) or (STK114 and 124), and (WTW114 and WTW124) or (WTW134 and WTW144)

ATW226 (24 credits) – Financial Mathematics
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one two-hour practical and four hours of self-study per week during the second semester.
One three-hour exam paper.
The aim of the advanced Financial Mathematics subject is to provide grounding in the theory of investment instruments, the mathematics of basic fixed-interest security valuation, interest rate sensitivity analysis, forward contract valuation, and the term structure of interest rates.
After the successful completion of the module the student should:
a) understand and be able to apply the concepts behind basic and complex financial problems, cash flow models and interest rates, and
b) be able to investigate and solve problems relating to discounting and accumulating, annuities, loans and cash flow schemes, interpreting the results of the investigation;
c) be confident in appraising projects, valuing investments, and the solving of complicated simple-rate and compound-rate problems, and
d) be able to discuss and apply the term structure of interest rates and interest rate models in the context of investment valuation.
Prerequisites: ATW216

ATW246 (24 credits) – Financial Mathematics (Advanced)
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one two-hour practical and four hours of self-study per week during the second semester.
One three-hour exam paper.
The aim of the advanced Financial Mathematics subject is to provide grounding in the theory of investment instruments, the mathematics of basic fixed-interest security valuation, interest rate sensitivity analysis, forward contract valuation, the term structure of interest rates, and stochastic interest rate models.
After the successful completion of the module the student should be able to:
a) understand and be able to apply the concepts behind basic and complex financial problems, cash flow models and interest rates, and
b) be able to investigate and solve problems relating to discounting and accumulating, annuities, loans and cash flow schemes, interpreting the results of the investigation;

c) be confident in appraising projects, valuing investments, and the solving of complicated simple-rate and compound-rate problems,
d) be able to discuss and apply the term structure of interest rates and interest rate models in the context of investment valuation, and
e) understand and be able to utilize basic stochastic interest rate models in investment valuation.

Prerequisites: 60% in ATW216 and (WTW114 and WTW124)

ATW316 (24 credits) – Actuarial Mathematics I
(Department of Mathematical Statistics and Actuarial Science)

Four lectures, three practicals and twelve hours of self-study per week during the first semester.
One three-hour exam paper.
After the successful completion of the module, the learner will be able to:
a) explain the concepts of decision theory and apply them,
b) calculate probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements,
c) construct risk models involving frequency and severity distributions and calculate the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements,
d) explain the theoretical aspects of ruin for a risk model both with and without simple reinsurance arrangements and calculate probabilities of ruin,
e) explain the fundamental concepts of Bayesian statistics and use these concepts to calculate Bayesian estimators by deriving the posterior distributions of different models,
f) describe the fundamental concepts of rating and apply them to simple experience rating systems, and
g) describe and apply techniques for analysing a delay (or run-off) triangle and projecting the ultimate position.

Prerequisite:ATW246 and WKS226

ATW314 (24 credits) – Actuarial Mathematics I
(Department of Mathematical Statistics and Actuarial Science)

Four lectures, three practicals and twelve hours of self-study per week during the first semester.
One three-hour exam paper
The content of this module is identical to ATW316, although the workload of the module is less than that of ATW316.

Prerequisite: ATW226

ATW306 (24 credits) – Actuarial Models (Advanced)
(Department of Mathematical Statistics and Actuarial Science)

Four lectures, three practicals and twelve hours of self-study per week during the second semester.
One three-hour exam paper.
After the successful completion of the module the learner will:
a) have thorough knowledge of several concepts of Survival models, estimation procedures of lifetime distributions and Markov models,
b) be confident with the use of the Binomial model for mortality,
c) be acquainted with simple assurance, annuity contracts and net premiums,
d) be able to describe the principles of actuarial modelling,
e) be able to derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities, and
f) be able to estimate transition intensities depending on age, exactly or using census approximation.

Prerequisite: ATW246

ATW304 (16 credits) – Actuarial Models
(Department of Mathematical Statistics and Actuarial Science)

Four lectures, three practicals and twelve hours of self-study per week during the second semester.
One three-hour exam paper.
The content of this module is identical to ATW306, although the workload of the module is less than that of ATW306.

Prerequisite:ATW226

ATW396 (24 credits) – Financial Economics
(Department of Mathematical Statistics and Actuarial Science)

Three one-hour lectures and one two-hour tutorial/practical per week.
One three-hour exam paper.
The aim of this module is to give successful candidates the skills needed to:
1. Value a variety of investments using a variety of financial economic models, including, mean-variance portfolio theory, single and multifactor models, pricing models (including those for options evaluation), and credit risk models.
2. Describe the assumptions and workings of financial markets, and investigate these by utilizing investment theory related to: investment risk, the Efficient Market Hypothesis, stochastic financial models, Brownian motion, and term structure of interest rates

On completion of the module the student should be able to:
a) Present the advantages and disadvantages of different measures of investment risk.
b) Describe and discuss the assumptions of mean-variance portfolio theory and solve investment valuation problems based in this theory.
c) Implement single and multifactor models of asset returns, and assess the properties of such models.
d) Evaluate and compare pricing models, discussing the principal results and assumptions and limitations of such models.
e) Compare the various forms of the Efficient Markets Hypothesis and discuss the evidence for and against the hypothesis.
f) Appraise stochastic models of the behaviour of security prices.
g) Apply the main concepts of Brownian motion (or Wiener Processes).
h) Analyse the properties of option prices, valuation methods and hedging techniques.

i) Outline and utilize the models of the term structure of interest rates.
j) Describe and apply simple models for credit risk.

Prerequisites: WTW214, WTW244, and ATW246

BCC214 (16 credits) – Biochemistry for agriculture and health sciences
(Department of Microbial, Biochemical and Food biotechnology)

Three lectures per week during the first semester.
One examination paper of three hours.
The role of water and salts in the cell, survey of the chemistry of carbohydrates, lipids, proteins and nucleic acids, the flow of information. Survey of the flow of energy and material through the cell, catabolic pathways, anaerobic and aerobic metabolism, anabolic pathways, integration of metabolic pathways, metabolic diseases.
After successful completion of the module the student should

a) have a basic knowledge of the structure of and differences between prokaryotic and eukaryotic cells;
b) have a basic knowledge of the principles of water as biological solvent, pH and buffers;
c) understand the general structure and properties of amino acids, lipids, carbohydrates and nucleic acids and the function of each;
d) have a basic knowledge of metabolism and the role of enzymes, cofactors and ATP;
e) be able to form a general view of the metabolic pathways and how it integrates with nutritional metabolism.

BES314 – Introductory housing
(Department of Consumer Science)

Three lectures per week in the first semester.
One examination paper of two hours.
Man and his housing needs are influenced by the individual and family values, standards and objectives in the different stages of the family life cycle. A variety of housing types are available to select from to fulfil the specific need.The family and its housing is dependent on the environment, therefore we emphasise a sustainable environment.
After the successful completion of this module the student should:

a) have a thorough knowledge of man's basic needs,
b) understand the factors that influence the needs,
c) be capable to set criteria for the housing of families in the different stages of the family life cycle,
d) be capable to select proper housing,
e) be capable to evaluate the sustainability of the housing environment

BLG114 (16 credits) – Building blocks of life
(Department of Genetics; Department of Microbial, Biochemical and Food Biotechnology; Department of Plant Sciences; Department of Zoology and Entomology)

Three lectures and three hours practical per week in the first semester.
Evaluation: assignments, class tests, two module tests and an examination paper of three hours.
Themes in the study of life. The central theme: evolution causes the unity and diversity of life. The scientific study of nature, science and society. Introductory chemical principles of life, the form and function of molecules. Water as biological solvent, physical and chemical characteristics of water, pH, water quality. Carbon as the backbone of living chemistry: diversity of chemical bonds in organic molecules, functional groups and biological function, ATP as energy currency in the cell. Macromolecules; synthesis and breakdown, structure and diversity of polymeric compounds, carbohydrates, lipids, proteins, nucleic acids as sources of information. The cell: methods of studying cells, pro- and eukaryotic cells, structure and function of organelles, the cytoskeleton, cell walls, extra-cellular matrix. Membrane structure and function, membrane protein and carbohydrates, transport systems in membranes. Introduction to metabolism: metabolic pathways, and different forms of energy, enzymes as biological catalysts, regulation of enzyme activity. Photosynthesis, the conversion of light energy to chemical energy. Communication between cells, origin of communication systems, receptors, signal transfer and biological response, programmed cell death. The cell cycle: mitosis and the control of the cell cycle.
After the successful completion of this module, students should be able to:

a) explain the central theme in living systems,
b) explain the scientific method in the study of life,
c) elucidate the introductory chemical principles underpinning the chemistry of life,
d) explain why the physical and chemical properties make water the ideal biological solvent,
e) describe the role of carbon in organic chemistry,
f) identify the different functional groups and explain their role in biological molecules,
g) describe the different macromolecules in living systems and explain how their turnover and properties enable them to play their specific roles,
h) explain cell structure and the methods that are used in the study thereof,
i) compare pro- and eukaryotic cells and describe the structure and function of organelles,
j) discuss membrane structure and explain how membrane proteins influence membrane structure, function and transport systems,
k) understand the concept of metabolism and discuss the energy conversions in metabolism,
l) explain the properties and role of enzymes,
m) discuss the metabolic pathways releasing energy (cellular respiration) and the energy associated with it,
n) discuss photosynthesis as a mechanism by which solar energy is captured and converted to chemical energy,
o) discuss communication in and between cells and explain how it affects cellular activity,
p) discuss the cell cycle and mitosis and the control thereof.

BLG124 (16 credits) – The mechanisms of evolution and biodiversity
(Department of Genetics; Department of Microbial, Biochemical and Food Biotechnology; Department of Plant Sciences; Department of Zoology and Entomology)

Three lectures and one three-hour practical per week throughout the second semester.

Evaluation: assignments, class tests, two module tests and an examination paper of three hours.
This module covers the basic principles of inheritance and how these give rise to diverse biological types through the process of evolution. The mechanisms of inheritance and the roles of genes and chromosomes in this are addressed. Diversification into populations and species is explained on the basis of natural selection and genetic variation. The different types of life that this process gives rise to, from single-celled micro-organisms to plants and animals, are discussed. The phylogenetic relationships between different groups and the principles of taxonomy and classification are addressed. The important characteristics of each of these groups are presented.
After the successful completion of this module, students should be able to:
a) describe the role of cell division and chromosomes in evolution,
b) compare the effect of different inheritance types on evolution,
c) describe the effect of molecular mutations from DNA to protein production,
d) describe the effect of genome evolution on the evolution of species,
e) describe the principles of Darwin's theory of evolution,
f) explain the origin of species and how evolution occurs within and between populations,
g) review the history of life on earth concisely,
h) describe the basic structure and morphology of the viruses, archaea, bacteria, protists, fungi, plants and animals (invertebrates and vertebrates),
i) explain the functions of the characteristic cellular and morphological structures of these groups,
j) describe the unique characteristics of each group as well as the diversity within these groups,
k) explain the evolutionary origin of each group,
l) describe the modes of reproduction of each group,
m) describe the phylogenetic relationships between the different groups,
n) explain the role of each group in the biosphere.

BLG144 (16 credits) – Organisms and the environment
(Department of Genetics; Department of Microbial, Biochemical and Food Biotechnology; Department of Plant Sciences; Department of Zoology and Entomology)
Three lectures and one three-hour practical per week throughout the second semester.
Evaluation: Assignments, class tests, two module tests and an examination paper of three hours.
This course deals with the form and function of plants and animals as well as the environment in which they live. The various components presented in this course are:
a) Plant form and function
- Plant structure, growth and development
- Resource acquisition and transport in vascular plants
- Soil and plant nutrition
- Angiosperm reproduction and biotechnology
- Plant responses to internal and external signals

b) Animal form and function
- Basic principles of animal form and function
- Animal nutrition
- Circulation and gas exchange
- The immune system
- Osmoregulation and excretion
- Hormones and endocrine system
- Animal reproduction
- Animal development
- Neurons, synapses and signalling
- Nervous systems
- Sensory and motor mechanisms
- Animal behaviour

c) Ecology
- An introduction to ecology and the biosphere
- Population ecology
- Community ecology
- Ecosystems
- Conservation biology and restoration ecology

Outcome: After completing this course the student will understand the various aspects of the form and function of plants and animals. The student will also understand and be able to describe the functioning and driving forces of ecosystems.

BMT124 (16 credits) – Introductory Biostatistics
(Biometrics – Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours of self-study per week during the second semester.
One three-hour examination paper.
Descriptive biometry, probability models. Biometrical inference, linear regression and correlation. Contingency tables and analysis of variance.
After successfully completed the module the student must be able to:
a) organise, analyse and interpret data by means of various analysing techniques, calculate probabilities, determine inferences in connection with means, variances and proportions, determine and interpret the relationship between variables, perform analysis of variance, and
b) have the skills to solve problems, follow the steps of the research process, make decisions regarding the methods to be applied, analyse data by means of various methods, interpret and obtain information from the analysed data.

BOC216 (24 credits) – Biochemistry of biological compounds
(Department of Microbial, Biochemical and Food Biotechnology)
Three lectures and four hours practical per week in the first semester.
One examination paper of three hours.
An introduction to the most important principles governing biochemistry. The module is designed to expand on the foundation that the student has acquired in chemistry and biology modules and to provide a biochemical framework that allows understanding of new phenomena.
After successful completion of the module the student should have:
(a) a broadened knowledge concerning the chemical architecture of cells, cell partitioning and organelles;
(b) a thorough knowledge of the principles of water as biological solvent, pH and buffers (including use of equations);
(c) a broadened knowledge of the nomenclature, geometry and chemical properties of carbohydrates, lipids, proteins and nucleic acids.
(d) a broadened knowledge of information metabolism w.r.t. replication, transcription and translation as well as information restructuring (restriction, repair, recombination, rearrangement, and amplification).
(e) be able to appreciate and observe laboratory safety practices.
(f) have developed problem-solving and psychomotor skills through.
    (i) performing calculations required for preparing solutions.
    (ii) performing titrations of amino acids and proteins.
    (iii) applying colorimetric techniques in the analysis of biochemical reactions.
    (iv) performing separation and analysis of biochemical compounds.
(g) developing positive interests, attitudes and values with regard to biochemistry.

BOC226 (24 credits) – Enzymology and introductory metabolism
(Department of Microbial, Biochemical and Food Biotechnology)
Three lectures and four hours practical per week during the second semester.
One examination paper of three hours.
An introduction to the most important principles controlling enzyme action and the flow of energy through living systems. The module is designed to make students aware of the principles of Michaelis-Menten kinetics of single substrate reactions, inhibitors and activators, the regulation of allosteric enzymes, coenzymes, the theory of catalysis, enthalpy, entropy and free energy, the living cell as open thermodynamic system, coupled reactions, redox reactions, the role of ATP, introduction to metabolism, glycolysis and fermentation, gluconeogenesis, glycogen metabolism, the pentose phosphate pathway, the Krebs cycle, electron transfer and oxidative phosphorylation, glyoxylate cycle and fatty acid oxidation, fatty acid biosynthesis, the metabolism of cholesterol and phospholipids, an overview of amino acid biosynthesis and catabolism including the urea cycle.
After successful completion of the module, the student should be able to:
a) understand and explain the principles of enzyme action, including the effect of activators, inhibitors and allosteric effectors
b) interpret kinetic data for single substrate reactions
c) explain the overall process and the details of the chemical changes occurring during carbohydrate and fat metabolism
d) explain the flow of energy through the metabolic pathways
e) understand and explain the control of selected metabolic processes
f) be able to explain and calculate the energy balance of the metabolic pathways
g) form an integrated view of the metabolic pathways and how it integrates with nutritional metabolism
h) explain the origin and effect of selected metabolic disorders in the context of global metabolic processes.
i) do different types of enzymatic assays
j) have the ability to interpret enzyme kinetic data illustrating the effect of effectors
k) understand and apply some of the techniques used in the study of metabolism.
l) use laboratory equipment presented in practical sessions
m) plan experiments and write a scientific report.

BOC314 (16 credits) – Molecular biology
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and three hours practical per week during the first semester.
One examination paper of three hours.
The emphasis of this course is placed on the cloning of genes from single-and multi-cellular organisms using a variety of different molecular cloning techniques. Expression vectors, molecular manipulation of genes and database mining will also be studied. The characterization of gene expression in transgenic organisms will also be discussed.
After successful completion of the course, the student should;
a) have a thorough knowledge of the modern methods used to isolate genetic material from different sources,
b) acquired the theoretical knowledge and practical skills to clone genes from both single and multi-cellular organisms and be familiar with expression systems that are used in recombinant DNA technology,
c) be able to explain how the gene and the encoded protein can be characterised in transgenic organisms and
d) understand genomics and proteomics information-based biology
[This module has a credit value of 16 credits. 12 credits are for subject specific outcomes and 4 credits outcomes with respect to written reports relating to the recording of experimental results, experimental and laboratory skills and group work relating to problem solving.]

BOC324 (16 credits) – Advanced enzyme kinetics and metabolism
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and three hours practical per week during the second semester.
One examination paper of three hours.
In this module the student undertakes an advanced study of mono and bisubstrate enzyme reactions, the mechanisms used to regulate enzymes, principles of the regulation of metabolic pathways and principles of metabolic engineering and metabolic flow analysis.
After successful completion of the module, the student should be able to:

a) understand and explain the principles of enzyme, substrate and regulator interactions.
b) understand different enzyme regulation mechanisms
c) explain details regarding the integrated nature of and the control of metabolism.
d) understand and apply the principles of metabolic engineering and metabolic flow analysis

[This module has a credit value of 16 credits. 12 credits are for subject specific outcomes and 4 credits outcomes with respect to written reports relating to the recording of experimental results, experimental and laboratory skills and group work relating to problem solving.]

BOC334 (16 credits) – Proteome analysis
(Department of Microbial, Biochemical and Food Biotechnology)

Two lectures and a three hours practical per week during the first semester.
One examination paper of three hours.
In this module the student will be trained in proteomics, the high throughput analysis of the entire protein content of a cell-type, tissue or an organism. Students will gain knowledge of proteins properties that allow separation by liquid chyromatography, expression proteome analysis by 2D gel electrophoresis, protein identification and post-translational modification analysis by mass spectrometry, student proteomics including X-ray crystallography and nuclear magnetic resonance, interaction proteomics including immuno-precipitation and yeast two-hybrid analysis, functional proteomics, and applications of proteomics in disease diagnosis, drug development and biotechnology.
After completion of this module the student will possess a thorough understanding of:
a) the scope of proteomic analysis
b) the methodologies employed in modern proteomics
c) the application of proteomics in molecular life sciences.

[This module has a credit value of 16 credits. 12 credits are for subject specific outcomes and 4 credits outcomes with respect to written reports relating to the recording of experimental results, experimental and laboratory skills and group work relating to problem solving.]

BOC344 (16 credits) – Structure, function and topology of membranes
(Department of Microbial, Biochemical and Food Biotechnology)

Two lectures and a three hours practical per week during the second semester.
One examination paper of three hours.
In this module the student is exposed to advanced aspects of membrane structure, compounds associated with membranes such as glycoproteins, membrane lipids, glycolipids, membrane proteins, membrane transport systems, receptors, various signal transduction systems, in pro and eukaryotic cells and their role in metabolic regulation, synthesis of proteins in membranes and techniques used to study membranes and the characterisation of membrane components.
After successful completion of this module the student should be able to:
a) understand the principles of membrane structure and how different membrane components are responsible for the functional properties of membranes.
b) understand the development and functioning of different signal transduction mechanisms
c) understand and apply the techniques which are used to isolate and characterise membrane components with respect to their structure and function

[This module has a credit value of 16 credits. 12 credits are for subject specific outcomes and 4 credits outcomes with respect to written reports relating to the recording of experimental results, experimental and laboratory skills and group work relating to problem solving.]

BRS111/BRC111 (4 credits) – Computer literacy
(Department of Computer Science and Informatics)

One lecture per week and one three-hour practical per week during the first semester.
This module is evaluated by continuous assessment and no special examinations are granted.
After the successful completion of the module the student should have:
a) a basic knowledge of the principles of microcomputers and microcomputer hardware,
b) knowledge of the basic commands of an operating system and must be able to apply it,
c) knowledge of the basic commands of a general word processing program and must be able to apply it,
d) knowledge of the basic commands of a spread-sheet program, and must be able to apply it,
e) knowledge of the basic commands of the Internet and must be able to apply it.
f) knowledge of the basic commands of a presentation program and must be able to apply it.

BRS121 (4 credits) – Advanced computer literacy
(Department of Computer Science and Informatics)

One lecture per week and one three-hour practical per week during the second semester.
This module is evaluated by continuous assessment, and no special examinations are granted.
After the successful completion of the module the student should have:
a) knowledge of advanced aspects of word processing, such as tables, table of contents and bibliography, and must be able to apply it,
b) knowledge of advanced aspects of spread sheets, including graphs and linking with documents, and must be able to apply it,
c) knowledge of advanced aspectsof a presentation program and must be able to apply it,
d) knowledge of the basic commands of a database program and must be able to apply it.

Chemistry – General learning outcomes

Development and accumulation of knowledge on the selected topics by means of lectures, textbooks, resource-based learning, utilisation of a reference library, computer-assisted learning and assignments.
Development of skills in a practical field of application through lectures, reports, video and computer-assisted education and experimental procedures under typical laboratory conditions.

Development of **independent reasoning and thinking skills** by means of tutorials, creative problem solving and group seminars.
Personality development by interactive participation in teaching, tutorial sessions, group discussions and self-evaluation.
Planning and managing of the learning process by interactive lecturer/student discussions and independent study.

CEM112 (8 credits) – Chemistry for the health sciences: Nursing
(Department of Chemistry)
This module has a value of 8 credits, 7 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy and problem solving skills.
Contact sessions
Three lectures per week.
Assessment
Continuous: A minimum of 4 assignments.
Formal: Two written assessments and a final assessment of 1 hour each.
After successful completion of this module the student will be able to demonstrate knowledge and understanding of the fundamental principles underpinning a large learning area of general, inorganic, physical and organic chemistry as well as practical application and the importance of these principles in the health sciences with respect to:
Energy and matter (properties and states of matter, changes of states, energy involved in changes of state, composition of matter),
Structure of matter (fundamental particles inside the atom, isotopes, arrangement of electrons in the atom, energy sublevels, the periodic table),
Chemical bonding (molecules, stability of the atom, symbols and formulas, electron-dot structures, formation of ions, the covalent and ionic bond, oxidation numbers, percentage composition),
Radioactivity (alpha, beta, gamma and X-rays, detection and measurement of radiation, half-life, radiosiotopes in medicine),
Chemical equations and reactions (balancing chemical equations, chemical equilibrium, reaction dynamics),
The gaseous state (the kinetic molecular theory and combined gas laws, air pollution and health hazards),
Oxygen and other gases (physical and chemical properties, preparation and medical application of a series of gases),
Oxidation and reduction (basic principles of redox chemistry, the importance of redox reactions in medicine),
Water (physical and chemical properties, purification and uses),
Liquid mixtures (properties and concentration of solutions, isotonic, hypo- and hypertonic solutions, diffusion and osmosis in living cells),
Acids and bases (chemical properties of acids and bases, medical applications, weak and strong acids/bases, the principle of pH, pH and health),
Salts (formation and medical applications of salts, buffer solutions),
Organic chemistry (introduction to organic chemistry, alkanes, alcohols, ethers, organic acids, the medical importance and applications of organic compounds),
as well as effective interaction and co-operation within the learning group.

CEM114 – Inorganic and Analytical Chemistry (Mainstream)
This module has a value or 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
CEM114: Three lectures and one tutorial per week, one three-hour practical session per week during the 1st semester. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 7 practical experiments and 6 assignments.
Formal: Two written assessments and a final assessment or 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge and understanding or the fundamental principles underpinning inorganic and analytical chemistry with respect to:
Fundamental principles and stoichiometry (classification or matter, valency, oxidation numbers, rules or nomenclature, stoichiometry, mole concept, empirical and molecular formula),
Atomic structure (quantum numbers, orbital filling with electrons (Z = 36), ionisation energy, electron affinity, atom and ion sizes),
Volumetric analysis (titration types, concentration terminologies like percentage, molar concentration with reference to milli-mol, μ-mol, mg l^{-1}, ppt and ppm, balancing or redox reactions, stoichiometric relations, standard solutions, volumetric measurements, mass measurements),
Chemical bonding (covalent bond theory, Lewis structures, resonance structures, electronegativity, polarity, hydrogen bond, ionic bond),
Chemical equilibrium (equilibrium constant, calculations involving equilibrium concentrations, Le Chatelier's principle, solubility product constant),
Acids and bases (ionisation or H_2O and pH, strong acids and bases, titration curves for a strong acid/strong base, indicators, weak acids and bases, K_a and K_b, Brønsted-Lowry and Lewis acid theories, hydrolysis or salts, oxyacids, buffers),
Chemistry in practice (i.e. Acetic acid and ammonia, modern materials, liquid crystals, ceramics and chemistry in the environment),
as well as skills and techniques required in quantitative and qualitative analysis and clear concise scientific reporting or experimental procedures on samples or environmental related problems and effective interaction and working relationships within the learning group.

CEM124 – Physical and Organic Chemistry (Mainstream)
This module has a value or 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
CEM124: Three lectures and one tutorial per week, one three-hour practical session per week during the 2nd semester. A 70% attendance is compulsory for practicals.

Assessment
Continuous: A minimum van 7 practical experiments and 6 assignments.
Formal: Two written assessments and a final assessment or 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding or the fundamental principles underpinning physical and organic chemistry with respect to:
Phases and Solutions: Description or the phases or matter and the influence or solutes on the phase characteristics or the gas phase (atmospheric pressure, pressure or a column {barometer, manometer} Gas laws {Boyle, Charles, Avogadro, Ideal gas law, Dalton, Henry}), Colligative properties (boiling point elevation and freezing point depression),
Thermodynamics: Elementary calculations on heat transfer, the first law or thermodynamics, thermochemical processes and introduction to reaction entropy and free energy.
Electrochemistry (voltaic cell, cell potential, cell notation, spontaneity).
Reaction kinetics: Reaction orders and calculation or reaction rates, reaction times and half-lives.
Quantum chemistry: Introductory concepts with respect to theoretical, structural and spectroscopic aspects.
Hybridization of the carbon atom; properties, synthesis and reactions of hydrocarbons, alkylhalides, alcohols, ketones, aldehydes, carboxylic acids and derivatives or carboxylic acids; introduction to stereochemistry and reaction mechanisms**,**
as well as skills and techniques with respect to both quantitative and qualitative analysis or physical/chemical applications such as natural product analysis and syntheses or organic compounds and clear concise scientific reporting or experimental procedures and effective interaction and working relationships within the learning group.

CEM144 – Physical and Organic Chemistry
This module is aimed at general biological and agriculture students. It has a value or 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
Three lectures and one tutorial per week, one three-hour practical session per week. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 7 practical experiments and 6 assignments.
Formal: Two written assessments and a final assessment or 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding or the fundamental principles underpinning physical and organic chemistry with respect to:
Phases and Solutions: Description or the phases or matter and the influence or solutes on the phase characteristics or the gas phase (atmospheric pressure, pressure or a column {barometer, manometer} Gas laws {Boyle, Charles, Avogadro, Ideal gas law, Dalton, Henry}), Colligative properties (boiling point elevation and freezing point depression),
Thermodynamics: Elementary calculations on heat transfer, the first law or thermodynamics and thermochemical processes.
Introductory Electrochemistry (voltaic cell, cell potential, cell notation, spontaneity).
Introductory Reaction kinetics: Reaction orders and calculation or reaction rates, reaction times and half-lives. (Emphasis on first order kinetics)
Introduction or Organic Chemistry. Hybridization or the carbon atom, properties, synthesis and reactions or hydrocarbons, alkyl halides, alcohols, ketones, aldehydes, carboxylic acids, derivatives or carboxylic acids; introduction to stereoisomerism and simple reaction mechanisms. Everyday applications, including the influence of chemical structure on physical properties and biological activity will be emphasized,
as well as skills and techniques with respect to both quantitative and qualitative analysis or physical/chemical applications such as natural product analysis and syntheses or organic compounds and clear concise scientific reporting or experimental procedures and effective interaction and working relationships within the learning group.

CEM214 (16 credits) – Physical Chemistry
(Department of Chemistry)
This module has a value of 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
Two lectures and twelve three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 10 practical experiments and 7 assignments.
Formal: Two written assessments and a final assessment of 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge and understanding of the fundamental principles underpinning inorganic and analytical chemistry with respect to:
Dynamics: Properties of gases and the kinetic molecular theory.
Thermodynamics: Advanced application of the first, second and third laws of thermodynamics to chemical systems as well as thermochemical calculations.
Phase studies: Properties of liquids and solutions.
Phase equilibria: Quantify real gas-, liquid- and solid mixtures.
Electrolytic solutions: To quantify electrolytic conductivity and transport.
Quantum chemistry: Atomic structure through the Schrodinger equation as well as own functions, own values and amplitudes of selected examples.
Quantum mechanics: Application of concepts in practice,
as well as the acquisition and development of skills and techniques with respect to analysis of physical/chemical applications and clear concise scientific reporting of experimental procedures and effective interaction and co-operation within the learning group.

CEM224 (16 credits) – Organic Chemistry
(Department of Chemistry)
This module has a value of 16 credits, 14 credits for subject specific learning outcomes and 2credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.

Contact sessions
Two lectures and twelve three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 9 practical experiments and 7 assignments.
Formal: Two written assessments and a final assessment of 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge and understanding of the fundamental principles underpinning organic chemistry with respect to:
Extension of the chemistry of carbonyl compounds, carboxylic acids and carboxylic acid derivatives.
The chemistry of aromatic compounds: structure of benzene, aromaticity, electrophilic substitution, the influence of substituents on electrophilic substitution, aromatic halides and hydrocarbons, carbonyl and nitro compounds, phenols and hydroxycarbonyl compounds.
Stereochemistry and conformation: synthesis and reactions of stereo-isomers,
as well as the acquisition and development of skills and techniques with respect to analysis of organic/chemical applications such as natural product analysis and syntheses of organic compounds and clear concise scientific reporting of experimental procedures and effective interaction and co-operation within the learning group.

CEM232 (8 credits) – Analytical Chemistry
(Department of Chemistry)
This module has a value of 8 credits, 7 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
One lecture per week, eight three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 6 practical experiments and 4 assignments.
Formal: Two written assessments and a final assessment of 1 hour each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding of the fundamental principles underpinning analytical chemistry with respect to:
Basic principles of error of observation and analysis thereof, buffer systems, analytical techniques of gravimetry, oxidimetry and spectrophotometry,
as well as the acquisition and development of skills and techniques required in quantitative analysis and clear concise scientific reporting of experimental procedures on samples of environmental related problems and effective interaction and co-operation within the learning group.

CEM242 (8 credits) – Inorganic Chemistry
(Department of Chemistry)
This module has a value of 8 credits, 7 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
One lecture per week, eight three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 6 practical experiments and 4 assignments.
Formal: Two written assessments and a final assessment of 1 hour each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding of the fundamental principles underpinning inorganic chemistry with respect to:
Properties of covalent bonding (localized and delocalized) employing the Molecular Orbital theory, calculations on electronegativity, effective nuclear charge and magnetism, molecular geometry, chemical properties of the 3d transition metal ions, chemistry of π-acid ligands and their complexes such as carbonyls, isocyanide, dinitrogen, phosphines and cyano complexes, nomenclature of complex compounds,
as well as the acquisition and development of skills and techniques required in experimental procedures on samples of environmental related problems and clear concise scientific reporting and effective interaction and co-operation within the learning group.

CEM314 (16 credits) – Analytical Chemistry
(Department of Chemistry)
This module has a value of 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
Two lectures and ten three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 8 practical experiments and 4 assignments.
Formal: Two written assessments and a final assessment of 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding of the fundamental principles underpinning analytical chemistry with respect to:
Modern analytical techniques such as nuclear magnetic resonance, spectrometry, electroanalytical methods and classical analytical techniques such as potentiometry, voltammetry and amperometry. Gas chromatography, complexometry and UV/visible spectrometry,
as well as the acquisition and development of skills and techniques required in modern analytical chemistry and clear concise scientific reporting of experimental procedures on samples and effective interaction and co-operation within the learning group.

CEM324 (16 credits) – Inorganic Chemistry
(Department of Chemistry)
This module has a value of 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.

Contact sessions
Two lectures and ten three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 8 practical experiments and 4 assignments.
Formal: Two written assessments and a final assessment of 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding of the fundamental principles underpinning inorganic chemistry with respect to:
Bonding theories and the chemistry of organometallic complexes, solution behaviour of metal complexes, introductory theory of X-ray crystallography (powder and single-crystal X-ray crystallography) in structure analysis in the solid state,
Solid state analyse of ionic compounds in centric cubic space groups.
Advanced knowledge on coordination chemistry, specifically aimed at the crystal field and molecular orbital theories (as reflected in simple electronic spectra and magnetic properties), organometallic chemistry, substitution mechanisms in square-planar and octahedral complexes and general industrial and catalytic applications of organometallic catalysts,
as well as the acquisition and development of skills and techniques required with respect to experimental procedures on samples of environmental related problems and clear concise scientific reporting and effective interaction and co-operation within the learning group.

CEM334 (16 credits) – Physical Chemistry
(Department of Chemistry)
This module has a value of 16 credits, 14 credits for subject specific learning outcomes and 2credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
Two lectures and ten three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 8 practical experiments and 4 assignments.
Formal: Two written assessments and a final assessment of 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge, and understanding of the fundamental principles underpinning physical chemistry with respect to:
Dynamics: chemical kinetics and surface chemistry.
Thermodynamics: advanced chemical thermodynamics, free energy, chemical equilibrium, multicomponent systems and electrochemistry.
Macromolecular chemistry: the syntheses, characterization and molecular mass determination of polymers.
Basic principles of nuclear and radiochemistry,
as well as the acquisition and development of skills and techniques with respect to analysis of physical/chemical applications and clear concise scientific reporting of experimental procedures and effective interaction and co-operation within the learning group.

CEM344 (16 credits) – Organic Chemistry
(Department of Chemistry)
This module has a value of 16 credits, 14 credits for subject specific learning outcomes and 2 credits for critical (generic) outcomes with respect to literacy skills in oral and written reasoning, numeracy, experimental and problem solving skills.
Contact sessions
Two lectures and ten three-hour practical sessions. A 70% attendance is compulsory for practicals.
Assessment
Continuous: A minimum van 8 practical experiments and 4 assignments.
Formal: Two written assessments and a final assessment of 2 hours each.
After successful completion of this module the student will be able to demonstrate knowledge and understanding of the fundamental principles underpinning organic chemistry with respect to:
The principles and applications of physical techniques (e.g. NMR). Introduction to dynamic stereochemistry.
Advanced reactions, mechanisms and their stereochemistry including reactions of carbohydrates, the Diels-Alder reaction, the addition of alkenes (e.g. oxymercuration, hydroboration, analyse addition), nucleophilic addition of aldehydes and ketones (e.g. Wittig reaction, Cannizzarro reaction), alpha substitution of carbonyl compounds (e.g. alpha-halogenation, alkylation of enolate ions) and carbonyl condensation reactions (e.g. Claisen condensations),
as well as the acquisition and development of skills and techniques with respect to analysis of organic/chemical applications such as natural product analysis and syntheses of organic compounds and clear concise scientific reporting of experimental procedures and effective interaction and co-operation within the learning group.

CHE112 – Introduction to Chemistry-Development module[2 periods and 1tutorial per week]
(Extended Programme and Distant Learning)
This development module is presented in the 1st semester and will assist in the development of students so that certain ambiguous chemistry concepts with respect to the school syllabus can be clarified.
Content
This module is a development module with subject specific learning outcomes aimed at clarifying ambiguous chemistry concepts in the school syllabus as well as critical (generic) outcomes aimed at the development of literacy skills (oral and written reasoning), numeracy and problem solving skills.
Assessment
Continuous: A minimum of 4 assignments.
Formal: Two written assessments and a final assessment of at least 1½ hours.
After successful completion of this module the student will have acquired knowledge, understanding and insight of the fundamental principles of general chemistry regarding:
Mathematical skills (Significant numbers, mathematical calculations, handling of logarithms to the base 10 and natural logarithms, the drawing of graphs on scale on graph paper), Classification of matter, The Periodic table, Chemical formulas and nomenclature, Basic structure of the atom, fundamental principles, ions and formation of molecules, relative atomic mass, molar mass, The mole concept, molar concentration, parts per million and percentage concentration, Introduction to acids and bases, relevant acid-base

theories and pH-calculation, Introduction to gases – laws of Boyle, Charles and the combined gas laws as well as the Kelvin temperature,
and will have obtained and developed basic analytical skills and techniques (quantitatively and to a lesser degree qualitatively) of physical/chemical applications and will be able to write a short scientific report. The student will also have acquired the ability to effectively interact and work within the learning group.

CHE132 – Organic Chemistry [2 periods and 1 tutorial per week]
(Extended Programme and Distant Learning)
This module is presented in the 1st semester and is a continuation of the new school syllabus of Physical Science specifically.
Content
This module has a value of 8 credits, 7 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills (oral and written reasoning) and problem solving skills.
Assessment
Continuous: A minimum of 4 assignments.
Formal: Two written assessments and a final assessment of at least 1½ hours.
After successful completion of this module the student will have acquired knowledge, understanding and insight of the fundamental principles of organic chemistry regarding:
Hybridization of the carbon atom; properties, preparation and reaction of hydrocarbons, alkyl halides, alcohols, ketones, aldehydes, carboxylic acids, derivatives of carboxylic acids; introduction to stereoisomerism and reaction mechanisms,
and will have obtained and developed basic analytical skills and techniques (both quantitative and qualitative) of chemical applications, synthesis of organic compounds and the analysis/application of natural products. The student will be able to write a short scientific report and will also have acquired the ability to effectively interact and work within the learning group.

CHE122 – Physical Chemistry [2 periods and 1 tutorial per week]
(Extended Programme and Distant Learning)
This module is presented in the 2nd semester and follows directly on the development module, CHE112. Access to CHE122 is a final mark of at least 50% in CHE112 + CHE132 + WTW154 respectively.
Content
This module has a value of 8 credits, 7 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills (oral and written reasoning) and problem solving skills.
Assessment
Continuous: A minimum of 4 assignments.
Formal: Two written assessments and a final assessment of at least 1½ hours.
After successful completion of this module the student will have acquired knowledge, understanding and insight of the fundamental principles of physical chemistry regarding:
Phases and Solutions: Description of the phases of matter and the influence of solutes on the phase characteristics of the gas phase (atmospheric pressure, pressure of a column {barometer, manometer}; Gas laws {Boyle, Charles, Avogadro, Ideal gas law, Dalton, Henry}), Colligative properties (boiling point elevation and freezing point depression),
Thermodynamics: elementary calculation on heat transfer, the First Law of thermodynamics, thermochemical processes and introduction to reaction entropy and free energy.
Reaction kinetics: Reaction orders and calculation of reaction rates, reaction times and half-lives.
E7lectrochemistry (Voltaïc cell, cell notation, cell potential, spontaneity),
and will have obtained and developed basic analytical skills and techniques (both quantitative and qualitative) of physical/chemical applications. The student will be able to write a short scientific report and will also have acquired the ability to effectively interact and work within the learning group.

CHE142 – Inorganic and Analytical Chemistry[2 periods and 1 tutorial per week]
(Extended Programme and Distant Learning)
This module is presented in the 2nd semester and follows directly on the development module, CHE112. Access to CHE142 is a final mark of at least 50% in CHE112 + CHE132 + WTW154 respectively.
Content
This module has a value of 8 credits, 7 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills (oral and written reasoning) and problem solving skills.
Assessment
Continuous: A minimum of 4 assignments.
Formal: Two written assessments and a final assessment of at least 1½ hours.
After successful completion of this module the student will have acquired knowledge, understanding and insight of the fundamental principles of inorganic and Analytical chemistry regarding:
Empirical and molecular formulas as well as stoichiometry, Quantitative analyses (Gravimetry en Volumetry), Oxidation, reduction, oxidation number and balancing of redox reaction equations ; Quantum mechanical atomic theory, Electron distribution, polarity and periodicity, Bonds, Lewis structures and molecular geometry; Chemical equilibrium and solubility products, Acids, bases, pH and buffers,
and will have obtained and developed basic analytical skills and techniques (both quantitative and qualitative) of physical/chemical applications. The student will be able to write a short scientific report and will also have acquired the ability to effectively interact and work within the learning group.

CHE151 – Inorganic and Analytical Chemistry *(Practical)* [3 periods per week]
This module is presented in the 1st semester and follows on the modules, CHE122 and CHE142.Access to CHE151 is a final mark of at least 50% in CHE122 + CHE142 + WTW164 respectively.
Content
This module has a value of 4 credits, 3 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills (oral and written reasoning), mathematical skills, problem solving skills and experimental skills.

Assessment
Continuous: a minimum of 7 practical experiments. A 70% attendance is compulsory for practicals.
Formal: A final assessment of at least 1½ hours.
After successful completion of this module the student will have acquired knowledge, understanding and insight of the fundamental experimental principles with respect to Inorganic and Analytical Chemistry,
and will have obtained and developed basic experimental skills and techniques regarding analytical skills, (both quantitative and qualitative) of physical/chemical applications. The student will be able to write a short scientific report and will also have acquired the ability to effectively interact and work within the learning group.

CHE161 – Analytical, Physical and Organic Chemistry *(Practical)* [3 periods per week]
This module is presented in the 2nd semester and follows on the CHE151 module. Access to this module is a minimum of 50% in CHE151.
Content
This module has a value of 4 credits, 3 credits for subject specific learning outcomes and 1 credit for critical (generic) outcomes with respect to literacy skills (oral and written reasoning), mathematical skills, problem solving skills and experimental skills.
Assessment
Continuous: a minimum of 7 practical experiments. A 70% attendance is compulsory for practicals.
Formal: A final assessment of at least 1½ hours.
After successful completion of this module the student will have acquired knowledge, understanding and insight of the fundamental experimental principles regarding Analytical, Physical and Organic Chemistry and will have obtained and developed basic experimental skills and techniques with regards to analytical skills, (both quantitative and qualitative) of physical/chemical applications. The student will be able to write a short scientific report and will also have acquired the ability to effectively interact and work within the learning group.

DRK214 (16 credits) – Parasites, Vectors and Toxic (Poisonous and Venomous) Animals
(Department of Zoology and Entomology)
Three lectures per week throughout the first semester.
Evaluation by work assignments, class tests, two module tests and one examination paper of three hours.
Identification, morphology, life cycles, pathology and treatment of parasites and vectors of medical and veterinary importance in Africa. Identification, nature and extent of veterinary and medically important poisonous and venomous invertebrates (excluding insects) and vertebrates in South Africa. Nature and action of different toxins as well as emergency treatment.
Outcome: After successfully completing this module, the student will be able to identify important parasites and vectors in an African context, as well as toxic animals from South Africa, and acquire knowledge on distribution, pathology and prevention of the parasites and vectors as well as knowledge regarding the toxicity of poisonous and venomous animals.

DRK224 (16 credits) – Africa Vertebrates
(Department of Zoology and Entomology)
Three lectures per week throughout the second semester.
Evaluation by work assignments, class tests, two semester tests and one examination paper of three hours.
The unique diversity of the vertebrate fauna of Africa is pointed out with emphasis on the endemic fauna of the southern African sub region: Systematics, ecology, survival status, utilisation, etc.
Outcome: After successfully completing this module, the student will be able to identify any African vertebrate and understand the ecology of African animals.

DRK252 (8 credits) – Invertebrate Biodiversity (practical)
(Department of Zoology and Entomology)
One four-hour practical per week throughout the first semester.
Evaluation by work assignments, class tests and a practical examination of three hours.
Taxonomy, functional morphology and anatomy, phylogeny, ontogeny and biology of selected invertebrate phyla.
Outcome: After successfully completing this module, the student will have a basic knowledge of the morphology and biology of selected groups of invertebrates.

DRK262 (8 credits) – Vertebrates: Research Techniques (practical)
(Department of Zoology and Entomology)
One four-hour practical per week throughout the second semester.
Evaluation by work assignments, class tests and one practical examination of three hours.
Research techniques which can be used for the efficient collection and analysis of data with regard to vertebrates in natural environments are explained and practically implemented.
Outcome: After successfully completing this module, the student will be able to conduct research projects independently under field conditions.

DRK314 (16 credits) – Marine and Freshwater Ecology
(Department of Zoology and Entomology)
Two lectures and one three-hour practical per week throughout the first semester.
Evaluation by work assignments, class tests, two module tests and one practical examination and one examination paper of three hours each.
The South African coast is unique largely as a result of ocean currents, which result in dividing our coastline into three distinct regions, each hosting a unique intertidal fauna. The composition of these ecosystems is studied with special reference to sandy beaches, rocky shores, kelp beds and estuaries. The practical component of this module is in the form of a marine field excursion during the autumn recess.
In freshwater ecology basic limnological techniques are demonstrated. These include mapping of small dams, determining pH, conductivity, dissolved oxygen, etc., as well as techniques for collection, identification and quantification of aquatic organisms such

as plankton, benthos, epibioton and fishes.
Outcome: After successfully completing this module, the student will have a thorough knowledge of the functions and interactions of intertidal ecology and will be able to determine physical and chemical parameters of water such as collection and identification of aquatic organisms.

DRK324 (16 credits) – Life strategies in Arid Environments
(Department of Zoology and Entomology)
Two lectures and one three-hour practical per week throughout the second semester.
Evaluation by work assignments, class tests, two semester tests and one practical examination and one examination paper of three hours each.
This module deals with life strategies of animals living in arid environments with special reference to thermoregulation, respiration, water balance and bioenergetics.
Outcome: After successfully completing this module, the student will have insight into the anatomical, behavioural and physiological adaptations successfully developed by animals in arid environments.

DRK334 (16 credits) – Conservation Ecology
(Department of Zoology and Entomology)
Three lectures per week throughout the first semester.
Evaluation by work assignments, class tests, two module tests and one examination paper of three hours.
The influence of human activities on ecosystems is critically reviewed. This includes humans as latecomers in evolution, man's ecological footprint, biodiversity, speciation, extinction and Africa's natural history. Some conservation issues are analysed. These include an evaluation of the state of our natural resources, translocation and introduction of aquatic animals, aquaculture, the mining industry and in particular the exploration of alluvial diamonds on the west coast, damming of rivers, etc.
Outcome: After successfully completing this module, the student will be able to critically evaluate human impact on the environment and will be able to provide practical solutions for environmental problems.

DRK344 (16 credits) – Animal behaviour
(Department of Zoology and Entomology)
Two lectures and a three hours practical per week throughout the second semester.
Evaluation by work assignments, class tests, two module tests and one examination paper of three hours.
Introduction to the study of animal behaviour where the logic of natural selection forms a continuous theme. As such aspects of genetics, ecology, evolution, physiology and human behaviour are also raised.
Outcome: After successfully completing this module, the student will be well-grounded in the basic principles and concepts of behavioural science to be able to interpret and understand the behaviour of animals (and man).

ENT114 (16 credits) – Introduction to Morphology, Anatomy and Bio-ecology of insects, as well as Agriculturally Important Insect Pests and Control Measures (Agricultural Service Module)
(Department of Zoology and Entomology)
Three lectures per week, plus one three-hour practical per week throughout the first semester.
Evaluation: Class tests, two module tests, practical tests, work assignments and one exam paper of three hours.
Introduction to entomology; morphology of body wall, head, thorax and abdomen; types of mouth parts; internal anatomy of organ systems; growth and metamorphosis; insect orders with examples and life cycles; identification of the most important pests of agricultural and veterinary importance and the damage and diseases caused by them; insects as vectors of plant and animal diseases; life cycles. Introduction to pesticide classification, development, method of operation, formulations and toxicity. **Outcome**: After completing this module, the student will have a better insight in basic morphology, anatomy and functioning of the insect body, and relate this to the most important pest insects in South African agriculture.

ENT216 (24 credits) – Functional Morphology and Anatomy, Classification and Identification and Evolutionary Biology of Insects
(Department of Zoology and Entomology)
Three lectures and four hours practical per week throughout the first semester.
Assessment: Class tests, assignments, two module tests, one theory examination paper and one practical examination paper of three hours each.
Characteristics of arthropods, in particular those of hexapods (insect-like organisms); morphology of head, thorax and abdomen; locomotary organs, mouth parts and reproductive organs; segmentation; growth and metamorphosis; anatomy of internal organs; characteristics to differentiate between orders; insect systematics and insect biology according to evolutionary form and function, processes and patterns, time and space and scale.
Microscope and key identification of all developmental stages of insects up to family level; morphological and anatomical dissections of adult insects; elementary comparative morphology; basic classification of invertebrates and arthropods.
Outcome: Upon completion of this module students will be trained in the composition of the diverse variation in form and structure of the insect body, as well as how insects are able to survive under diverse conditions. Students will also have insight into where insects fit into the animal kingdom and they will at least be able to identify insects to order and family level.

ENT226 (24 credits) – Ecophysiology of Insects
(Department of Zoology and Entomology)
Three lectures and four hours practical per week throughout the second semester.
Assessment: Service learning, class tests, assignments, two module tests, one theory examination paper and one practical examination paper of three hours each.
Respiration; feeding and feeding habits; digestion; physiology of body wall; blood system; reproduction; metamorphosis; excretion and water regulation; thermoregulation; ekso- and endocrine glands and pheromones; nervous system and light, mechanical and chemical reception of insects under variable environmental conditions.
Laboratory trials concerning feeding and digestion; characteristics of body wall; respiration; excretion; blood circulation; communication and endocrine system.

Outcome: Upon completion of this module students will understand the general characteristics and physiological function of insects and basically be able to investigate all this in practice.

NB: Students should take note of the prerequisites set for enrolment in ENT300 modules.

ENT314 – Advanced Insect Ecology
(Department of Zoology and Entomology)
Two lectures and three hours practical per week throughout first semester; field excursion.
Assessment: Class tests, module tests, seminars, literature discussions, practical tests, practical reports and one theory examination paper and one practical examination of three hours each.
Main components of and basic processes in ecosystems; influences of environmental forces; insect – plant relationships; prey – predator interactions; parasite – host interactions; population dynamics; mutualism; pollination ecology; energy flow; characteristics of populations and communities; the niche concept. Practical determination of ecosystem functioning; habitat differentiation; biotic and abiotic components of a habitat; importance of environmental factors; species richness; life strategies; host relationships; guild structure and interaction; niche structure; population composition; morphological form and function; quantitative and qualitative analysis.
Outcome: After completion of this module, the learner will understand the basic ecology of the different functional groups of insects.

ENT324 (16 credits) – Applied Insect Pest Management
(Department of Zoology and Entomology)
Two lectures and one three-hour practical per week throughout the second semester.
Evaluation: Class tests, two module tests, community service, practical tests and one theory examination paper and one practical examination of three hours each.
Definition of a pest; economical threshold values; pest prediction- and monitoring; ecological principles; pest control and the environment; chemical control; integrated pest management; pesticide application. Practical field applications of pest management; case studies; calibration of pesticide application equipment; pesticide application techniques and principles.
Outcome: After completing this module, the student will have insight in and be able to apply the concept of integrated pest management of insect pests and handle pesticides responsibly.

ENT334 – Advanced Medical, Veterinary and Forensic Entomology
(Department of Zoology and Entomology)
Two lectures and three hours practical per week throughout first semester.
Assessment: Class tests, module tests, seminars, literature discussions, practical tests and one theory examination paper and one practical examination of three hours each.
Identification of the medical and veterinary important insects; identification of the diseases they transmit; insects as vectors of diseases of man and animals; biology and life cycles; ecological preferences and host specificity; identification of forensic important insects and their role in forensic medicine.
Outcome: After completion of this module, the learner will be able to identify insects of medical and veterinary importance, as well as the diseases they transmit. The learner will also be able to identify insects of forensic importance and understand their role in the decomposition process of carcasses.

ENT344 (16 credits) – Applied Insect Biochemistry and Pharmacology
(Department of Zoology and Entomology)
Two lectures and one three-hour practical per week throughout the second semester.
Evaluation: Class tests, two module tests, practical tests and one theory examination paper and one practical examination of three hours each.
Biochemistry of flight muscles; metabolism of carbohydrates, lipids, amino acids, proteins and nucleic acids; biochemistry of growth and development; nervous system; pharmacology; detoxification and defensive excretions and application in chemical control. Setting up and conducting laboratory experiments on biochemical and pharmacological aspects of metabolism and key enzyme inhibition; pesticide identification and pesticide development.
Outcome: After successfully completing this module, the student will be knowledgeable regarding the unique biochemical and strong and weak points of various orders, families and even species of insects, and be able to selectively benefit or harm insect species on the basis of these characteristics through biochemical intervention.

ENT354 – Agricultural Entomology
(Department of Zoology and Entomology)
Two lectures and three hours practical per week throughout first semester.
Assessment: Class tests, module tests, seminars, literature discussions, practical tests and one theory examination paper and one practical examination of three hours each.
Identification of the most important South African pests of agricultural crops; biology, ecology and life cycles of pest species; the physical damage indices on agricultural crops; insects as vectors of diseases of agricultural crops; ecological preferences and host specificity.
Outcome: After completion of this module the learner will be able to identify insects of importance on agricultural crops in South Africa, as well as their damage and disease symptoms.

FFG216 (24 credits) – Cellular Physiology and Fundamentals of Homeostasis
(Department of Basic Medical Sciences)
Three lectures and four hours directed learning per week. Study assignments.
One exam paper of three hours.
Introduction to Physiology: Functional organisation of the human body and control of the internal environment. The cell and its function. Genetic control of protein synthesis, cell function, and cell reproduction.

Membrane Physiology, Nerve, and Muscle:: Histophysiology. Transport of ions and molecules through the cell membrane. Membrane potentials and action potentials. Excitation and contraction of skeletal muscle. Excitation and contraction of smooth muscle. Control of nervous and muscular functions. Autonomic nervous system.

FBS114 (16 credits) – Financial Management and Reporting I
(Department of Mathematical Statistics and Actuarial Science)
Three one-hour lectures and one two-hour tutorial/practical per week.
One three-hour exam paper.
The aim of this module is to introduce the following topics to students wishing to study actuarial science:
1. The key principles of finance
2. Company ownership
3. Taxation
4. Financial instruments
5. Use of derivatives
6. Issue of shares
7. Introduction to accounts
8. The main accounts
9. Group accounts and insurance company accounts
10. Interpretation of accounts
11. Limitations of accounts
12. Financial institutions
13. Capital Asset Pricing Model (CAPM)

After the successful completion of this module the student should:
a) Know and understand the principal terms in use in investment and asset management.
b) Be aware of the key principles of finance.
c) Describe the structure of a joint stock company and the different methods by which it may be financed
d) List and apply the basic principles of personal and corporate taxation.
e) Demonstrate a knowledge and understanding of the characteristics of the principal forms of financial instruments issued or used by companies and the ways in which they may be issued
f) Describe the major types of financial institution operating in the financial markets
g) Interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation.
h) Define what is meant by a company's cost of capital and the Capital Asset Pricing Model (CAPM), and analyse the weighted average cost of capital (WACC).

FBS122 (8 credits) – Financial Management and Reporting II
(Department of Mathematical Statistics and Actuarial Science)
Two one-hour lectures and one one-hour tutorial/practical per week.
One three-hour exam paper.
The aim of this module is to introduce the following topics to students wishing to study actuarial science:
1. Generating accounts
2. Depreciation and reserves
3. Weighted average cost of capital and the
4. Capital structure and dividend policy
5. Capital project appraisal

After the successful completion of this module the student should:
a) Construct basic accounts of different types and describe the role and principal features of the accounts of a company.
b) Discuss the factors to be considered by a company when deciding on its capital structure and dividend policy.
c) Define what is meant by a company's cost of capital and discusses how its cost of capital interacts with the nature of the investment projects it undertakes.
d) Show how financial techniques can be used in the assessment of capital investment projects.

FFG226 (24 credits) – Homeostasis of food and energy
(Department of Basic Medical Sciences)
Three lectures and four hours directed learning per week. Study assignments.
One exam paper of three hours.
Nutrition and Metabolism: Metabolism of carbohydrates, lipids, and proteins. Functions of the liver. Diet and regulation of feeding. Energy metabolism. Body temperature.
Gastro-intestinal Physiology: General principles of gastro-intestinal function. Histophysiology. Digestion and absorption. Secretory functions of the alimentary tract.
Endocrine Physiology: Introduction to endocrine physiology. Mechanisms of hormonal action. Endocrine control of water-, electrolyte, and energy homeostasis. Male and female reproductive physiology – hormonal control, conception, pregnancy.

FFG316 (24 credits) – Homeostasis of fluids and gases
(Department of Basic Medical Sciences)
Three lectures and four hours directed learning per week. Study assignments.
One exam paper of three hours.
The heart and circulation: Circulatory body fluids. The physiology of blood. The heart – structure and function. Dynamics of blood and lymph flow. Cardiovascular regulatory mechanisms.
The kidney and body fluids: Fluid compartments. Histophysiology. Glomerular filtration. Tubular reabsorption and secretion. The role of the kidney in the regulation of blood and extracellular fluid volume, as well as pH and electrolyte homeostasis.
Respiration: Principles of pulmonary ventilation, perfusion (circulation) and diffusion – histophysiology. Transport of oxygen and carbon dioxide in blood and body fluids. The role of the lung in pH homeostasis. Regulation of breathing.

FFG326 (24 credits) – Man in his environment – physiological adjustments
(Department of Basic Medical Sciences)
Three lectures and four hours directed learning per week. Study assignments.
One exam paper of three hours.
Homeostatic adjustments: Foetal development and on being born –alterations in the immediate postpartum period, and the neonatal period. Physiological adaptations in hot and cold environments. Life at varying oxygen pressures. On being lost on mountains, in deserts, and at sea. Circadian rhythms. Body defences – immunity and infections. On nutrition – modern tendencies and views.

FFG332 (8 credits) – Basic Neuroscience
(Department of Basic Medical Sciences)
Two lectures per week. Study assignments.
One exam paper of two hours.
The central nervous system: Structure and organisation. Embryological development. Cerebral cortex, sub cortical structures, cerebellum, brainstem, spinal cord. Higher functions of the brain – intellect, learning and memory, behaviour and motivation, sleep, epilepsy, psychosis.
The peripheral nervous system: Afferent division – receptor physiology, pain senses. Histo-physiology. Efferent division – somatic nervous system. Neuromuscular junction.
Autonomic nervous system: Physiological anatomy, characteristics, reflexes effects of stimulation and drugs. Sympathetic nervous system. Parasympathetic nervous system.

FFG342 (8 credits) – Basic and Applied Exercise Physiology
(Department of Basic Medical Sciences)
Two lectures per week. Study assignments.
One exam paper of two hours.
Exercise Physiology: Functional changes in human systems – immediate response, long-term adaptations, fitness. Mechanisms responsible for changes. Nutrition and muscle metabolism – aerobic, anaerobic. Muscle fibres – types and genetic potential. Work capacity and monitor of exercise. Drugs and the athlete.

FSK112 (8 credits) – Physics for students in the Building Sciences
(Department of Physics)
Two one-hour lectures per week during the first semester.
One examination paper of two hours.
Mechanics: Revision of the concepts displacement, velocity, acceleration, force, work, energy, power and momentum. Addition and resolving of vectors. Equilibrium. Moment of force and equilibrium. Equations of motion: Linear motion. Newton's second law, mass, weight. Work and energy. Elasticity and surface tension.
Heat and thermodynamics: Temperature and its measurement, thermal expansion. Heat, units and transfer.
Electricity: Potential, electrical current and circuits, electromagnetic induction, electromagnetic waves, alternating currents and transformers.
Light, sound and colour: Nature and propagation, optics, reflection, refraction, illumination.
After successful completion of the module a successful student should
a) be able to describe the basic phenomena and theory concerning mechanics, heat, sound, optics and electricity, as well as the applications thereof in the building sciences, and
b) have the skills to solve problems, applied to the above topics.

FSK114 (16 credits) – Mechanics, optics and electricity
(Department of Physics)
Three one-hour lectures and one tutorial/practical session of three hours per week in the first semester.
One examination paper of two hours.
Logical exposition of fundamental principles and the development of problem solving skills are addressed.
Mechanics: Revision of the elementary concepts: displacement, velocity, acceleration, force, work, energy, power, projectile motion and rotation.
In the above vector quantities and simple calculus is used wherever needed.
Geometrical optics: The electromagnetic spectrum, plane mirrors, spherical mirrors, image formation, thin lenses, optical instruments.
Electricity: Electrical charge, electrical field, electrical potential, current, resistance, circuits.
After successful completion of the module a successful student should
a) be able to describe the basic phenomena and theory concerning mechanics, geometrical optics and electricity, and
b) have the skills necessary to solve problems, applied to the above topics, as well as collect, analyse, order and critically evaluate information.

FSK124 (16 credits) – Mechanics, thermodynamics, electricity and magnetism
(Department of Physics)
Three one-hour lectures and one tutorial/practical session of three hours per week in the second semester.
One examination paper of two hours.
Logical exposition of fundamental principles and the development of problem solving skills are addressed.
Mechanics: Momentum, collisions, rotation, gravitation, oscillations, waves.
Thermodynamics: Temperature, heat, first law of thermodynamics, kinetic theory of gases, entropy, second law of thermodynamics.
Electricity and magnetism: Gauss's law, capacitance, magnetic field, Ampere's law, induction and inductance, simple alternating current circuits.
After successful completion of the module a successful student should
a) be able to describe the basic phenomena and theory concerning mechanics, thermodynamics, electricity and magnetism, and

b) have the skills to solve problems, applied to the above topics, as well as collect, analyse, order and critically evaluate information.

FSK134 (16 credits) – Mechanics, optics, electricity, biologically and medically relevant topics
(Department of Physics)
Three one-hour lectures and one tutorial/practical session of three hours per week in the first semester.
One examination paper of two hours.
Applications of physics in biology and medicine are discussed in this module.
Mechanics: Revision of the elementary concepts: displacement, velocity, acceleration, force, work, energy, power. Treatment of the above without calculus.
Geometrical optics: The electromagnetic spectrum, plane mirrors, spherical mirrors, image formation, thin lenses, optical instruments.
Electricity: Electrical charge, electrical field, electrical potential, current, resistance, circuits.
Biologically and medically relevant topics: Physical principles of apparatus used in biology and medicine, some applications of physics in these fields.
After successful completion of the module a successful student should:
a) be able to describe the basic phenomena and theory concerning mechanics, geometrical optics and electricity as well as the applications thereof in biology and medical science, and
b) have the skills to solve problems, applied to the above topics, as well as collect, analyse, order and critically evaluate information.

FSK144 (16 credits) – Mechanics, thermodynamics, electricity, magnetism, biologically and medically relevant topics
(Department of Physics)
Three one-hour lectures and one tutorial/practical session of three hours per week in the second semester.
One examination paper of two hours.
Applications of physics in biology and medicine are discussed in this module.
Mechanics: Momentum, collisions, rotation, gravitation, oscillations, waves.
Thermodynamics: Temperature, heat, first law of thermodynamics, kinetic theory of gases, entropy, second law of thermodynamics.
Electricity and magnetism: Gauss's law, capacitance, magnetic field, Amperé's law, induction and inductance, simple alternating current circuits.
Biologically and medically relevant topics: Physical principles of apparatus used in biology and medicine, some applications of physics in these fields.
After successful completion of the module a successful student should
a) be able to describe the basic phenomena and theory concerning mechanics, thermodynamics, electricity and magnetism, as well as the application thereof in biology and medical science, and
b) have the skills to solve problems, applied to the above topics, as well as collect, analyse, order and critically evaluate information.

FSK154 (16 credits) – Introductory astronomy
(Department of Physics)
Three one-hour lectures per week during the first semester.
One examination paper of two hours.
The sky as a celestial sphere, including the visibility of stars and constellations; Cycles of the moon, the seasons and eclipses; Heliocentric universe and Kepler's laws of planetary motion; Stars, their types, structure, spectral classification and the Hertzsprung-Russell diagram; formation, evolution and death of stars; neutron stars and black holes; Galaxies and the Milky way; The big bang and the age of the universe; Astronomical measurements and techniques applicable to multi-wavelength astronomy.
After successful completion of the module the student will be able to:
a) define basic astronomical terms and explain phenomena associated with the motion of the earth and moon.
b) describe and interpret the laws governing motion of the planets.
c) describe the birth, evolution and death of stars.
d) describe the structure and basic properties of galaxies, and the theory of the big bang.
e) interpret data obtained from different wavelength observations (multi-wavelength astronomy).

FSK164 (16 credits) – Principles and Practice of Observational Astronomy
(Department of Physics)
Three one hour lectures per week during the second semester.
Six practical sessions during the second semester
One two hour exam paper.
a) Astronomical Instrumentation: Telescopes (Radio, Infrared, Optical, X-ray and Gamma-Ray)
b) Telescope Optics (Resolving Power and Magnification).
c) Astronomical Observations and Measurements: Photometry, Spectroscopy, Parallax measurements to determine distances to stars.
d) Introduction to the Celestial Sphere, Basics of spherical geometry.
e) Coordinate systems: Equatorial (RA-Dec), Alt-Az system, Ecliptic coordinates, Galactic Coordinates, Sidereal Time.
f) Introduction to Celestial Mechanics (Two Body problem).
g) Introduction to practical CCD photometry.
After successful completion of the module the student should:
- Apply the basic principles of observational astronomy in problems and practice with astronomical instrumentation, i.e. discuss and differentiate between different astronomical instrumentation, apply theoretical concepts of spherical trigonometry to practical problems in positional astronomy.
- Apply basic theoretical concepts in practical applications.

FSK214 (16 credits) – Mechanics, waves and optics
(Department of Physics)
Three one-hour lectures per week during the first semester.
One examination paper of three hours.
Much of physics and engineering demands a thorough knowledge of vibrating systems and wave behaviour. After a review of Newtonian dynamics, it is applied to systems experiencing a restoring force, leading to simple harmonic motion. This theory is generalized to the cases of damped and driven oscillators. The wave equation is derived, and standing waves, as well as the reflection and transmission of waves are explained. Polarization, interference and diffraction of light, illustrating its wave nature, are then discussed.
After the successful completion of the module the student should:
a) be able to solve dynamics problems for forces that are constant, time dependent, position dependent and velocity dependent, for arbitrary initial conditions;
b) be able to explain the concept of a restoring force, be able to apply Hooke's Law and explain briefly its applicability to elasticity theory;
c) be able to derive and apply equations describing an undamped vibrating system (simple harmonic oscillator) and describe the associated physical quantities;
d) be able to derive and apply equations describing damped harmonic motion (with or without a driving force), and to explain the concept of resonance;
e) be able to decompose periodic functions into Fourier series;
f) be able to discuss the wave equation, standing waves and the transmission and reflection of waves;
g) be able to explain superposition, coherence and Young's experiment, and perform calculations of the interference of light in a Michaelson interferometer and thin films;
h) be able to derive and apply an equation for the intensity pattern as light passes through a single slit, be able to apply equations for the diffraction through a circular aperture and through a double slit, explain the Rayleigh criterion for resolving power end derive and apply equations describing the properties of a diffraction grating.

FSK224 (16 credits) – Electronics
(Department Physics)
Two one-hour lectures and one practical session of 5 hours per week.
One examination paper of three hours.
Electronics: Properties of semiconductors, diodes, rectifier circuits, zener diodes, power supplies, transistors, transistor amplifiers, operational amplifiers, operational amplifiers in feedback circuits, timer circuits, digital circuits and, computers ports.
Practical work in electronics: Diodes, power supplies, transistors, operational amplifiers in feedback circuits, timer circuits, digital circuits and computers control. A project and seminar.
After successful completion of the module the successful student should:
a) be able to describe and apply the basic theory regarding semi-conductors, diodes, rectifier circuits, zener diodes, power supplies, transistors, transistor amplifiers, operational amplifiers, operational amplifiers in feedback circuits, timer circuits and digital circuits.
b) have the skill to read electronic circuits and be able to know how the circuit operates.
c) have the skill to design *smaller* electronic circuit.
d) have a limited skill to interface a computer with an electronic circuit.

FSK232 (8 credits) – Practical work: Physics
(Department of Physics)
One practical session of 5 hours per week during the first semester.
Practical work on oscillations, waves and optics: experiments with mechanical oscillations, light interference, and computer simulations of waves and Fourier analysis.
After the successful completion of the module the student should:
a) be familiar with common experimental apparatus and measuring systems (e.g. multi-meter, oscilloscope, vernier scale, etc.).
b) be confident in working with apparatus.
c) be able to write a scientific report.

FSK242 (8 credits) – Electromagnetism
(Department of Physics)
Two one-hour lectures per week during the second semester.
One examination paper of two hours.
The electromagnetic force is one of the four fundamental forces in nature. It dominates the interaction of matter on the atomic scale and governs the behaviour of the full spectrum of electromagnetic waves.
After the successful completion of the module the student should:
a) have a working knowledge of vector algebra;
b) be able to explain the concepts of and solve problems in electrostatics, direct current circuits, alternating current circuits and magnetostatics;
c) be able to calculate induced electric fields and potentials;
d) be able to calculate the forces on charges moving in an electric field and currents flowing in a magnetic field;
e) be able to explain and apply Maxwell's equations and the concept of electromagnetic waves.

FSK254 (16 credits) – Ophthalmic Optics/Visual Optics
(Department of Physics)
Three one-hour lectures per week during the first semester.
One examination paper of three hours
This module covers the basics of lens materials including single vision lenses, prisms, bifocals and vertical imbalance. Optical principles are applied to the study of ophthalmic lenses including spheres, cylinders, prisms, multi-focal lenses and contact lenses. Design parameters for ophthalmic lenses and applications to the correction of vision defects are also discussed. Students are

familiarized with the basic optical structure of the eye as well as the cornea and lens as refracting components, the pupil as a limiting aperture and paraxial schematic eye. Other topics in the module will include the following: image formation and refraction, optical effects of ophthalmic lenses, light and the eye, aberrations and retinal image quality.
At the completion of this module, the student should have a basic knowledge of and/or skill in the following areas:
a) Physical and optical characteristics of single vision lenses, neutralization and lens effectively 0change.
b) Ophthalmic prisms and prismatic effects of lenses. Resultant of combination of prisms, prism effects in various lens forms, thickness considerations and neutralization.
c) The physical and optical characteristics of multi-focal lenses, including segments, common types and how they work, displacement effects in segments, segment measurements and blank sizes.
d) The calculation of and compensation for vertical imbalance problems.
e) Describe important optical concepts relative to the eye, cornea, lens and pupil.
f) Define the axes of the eye and be familiar with the concept of paraxial schematic eyes.
g) Describe image formation on the retina including the effect of refractive errors.
h) Describe various magnifications, field-of-view and field-of-vision as applied to ophthalmic lenses.
i) Familiar with the electromagnetic spectrum and optical concepts such as absorption, transmittance and scattering.
j) Define monochromatic aberrations and apply to schematic eyes.

FSK264 (16 credits) – Special Ophthalmic Optics
(Department of Physics)
Three one-hour lectures per week during the second semester.
One examination paper of three hours.
Fundamentals of optics with specific application to the ocular system; Concepts of optics, geometrical optics and paraxial optics; Spectacle design and materials; Commercial coatings, treatments and tints; Contact lens design materials; Differences in optical property calculations between contact lenses and spectacles; New surgical and laser treatments.
After successful completion of the module the student will be able to:
a) describe an optical system mathematically and apply the various schematic eye models in order to predict the properties of images formed or the necessary optical system parameters required to create a given image;
b) derive and describe the refractive errors for conditions such as myopia, hypermetropia and astigmatism;
c) calculate the spectacle focal power, spectacle magnification and spectacle refraction and assist patients in choosing a set of spectacles for his/her unique needs by listing and comparing the various types and shapes of lenses, frame materials and lens coatings and treatments;
d) distinguish between the types of contact lenses available and describe how they are manufactured, as well as calculate their mathematical image formation properties;
e) explain and compare the various surgical procedures such as LASIK, LASEK, cataract surgery and CK, and list the contraindications and possible side effects of these procedures;
f) review several recent important developments in the field of ophthalmic optics and evaluate their significance.

FSK314 (16 credits) – Modern Physics
(Department of Physics)
Three one-hour lectures per week during the first semester.
One examination paper of three hours.
Special relativity: Galilean and Lorentz transformations, length contraction, time dilation, relativistic Doppler shift and aspects of relativistic mechanics.
Particle properties of waves: Black-body radiation, photo-electric effect, Compton effect, gravitational red and blue shift, Mössbauer effect and applications.
Wave properties of particles: Electron diffraction, de Broglie waves, probability waves, Heisenberg's uncertainty principle.
Introductory quantum physics: Schrödinger's equation, one dimensional potential well, quantum mechanical tunnelling and its applications, hydrogen atom, orbital angular momentum and electron spin, Zeeman effect and applications.
Nuclear Physics: The atomic nucleus, radioactivity, quantum mechanical treatment of alpha-decay, nuclear fission and fusion reactions, reaction rate, neutron transport in reactors.
After the successful completion of this module, the successful student should have
a) a solid and useable background in the basic aspects and theories with respect to special relativity, introductory quantum mechanics and nuclear physics, and
b) the necessary skills to solve relevant problems in these disciplines.

FSK324 (16 credits) – Solid-state Physics
(Department of Physics)
Three one-hour lectures per week during the second semester.
One examination paper of three hours.
Structure of solids: Crystallography: crystal planes, crystal lattice, reciprocal lattice, Defects: point defects, dislocations, X-ray diffraction.
Lattice dynamics: Lattice vibrations: Einstein and Debye models, normal modes and density of states, thermal properties, Brillouin zones.
Free electron model: Electrical and thermal conduction, Fermi level, Hall effect.
Periodic Potential: Band theory: nearly free electron and tight binding approach.
After successful completion of the module the student should have thorough knowledge and be able to solve relevant problems on:
a) crystal structures and the interatomic forces responsible for these structures
b) diffraction by crystals (x-rays, electrons and neutrons)
c) lattice vibrations and the effects on thermal, acoustic, and optical properties
d) the free-electron model in metals and
e) energy bands in solids.

FSK332 (8 credits) – Statistical Physics I
(Department of Physics)
One one-hour lecture per week during the first semester.
One examination paper of two hours.
Phase space, distribution function, the most probable distribution, Lagrange multipliers, Boltzmann distribution, degeneracy of energy levels, the Maxwell-Boltzmann velocity distribution, the Maxwell-Boltzmann speed and energy distributions, the derivation of the equation of state of an ideal gas using the Maxwell-Boltzmann distribution, paramagnetism. Applications in terms of transport processes like effusion and diffusion, derivation of the hydrodynamic equations of motion of gases and fluids, heat conduction, propagation of sound waves, and viscosity.
After successful completion of the module the successful student should
a) have a solid and useable background in the basic aspects of statistical physics and transport theory in the classical limit.
b) have the necessary background to solve basic problems in kinetic theory, thermodynamics and fluid dynamics.

FSK342 (8 credits) – Statistical Physics II
(Department of Physics)
One one-hour lecture per week.
One examination paper of 2 hours.
Quantum statistics, the Fermi-Dirac and Bose-Einstein statistics and distributions, the equation of state of a quantum gas, Fermi temperature, low-temperature properties of a degenerate gas, the degenerate electron gas, valence and conduction bands in semiconductors, degenerate gases in astrophysics: white dwarfs and neutron stars, Blackbody radiation, the photon gas, stimulated emission, Debye specific heat, electron specific heat.
After successful completion of the module the successful student should
a) have a solid and useable background in the basic aspects of statistical physics in the quantum limit.
b) have the necessary background for the solving of basic problems in this discipline.

FSK352 (8 credits) – Practical work: Physics
(Department of Physics)
One practical session of 5 hours per week during the first semester.
Practical work on phenomena that are explained by modern physics, as well as a few experiments in statistical physics and thermodynamics.
After the successful completion of the module the student should:
a) be familiar with physical apparatus and measuring systems.
b) be confident in working with physical apparatus.
c) be able to write a scientific report.

FSK362 (8 credits) – Practical work: Physics
(Department of Physics)
One practical session of 5 hours per week during the second semester.
Practical work on phenomena that are explained by solid state theory as well as a few experiments in statistical physics and thermodynamics.
After the successful completion of the module the student should:
a) be familiar with physical apparatus and measuring systems.
b) be confident in working with physical apparatus.
c) be able to write a scientific report.

FSK372 (8 credits) – Radiative processes I
(Department Physics)
One lecture per week during the first semester.
One examination paper of two hours.
Fundamentals of radiative transport, intensity, radiative momentum and transfer, thermal radiation, the Einstein coefficients, scattering effects random walks and radiative diffusion. A brief introduction of radiation fields, review of Maxwell's equations. Plane electromagnetic waves, Electromagnetic potentials. The radiation of moving charges: the Larmor formula, Thomson scattering, radiation from harmonically bound charges. Introduction of relativistic mechanics, emission of relativistic particles, invariant phase volumes and specific intensity. An investigation of the fundamentals of radiation propagating through a magnetized plasma, e.g. introducing the plasma frequency, Faraday rotation and Cerenkov radiation, the Razin effect.
After successful completion of the module the successful student should:
a) have a solid and useable background in the fundamentals of radiation transport and radiation of individual charged particles, and be familiar with the concepts of radiative flux, specific intensity, radiative transfer, thermal radiation, the Einstein coefficients, scattering effects (random walk) and radiative diffusion, the basic radiation fields, Maxwell's equations, plane electromagnetic waves, retarded potentials for single charges, velocity and radiation fields, radiation of non-relativistic systems of particles, Thomson scattering, as well as radiation reaction and the radiation of harmonically bound particles as a mechanical model for the emission of bounded particles, four-vectors, and the relativistic expressions for the fields of charged particles and some basic properties of relativistic mechanics;
b) have the necessary background to solve basic problems in this discipline, and apply basic concepts to solve problems related to radiation transport in astrophysical environments like stellar atmospheres and molecular clouds and supernova remnants, the propagation of electromagnetic waves in a non-conducting and conducting medium, the power radiated by rotating magnetic objects (pulsars) and accelerated single charged particles and oscillating dipoles, relativistic mechanics.

FSK382 (8 credits) – Radiative processes II
(Department Physics)
One lecture per week during the second semester.
One examination paper of two hours.

The emission of single speed electrons in the vicinity of a massive nucleus, thermal bremsstrahlung emission, relativistic bremsstrahlung, synchrotron emission, expressions for the total emitted power, beaming, Compton and Inverse-Compton scattering, cross section, energy transfer and spectral regimes, atomic structure (review of the Schrodinger equation and fundamentals of atomic physics), Zeeman effect and hyperfine structure, thermal distribution of ionized energy levels leading to the Saha equation, radiative transitions (Milne relations)and line broadening mechanisms, e.g. Doppler broadening, natural broadening and collisional broadening mechanisms.
After successful completion of the module the successful student should:
a) have a useable background in the fundamental aspects of radiation processes of single charged particles, and be familiar with bremsstrahlung, the basic properties of synchrotron radiation, Compton and Inverse-Compton scattering, atomic processes related to radiation, e.g. Zeeman splitting, hyperfine structure, the Saha equation and radiative transitions and line broadening mechanisms;
b) have the necessary background to solve basic problems in this discipline, and apply fundamental concepts introduced above to solve basic problems related to: bremsstrahlung, synchrotron radiation of single particles, Compton and Inverse-Compton radiation, atomic processes related to radiation and radiation transport.

GEN216 (24 credits) – Principles of Genetics
(Department of Genetics)
Three lectures and a five hour practical per week (First semester).
One examination paper of three hours.
Mendelian laws; Mendelian inheritance; non-Mendelian inheritance; statistical testing of hypotheses; calculation of probabilities; multiple alleles; pedigrees; sex-linked inheritance; cytoplasmic inheritance; polygenic inheritance; mitosis; meiosis; cross over; 3-point gene mapping; deletion mapping; chromosome abnormalities; modern mapping methods; introduction to population genetics, introduction to behavioural genetics, introduction to molecular systematics and introduction to forensic genetics.
After completing the module successfully, the student should
a) be able to determine the type of inheritance of different genetic traits,
b) be able to test and interpret inheritance hypotheses,
c) be able to determine and interpret inheritance probabilities,
d) be able to apply their inheritance knowledge on family pedigree analyses,
e) prove when genes are linked,
f) be able to determine the sequence of and distance between linked genes,
g) have a general overview of genetics.

GEN246 (24 Credits) – Molecular Genetics
(Department of Genetics)
Three lectures and five hour practical per week (Second semester).
One examination paper of three hours.
The module introduces DNA as the blueprint of life. The central dogma of molecular biology will be studied, which includes the transcription of DNA to RNA, followed by the translation of RNA to proteins; DNA replication and organization into chromosomes; DNA mutations and mechanisms for repairing mutations; the basis of gene regulation and expression in prokaryotes and eukaryotes. The advent of recombinant DNA technology will be discussed by considering various DNA cloning tools and the importance of genome sequencing and analysis. The possibility of improving life through the production of Genetically Modified Organisms (GMOs) will also be studied.
After successful completion of the module the student will be able to:
a) explain the basis of DNA as the genetic material, including the structure and function thereof in the cell
b) understand the link between DNA, RNA and proteins as well as the process of protein synthesis
c) describe the different mechanisms controlling the genetic integrity between individuals of different generations
d) discuss the basis of gene regulation and expression in prokaryotes and eukaryotes
e) comprehend the implications and impact of recombinant DNA technology, including the production of Genetically Modified Organisms (GMOs).

GEN324 (16 credits) – Evolutionary Genetics
(Department of Genetics)
Two lectures and a three-hour practical per week (Second semester).
One exam paper of three hours.
The main aim of this module is to study how organisms may differ on chromosomal and DNA level and to determine the influence of these differences on evolution, speciation, genetic variation and phylogeny. Basic concepts of phylogeny and methods to determine phylogenetic relationships are examined.
After completing the module successfully, the student should:
a) be able to distinguish between different types of chromosomal evolution,
b) be able to execute genomic analyses,
c) be able to evaluate phylogenetic relationships on the basis of chromosomal evolution,
d) be able to analyse genetic variation between and in populations,
e) discuss the evolution of DNA on molecular level,
f) be able to select a proper gene for phylogenetic analysis,
g) be able to select an out-group and to understand the necessity thereof,
h) be able to analyse phylogenetic relationships and interpret data.

GEN334 (16 credits) – Forensic Genetics
(Department of Genetics)
Two lectures and a three-hour practical per week (First semester).
One exam paper of three hours.
The main aim of this module is to study how STR markers and other molecular techniques are applied in the field of forensic genetics. The interpretation of DNA profiles is demonstrated and the practical application of DNA profiles in the identification and

parentage analysis process are explained. The accreditation and certification of DNA forensic laboratories are discussed. The topic of wildlife forensics is also addressed.
After completing the module successfully, the student should
a) be able to describe and differentiate between the different techniques used for DNA profiling,
b) be able to explain how these profiles can be applied in DNA forensics,
c) discuss how STR technology is used to verify parentage,
d) discuss how STR technology is used to identify individuals,
e) be able to justify the existence of a national DNA database in South Africa,
f) be able to describe and explain why forensic laboratories should be accredited and certified.

GEN344 (16 credits) – Population Genetics
(Department of Genetics)
Two lectures and a three-hour practical per week (Second semester).
One exam paper of three hours.
Gene frequencies in large and small populations; effects of genetic drift; selection; mutation; migration; and inbreeding on evolution; variance; resemblance between relatives; QTLs; population genetic principles applied in nature conservation and the effects on the genetic management of biodiversity.
After completing the module successfully, the student should
a) be able to describe what factors may have an influence on gene frequencies,
b) be able to discuss how these factors may change evolution in populations,
c) be able to judge the importance of genetic diversity.

GEN354 (16 credits) – Behavioural Genetics
(Department Genetics)
Two lectures and three hours practical per week (First semester)
One examination paper of three hours.
Chromosomal and sex linked disorders, patterns of inheritance and pedigree analysis, single gene and multifactorial disorders, prenatal diagnosis, the potential contribution of genotype and/or environment on behavioural studies, quantitative studies, twin and adoption studies, identifying genes contributing to human behaviour, deeper study of human behaviour, including cognitive disabilities, psychopathology, personality and personality disorders.
After completing the module successfully, the student should
a) Understand the basic scientific background on human and behavioural genetics
b) Understand chromosomal disorders and mechanisms of ethiology
c) Be able to interpret pedigrees,
d) Understand the effect of different genetic techniques on society
e) Evaluate the boundaries of ethical research
f) Apply the various research types when studying behaviour
g) Plan an experiment to determine if a certain behavioural trade is inherited or influenced by the environment.

GEO114 (16 credits) – Introduction to Physical Geography
(Department or Geography)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Universe, solar system, earth, Climatology, hydrogeography, soilgeography, biogeography, weathering and erosion, geomorphology, environmental geography.
Practicals: Elementary cartography and the representation and interpretation or data.
Students that successfully complete this module should be able to:
a) demonstrate and understand processes active in and on the earth and
b) apply the basic skills and techniques to compile, interpret and present data.

GEO124 (16 credits) – Introduction to human Geography and cartography
(Department of Geography)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Population dynamics, development of rural and urban settlements, urbanisation, agriculture and the provision of food, rural land use, sources of energy, economic geography.
After completion of the module the successful student should have:
a) the ability to describe the basic phenomena and theories concerning population, rural and urban settlements, as well as rural and economic activities;
b) the skills to solve problems and gather and analyse data with regard to the topics mentioned above;
c) a thorough knowledge of demographic dynamics and cultural diversity;
d) knowledge of the urbanized world, nodes and hierarchies, as well as flows and networks; and
e) the ability to interpret maps.
[This module accounts for 16 credits of which 2 are allocated to critical outcomes including: communication, interpersonal and language skills, problem solving and the evaluation and debating of information.]

GEO214 (16 credits) – Urban development
(Department of Geography)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Components of development: theoretical framework: development and criteria of measuring, spatial models, characteristics of third world countries, local development.

Urban components: human settlements, spatial models, intra urban structure, urbanisation in first and third world context, impact of urbanisation on the physical and social environment, economic activities, residential function, housing and services, transport, social dynamics, institutional framework, problems and challenges of first and third world cities, case studies.
Spatial analysis: collection and preparation of data, statistical principles of application in spatial analysis, application programs, interpretation of results, case studies.
After successful completion of the module the student should have:
a) a thorough knowledge of urban processes and economic activities in urban settlements;
b) knowledge of residential areas and problems occurring in the city;
c) an understanding of the concept "development" and the role of urban areas in this process;
d) a thorough understanding of the theoretical paradigms describing the concept of development;
e) a thorough knowledge of the implementation of this theoretical development framework in the South African space economy; as well as the knowledge to identify and interpret urban phenomena and problems in practise;
f) a thorough knowledge of the interpretation and description of data; and
g) the skills to interpret maps.

GEO224 (16 credits) – Environmental studies
(Department of Geography)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Environmental problems and causes, history of the use and conservation of resources, ecosystems and how they work, population dynamics, economy and the environment, water sources, pollution: air and water pollution, solid waste.
After successful completion of the module, the student should have a thorough knowledge of the functioning and management of the physical environment.

GEO234 (16 credits) – Process geomorphology and geomorphologic hazards
(Department of Geography)
Three lectures and one two hour practical a week.
One three-hour examination paper.
Fluvial geomorphology. Aeolian geomorphology. Introduction to coastal geomorphology. Slopes and slope processes. Geomorphologic hazards.
After successful completion of the module, the student should have knowledge of the relevant geomorphologic processes and their relation to geomorphologic hazards.

GEO314 (16 credits) – Applied urban development and spatial transformation
(Department of Geography)
Three periods a week.
One three-hour examination paper.
Geography of apartheid, inequality and post-apartheid, spatial transformation of urban areas, changing urbanisation processes and patterns, spatial re-integration of the former homelands. The following objectives are to be achieved during the module:
a) to analyse the geography of apartheid scientifically;
b) to interpret the geography of inequality on national, regional and local level;
c) to understand the geography of post-apartheid and to be able to apply the concept;
d) to critically analyse urbanisation and urban growth as spatial processes, to identify challenges associated with fast growing cities and to propose possible solutions;
e) to critically analyse the spatial transformation of urban areas, to identify future challenges and to propose possible solutions in this regard.

GEO324 (16 credits) – Environmental management and analysis
(Department of Geography)
Three lectures and one three hour practical a week.
One three-hour examination paper.
The South African environment and processes and systems in the environment, environmental management plans, integrated environmental management procedures, environmental impact analyses, environmental auditing, evaluation models.
After successful completion of the module, the student should have a thorough knowledge of the functioning and management of the South African environment and of the techniques and procedures applied to environmental management.

GEO334 (16 credits) – Environmental Geomorphology
(Department of Geography)
Three lectures and one two hour practical a week.
One three-hour examination paper.
Development of geomorphology as a discipline. Micro-scale geomorphologic processes. Introduction to geomorphology in Quaternary studies. Soils and sediments in geomorphology. Applied geomorphology. Geomorphology for engineers and geomorphology in environmental management.
After successful completion of the module, the student should have a knowledge of micro geomorphological processes and their function in the context of Quaternary and applied geomorphology.

GEO344 (16 credits) – Rural Geography
(Department of Geography)
Three theory lectures and two tutorial sessions per week.
One three-hour examination paper.

Theory:
The course aims to provide an introduction to rural development issues globally, It investigates the sustainable development of rural areas, the impact of migration on the development of rural areas, poverty at it manifests itself in different forms in rural areas, how poverty can be reduced in rural areas and finally the course studies rural-urban linkages.
Tutorial:
The course aims to provide an introduction to rural geography as to engage students in discussions related to rural development issues. Students will be provided with readings and must critically engage with concepts discussed during theory sessions.

GIS224 (16 credits) – Geographic Information Systems
(Department of Geography)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Theoretical framework of GIS, computer cartography, data structures and databases, collection and verification of data with spatial analysis and spatial modelling and the presentation of information with the aid of GIS. Elementary surveying. Identification of features and measurement on aerial photographs; image processing.
After successful completion of the module, the student should have a thorough knowledge of the basic principles of Geographic Information Systems and be able to do simple data import, processing, analyses and presentation on a computer. The student will have basic cartographic and surveying skills; be able to identify features and conduct measurements on photographs; be able to use the stereoscope for identification and surveying purposes; and have basic knowledge of satellite images and image processing.

GIS324 (16credits) – Geographic Information Systems
(Department of Geography)
Two lectures and one four hour practical a week.
One three-hour examination paper.
Geographical data and the computer, data collection and data acquirement, data verification, quality control, raster data models, vector data models, interpolation, spatial analysis and spatial modelling, errors, the management of a GIS. Application programs, data digitising, topology, data processing, removing of errors, digital image processing as data source, representation of information, report writing.
After successful completion of the module, the student should have a thorough knowledge of advanced principles of Geographic Information Systems and should be able to apply the knowledge to problematic situations. The student should understand the functioning of the relevant software, be able to collect, process and present data and write a report on a project.

GKDxyz – Soil Science
See Yearbook, Part 4 (Agricultural Sciences)

GLG114(16 credits) – Introduction to Geology
(Department of Geology)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Universe, solar system, earth, internal structure of the earth, palaeomagnetism and age determination, plate tectonics, crystallography, mineralogy, rock types, structural geology, stratigraphical principles and introduction to economic geology.
Practicals: Crystallographic systems, identification of the most common minerals and rock formations.
Students that successfully complete this module should be able to demonstrate and understand earth processes active in and on the earth.

GLG124 (16 credits) – General Geology
(Department of Geology)
Three lectures and one practical of three hours per week.
One examination paper of three hours.
Mineralogy: crystal structure, minerals.
Igneous rocks: volcanism, origin, nature and composition.
Sedimentary rocks: origin, nature and composition.
Metamorphic rocks: origin, nature and composition.
Plate tectonics: processes and products.
Palaeontology: fossils, geological timetable.
Stratigraphy: principles, South African stratigraphy, with reference to economic mineral deposits and fossil content.
African Plate: origin and development
Practicals: Study of crystals, minerals, rocks and fossils.
Students that successfully complete this module should be able to:
a) demonstrate and understand the natural geological processes active in, on and under the Earth's crust and
b) apply the basic skills and techniques to identify, compile and interpret geological processes and phenomena.

GLG202 (8 credits) – Geology of Southern Africa: genesis and age relationships
(Department of Geology)
One field school presented in either the April or September holiday
Continuous evaluation by means of tasks, reports and tests.
Stratigraphical relationships, occurrences and origin of rocks and ores.
Students that successfully complete this module should be able to:
a) identify and classify rocks and minerals in nature.
b) apply theoretical knowledge with sound judgement.
c) have the ability to study ore-deposits in southern Africa and to have a thorough knowledge of their occurrence.

GLG212 (8 credits) – Petrographical mineralogy
(Department of Geology)
One practical of five hours per week.
Continuous evaluation by means of practical examinations.
The petrographic microscope, optical mineralogy, minerals in hand sample, crystal morphology.
After the successful completion of the module the student should be:
a) familiar with the practical techniques of identification and classification of crystal forms and ore and rock-forming minerals in hand specimens as well as rock-forming minerals under the microscope.
b) able to interpret and apply this knowledge while rendering professional geological and mineralogical service.
c) equipped for independent post-graduate studies.

GLG214 (16 credits) – Advanced mineralogy
(Department of Geology)
Three lectures per week.
One examination paper of three hours.
Crystallography: crystal lattices, unit cell, Miller symbols, crystal morphology and growth.
Optical mineralogy: refractive indicatrixes, polarization and birefringence, indicatrixes, observations in orthoscopic and conoscopic view.
Crystal chemistry: bonds in metals and minerals, coordination polyhedra, ionic radii.
Systematic mineralogy: study of the most important minerals in each mineral class with special reference to chemical composition, crystal chemical structure, optical and physical characteristics, formation conditions and uses.
After the successful completion of the module the student should:
a) have a thorough knowledge of the theoretical principles of crystallography, optical mineralogy and the crystal chemistry of ore and rock-forming minerals.
b) be able to interpret and apply this knowledge while rendering professional geological and mineralogical service.
c) be equipped for independent post-graduate studies.

GLG222 (8 credits) – Sedimentological applications
(Department of Geology)
One practical of five hours per week plus two compulsory field excursions.
Continuous evaluation by means of tasks.
Practical application of sedimentological principles in borehole core logging, measurement of geological profiles and the compilation of geological maps in order to define palaeo depositional environments.
After the successful completion of the module the student should:
a) be able to compile and interpret sedimentological maps.
b) be able to measure and compile geological profiles.
c) be able to log borehole core and compile geological profiles.
d) have the necessary skills to study sedimentary units and reconstruct the palaeo depositional environment.

GLG224 (16 credits) – Advanced sedimentology
(Department of Geology)
Three lectures per week. One examination paper of three hours.
Introduction to sedimentology, physical characteristics, composition and classification of sedimentary rocks, sedimentary structures and depositional environments, sedimentary facies and basin analysis, stratigraphic definitions, analysis of selected depositional basins in southern Africa, reconstruction of Gondwana.
After the successful completion of the module the student should:
a) understand the processes, which operate on the surface of the Earth and will also be able to identify the products of these processes.
b) have the necessary skills to interpret all stratigraphic data in a competent manner in order to forecast where minerals and rocks of economic and strategic importance could occur.

GLG232 (8 credits) – Geological techniques: uses and applications
(Department of Geology)
One practical of five hours per week.
Continuous evaluation by means of tasks and tests.
Geohydrological principles: groundwater, structures and dewatering.
Stratigraphy: depositional basins and rock types.
Structural geology: basic structures and tectonites.
Sedimentology: rock types, principles and techniques.
Igneous geology: rock types and characteristics.
Metamorphic geology: rock types, structures and textures.
Economic geology: rock types and associated ore.
Geological field techniques: geophysical techniques, compass use, mapping, statigraphic profiling, core mapping, GPS, collecting, documentation and interpretation of field observations and report writing. Geotechnical properties of rocks.
After the successful completion of the module the student should have:
a) a thorough knowledge of which techniques may be employed in field-based geological analyses.
b) an understanding of how to apply theoretical knowledge on a practical basis.
c) the ability to map areas geologically, measure profiles, make geological observations and write reports.

GLG242 (8 credits) – Geological environmental management
(Department of Geology)
One practical of five hours per week
Continuous evaluation by means of tasks and tests
The identification and handling of environmental problems, pollution of surface and underground water, visits to waste storage and/or reclaimed mining areas.
After the successful completion of the module the student should be:
a) familiar with the practical techniques in the identification of heavy metal pollution.
b) able to interpret data with sound judgement and discuss the observations in a report.

GLG244 (16 credits) – Environmental Geology
(Department of Geology)
Three lectures per week.
One examination paper of three hours.
Basic principles of geology, geochemistry and Geohydrology, weathering, engineering geological aspects, impact studies, geological risk areas, waste management, earth and human health, legal aspects.
After the successful completion of the module the student should:
a) know and understand the basic principles related to natural processes.
b) be able to describe the influence of these processes on man and his environment and the influence of man on the environment.
c) be able to apply theoretical knowledge with sound judgement to identify and manage geological hazards.

GLG252 (8 credits) – Geological structures and maps
(Department of Geology)
One practical of five hours per week.
Continuous evaluation by means of tasks and tests.
Geological structures, maps and stratigraphic sections.
After the successful completion of the module the student should:
a) be able to interpret geological structures and maps.
b) know the basic principles and techniques used in the construction of sections.
c) be able to apply theoretical knowledge to practical problems with sound judgement.

GLG314 (16 credits) – Igneous petrology
(Department of Geology)
Three lectures and one practical of two hours per week.
One examination paper of three hours.
Principles of igneous petrogenesis: magma and the formation of igneous bodies, fractional crystallisation and magmatic differentiation.
Igneous rocks within specific tectonic provinces: layered complexes, granites, basalt occurrences, alkaline rocks, kimberlite and carbonate associations and massive-type anorthosite.
Practicals: Microscopic description and classification of igneous rocks.
After the successful completion of the module, the student should be able to:
a) give correct names to examples of common igneous rocks.
b) describe the properties of igneous rocks from the viewpoints of both macro and microscopic format.
c) provide probable origins for specific intrusions and complexes.
d) understand the essential characteristics of important South African occurrences such as the Bushveld Igneous Complex.

GLG324 (16 credits) – Economic and exploration Geology
(Department of Geology)
Three lectures and one practical of three hours per week.
One examination paper of three hours.
Processes of ore formation with southern African examples: Orthomagmatic, hydrothermal (magmatic-), sedimentary, supergene and metamorphic, aspects of industrial minerals and fossil fuel formation.
Mineral economics: Mineral legislation, mineral resource and ore reserve estimation and evaluation.
Practicals: The process of geological modelling, identification of ore minerals and textures in hand specimen, calculation of ore reseserves, mine visit.
After the successful completion of the module the student should have:
a) a sound knowledge of ore-forming processes under different conditions and in different environments, how ore deposits form in the evolving earth system and global tectonics.
b) the ability to evaluate ore deposits and to make educated recommendations regarding the exploitation of the ore-body.
c) the ability to, by means of sophisticated exploration techniques, explore for non-renewable ore deposits.

GLG334 (16 credits) – Advanced structural Geology
(Department of Geology)
Two lectures and one practical of three hours per week.
One examination paper of three hours.
Principles of deformation: geometry of stress, mechanical behaviour of crystals and rocks, shearing models, analysis of deformation.
Structures: faults, joints, folds and fabrics.
Practicals: Study of stress, faults, folds and deformation.
After the successful completion of the module the student should:
a) know and understand the principles and techniques associated with structural geology.
b) be able to apply this knowledge conceptually and practically for the purpose of a professional geological service.
c) be equipped for independent post-graduate studies.

GLG344 (16 credits) – Metamorphic petrology
(Department of Geology)
Two lectures and one practical of two hours per week.
One examination paper of three hours.
Macro-characteristics of metamorphites, classification, typomorphic minerals, chemographic representation. Processes of metamorphism.
Practicals: Identification of typomorphic minerals, metamorphic textures, metamorphic rocks.
After the successful completion of the module the student should have:
a) a thorough knowledge of what role the process of metamorphism plays in determining rock properties and which properties may be instrumental in unravelling the geological history (ore history) of an area.
b) the ability to differentiate between the various metamorphic rocks and be able to apply internationally acceptable names to these rocks.
c) the expertise to proceed with the mapping of metamorphic terrains.

GLG354 (16 credits) – Introduction to Geochemistry
(Department of Geology)
Three lectures and one practical of three hours per week.
One examination paper of three hours.
The processes by which chemical elements form in stars, and element distribution in the universe and our solar system; geochemical classification of elements, and element distribution in the rock cycle (chemical differentiation of the earth, including geochemical aspects of tectonic processes); calculation of reaction boundaries of geochemical reactions; the use of mineral geochemistry to construct geothermobarometric constraints; geochemistry of sedimentary rocks; multi-element normalised diagrams; the basic principles and uses of radioactive, radiogenic and light stable isotopes in geochronology and petrology; the use of major element data for rock classification.
Practicals: Mineral chemistry calculations and whole rock normative mineralogy. Graphic representation of geochemical data. Self-study and the preparation of a geochemical research report; presentation of the report to a peer group audience.
After successfully completing of this module the student should have the knowledge and ethics which enable him/her to render professional geochemical services. This includes:
a) a thorough knowledge of the distribution of elements in rocks.
b) knowledge of the classification schemes for elements and their applications.
c) application of distribution coefficients in geochemical interpretation.
d) the principles and basic applications of geochronology and isotope geochemistry.
e) knowledge of geothermobarometry and its application.
f) the basic applications of geochemistry on sedimentary cycles.
g) calculations of mineral formulas and normative mineralogy, using major element oxide data.

GLG364 (16 credits) – Exploration Geochemistry
(Department of Geology)
Three lectures and one practical of three hours per week.
One examination paper of three hours.
Geochemical dispersion, anomalies, weathering effects on geochemical anomalies and geochemistry as a prospecting aid, volatile components, fluid inclusions, model systems and isochores. The secondary environment as a prospecting medium.
Mineral economics and exploration; reconnaissance exploration; prospect and predevelopment; remote sensing; geophysical methods; exploration geochemistry; evaluation techniques; feasibility studies; case studies.
Practicals: Analytical techniques in exploration geochemistry, threshold calculation in probability plots, statistical processing of data, modelling and interpretation of geochemical data, solving practical exploration problems according to Levinson.
After the successful completion of the module the student should have:
a) a thorough knowledge of factors that influence geochemical dispersion and the principles controlling the distribution and migration of elements in the earth's crust.
b) the ability to apply analytical techniques to geochemical exploration problems.
c) the understanding to interpret geochemical anomalies and their relationship to mineral deposits.
d) know indicator minerals and pathfinder elements as proximity indicators to ore.

GLG374 (16 credits) – Petrochemical applications
(Department of Geology)
Three lectures and one practical of three hours per week.
One examination paper of three hours.
The use and interpretation of geochemical data in a responsible manner; sampling of rocks, soils and water for geochemical analysis; methods for data quality assurance; the principles of instrumental analysis; the interpretation of electromagnetic and mass spectra; common analytical methodes; statistical concepts needed for the intelligent reduction of geochemical data; the basic principles of physical metallurgy; interpretation of; geochemical maps and profiles.
Practicals: Reduction, manipulation and interpretation of geochemical data; analytical methods for isotope analysis; methods for mineral separation prior to chemical analysis; preparation and presentation of geochemical reports.
Successful completion of this module should allow students in:
a) reduce geochemical data in a sensible way for application to geological problems.
b) prepare rocks for chemical analysis, especially by XRF.
c) have a thorough knowledge of how to assess the quality of geochemical data.
d) understand the role of the geologist within the mineral beneficiation cycle.
e) understand the principles on which instrumental spectrometry is based.
f) separate dense and magnetic minerals from a silicate matrix.
g) write a geochemical report and present conclusions.

GLG384 (16 credits) – Environmental Geochemistry
(Department of Geology)
Three lectures and one practical of three hours per week.
One examination paper of three hours.
Basic principles of the distribution and geochemical behaviour of chemical elements in soil, water and air; interaction of surface geochemistry with humans; techniques for prediction and location of pollution; remediation and protection of the natural environment; the geochemical implications to the environment of various methods to generate energy on an industrial scale.
Practicals: Geochemical modelling; field-based project.
After successful completion of this module a student should have:
a) a sound knowledge of pH-Eh reactions in water and soils and the ability to construct and interpret simple pH-Eh diagrams.
b) basic knowledge of air chemistry and possible causes of atmospheric pollution.
c) knowledge about how to manipulate water chemistry.
d) knowledge of the effects of mining and associated contamination on the natural environment, especially acid mine drainage.
e) knowledge of trace element distribution of typical soil profiles and the effect of grain size on concentration.
f) a familiarity with the most important factors that lead to toxicity in the natural environment and its rehabilitation.
g) knowledge about the application of isotopes in environmental geochemistry.

GEO114 (16 credits) – Introduction to general Geosciences
(Department of Geography and Department of Geology)
Three lectures and one three hour practical a week.
One three-hour examination paper.
Universe, solar system, earth, internal structure of the earth, paleomagnetism and age determination, plate tectonics, crystallography, mineralogy, rock types, structural geology, stratigraphical principles, geological map of South Africa and geology of Africa. Climatology, hydrogeography, soilgeography, biogeography, weathering and erosion, geomorphology, environmental geography.
Practicals: Crystallographic systems, identification of the most common minerals and rock formations, elementary cartography and the representation and interpretation of data.
Students that successfully complete this module should be able to:
a) demonstrate and understand earth processes active in and on the earth and
b) apply the basic skills and techniques to compile, interpret and present data.

HTG214 (16 credits) – Histology (1)
(Department of Basic Medical Sciences)
Three lectures and three hours practical per week.
One exam paper of two hours and one practical exam of 30 minutes.
Histology is the study of microscopic structure, composition and functions of tissues. Topics in this module include cytology – the cell and its functions; epithelium – different types, functions, different types of glands and mechanisms of secretion; connective tissue- types, presentation, functions, cartilage and bone; muscle tissues; blood; nervous tissue; structure of the skin and its functions; microscopic features of blood vessels, lymphatic vessels and lymphoid organs.

HTG224 (16 credits) – Histology (2)
(Department of Basic Medical Sciences)
Three lectures and three hours practical per week.
One exam paper of two hours and one practical exam of 30 minutes.
Histology is the study of microscopic structure, composition and functions of tissues. Topics in this module include the microscopic features of the alimentary tract, respiratory system; the eye; the ear; microscopic features of the genito-urinary and endocrine systems.

HTG304 (16 credits) – Histological Techniques(Department of Basic Medical Sciences)
Three hours practical per week. Study assignments / projects.
Continual evaluation.
Light microscope techniques – fixatives, factors influencing fixation, artefacts, methods of fixation. Electron microscopy techniques – types of fixatives, factors influencing fixation, mixtures of fixation solutions. Tissue processing for light and electron microscopy – dehydration, clesring, embedding. Microtomy and staining of tissues for light and electron microscopy. Special techniques – frozen sections, double embedding, auto radiography. Histochemistry. Immunocytochemical techniques. Microscopes – light microscope (lenses and imaging), dark field, phase contrast, fluorescence. Electron microscopy – transmission, scanning, photo microscopy.

EHRM51305(16 credits) – Personnel Psychology
(Department of Industrial Psychology)
Personnel planning, Planning, Recruitment, Selection, Personnel development, Performance appraisal, Training (model), Maintenance of personnel, Compensation, Benefits, Occupational health, Strass, Labour relations, Management ethics.

IQM242 (8 credits) – Industrial Quality Management
(Department of Microbial, Biochemical and Food Biotechnology
Two lectures per week during the fourth quarter.
One examination paper of two hours.
Quality management plays an important role in all industries. The skill to apply this important concept in practice will equip the student with a sought after skill. This module includes introductory quality management, control charts, implementation of HACCP as well as quality control. Emphasis is placed on application which is highlighted with relevant case studies.
After the successful completion of the module the student should:
a) be able to construct a quality control program for any kind of industry.
b) have an overview of quality management systems as applied in industry.
c) have the skills to apply knowledge obtained in this module in quality accreditation systems.

ISC164 (16 credits) – Introduction to Investment Science
(Department of Mathematical Statistics and Actuarial Science)
Three one-hour lectures per week
One three-hour exam paper
The aim of this module is two-fold: to introduce many basic concepts used in investment science, namely, the time value of money, the workings of financial markets, interest rate risk, risk and return, and security valuation assumptions and procedures; and to introduce the research process for students
After successful completion of this module the student should:
a) Understand the concept of time value of money
b) Be able to manipulate, convert between, and utilize simple, compound nominal, and compound effective interest and discount rates
c) Be able to solve basic discounting, accumulating, and annuity problems
d) Understand basic loan theory and be able to create loan schedules on spread sheet software
e) Comprehend (and be able to solve basic calculations related to) money, bond, and equity markets
f) Comprehend (and be able to solve basic calculations related to) interest rate risk and the control of interest rate risk
g) Comprehend (and be able to solve calculations related to) risk and return, including portfolio theory, the security market line (SML), the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT)
h) Be able to summarise the procedures involved in technical and fundamental analysis
i) Be able to identify and create European option position and strategy profit diagrams
j) Be able to summarise the primary forms of the efficient market hypothesis.

ISC354 (16 credits) – Investment Science
(Department of Mathematical Statistics and Actuarial Science)
Three one-hour lectures and one two-hour tutorial/practical per week.
One three-hour exam paper.
This module expands on the contents of ATW2 by covering the following topics: Professional code and ethics, and standards of practice, investment valuation practices, complex investment valuation models, portfolio management procedures, introduction to alternative investments, and valuation of alternative investments and inclusion in an investment portfolio.
After successful completion of this module the student should be able to:
a) Recall the code and ethics, as well as the standards of practice of an exemplary professional investment body, and analyse the adherence to these rules of particular situations
b) Value a variety of investments with inherent complexities
c) Calculate the trading prices of investments as required in various investment markets
d) Recognise, compare and discuss sound portfolio management practices
e) Demonstrate knowledge of alternative investments including:
    a. an understanding of the working of the markets for alternative investments,
    b. the pricing of alternative investments, and
    c. the inclusion of alternative investments in investment portfolios.

Prerequisites: ISC164 and (ATW226 or ATW246)

ISM122 – Industrial Specific Management
(Department of Chemistry)
Weekly contact session.
One paper of sixty minutes.
Content
The module content includes a holistic approach to man-made disasters, with the emphasis on chemical disasters. Included are the legal aspects and requirements of the act on health and safety in the workplace, the management of disasters, scope of emergency planning, evaluation of risk, authority and responsibility, communication and information distribution. Aspects such as the danger of different chemical agents, content of an emergency plan, decontamination, design of a laboratory as well as the type of protective clothing and equipment needed in the management of disasters are also included in the module.
Outcome: After the successful completion of the module the candidate will be able to critically evaluate a chemical work environment in terms of the legal requirement, identify potential chemical disasters, evaluate and prevent or mitigate the impact with proper planning. The candidate will also be able to manage chemical disasters with the prevention of further contamination and personal damage or injuries.

ITR224 (16 credits) – Home planning
(Department of Consumer Science)
Two lectures and one practical of three hours per week in the second semester.
One examination paper of two hours.
Planning and arranging the home for individual families and communities of different socio-economic groups as well as special groups (disabled). Design application and evaluating of social, private and work areas are done. To be successful in planning a home the determination of needs, identification of problems and problem solving are essential. Selection of suitable soft furnishings.
After the successful completion of this module the student should have:
(a) thorough knowledge about planning a home for different groups of people (e.g. individual families, communities and special groups),
(b) design application and evaluation of different areas can be done,
(c) determination of needs, identification of problems and problem solving can be done,
(d) mastered skills in soft furnishing.

ITR234 (16 credits) – Interior design. Fabric study
(Department of Consumer Science)
Two lectures and one practicum of three hours per week in the first semester.

One examination paper of two hours.
Design: basic principles of design and guidelines. Design elements: line, form, shape, space, texture and colour.
Design elements: Proportion, scale, balance, rhythm, emphasis, harmony and character analyse.
Interior design, design style and designers are discussed. Study of material and furniture. Classification, origin, manufacture, properties, uses, care and maintenance. Aspects such as lighting, ventilation, temperature- and noise control are discussed.
After the successful completion of this module the student should have:
a) a thorough knowledge of interior design and design style to describe different styles of some designers.
b) the ability to apply design elements and principles in a design.
c) the ability to be able to classify, tell the origin, manufacture, properties, uses, care and maintenance of material and furniture.
d) to do and evaluate rooms, lighting, ventilation, temperature- and noise control.

KLE134 (16 credits) – Basic construction
(Department of Consumer Science)
Two lectures and one practical of four hours per week during the first semester.
One examination paper of two hours.
Pattern alterations. Implementation and evaluation of basic construction techniques. Use of a commercial pattern.
After the successful completion of this module the student should have:
a) a thorough knowledge of pattern alterations,
b) the ability to do pattern alterations,
c) the ability to use a commercial pattern for the construction of an article,
d) a thorough knowledge of basic construction techniques.
Fashion development: The role of designer, technology and world trends
Fashion cycles: Introduction, acceptance and rejection.
Fashion forecast: Designer, manufacturer, merchandise and the media. Fashion research sources.
After the successful completion of this module the student should have:
b) a thorough knowledge of the world of fashion.

KLE144 (16 credits) – Children's clothing and outfit planning
(Department of Consumer Science)
One lecture per week and one practical of three hours every week during the second semester.
One examination paper of two hours.
Children's clothing: classification, needs and requirements. Implementation of principles in construction and trimming of children's clothing.
Wardrobe planning: implementation of design elements and principles, personality and figure types, personal style and good taste
After the successful completion of this module the student should have:
a) a thorough knowledge of all the aspects applied to children's clothing.
b) the ability to apply design elements and principles to wardrobe planning
c) the ability to identify different personality and figure types
d) a thorough knowledge of wardrobe planning

KLE214 (16 credits) – Socio-cultural aspects of clothing.
(Department of Consumer Science)
Two lectures and one practicum of three hours per week during the first semester.
One examination paper of two hours.
Origin and functions of clothing. Interrelationship between clothing and cultural patterns, national habits and customs. Clothing expectations regarding social role, status and mobility. Fashion as a social phenomenon.
Special fabrics: Principles and guidelines for the handling of special fabrics. Application of principles for the handling of special fabrics. Application of principles for the handling of special fabrics when planning and constructing of articles (sleepwear, bra's and panties).After the successful completion of this module the student should have:
After the successful completion of this module the student should have:
(a) a thorough knowledge of the functions of clothing and the inter-relationship of clothing and cultural patterns,
(b) an understanding of clothing expectations in the depicting of social role, status and social mobility,
(c) insight in the relationship between the environment, clothing and health.
(d) a thorough knowledge about special fabrics.
(e) mastered the practical techniques required to construct sleepwear, bra's and panties from special fabrics.

KLE414 (16 credits) – Psychological aspects
(Department of Consumer Science)
Two lectures per week and one practicum of three hours per week during the first semester.
One examination paper of two hours.
Clothing as a non-verbal communication aid. Clothing and the self-image. Clothing symbolism. Conformity and individuality. Values, attitudes and interests. Theoretical perspectives with reference to clothing.
Tailoring: principles and guidelines in the using and application of tailoring principles are learnt when planning and constructing an article (jacket or coat).
After the successful completion of this module the student should have:
a) an understanding of clothing as a non-verbal communicator.
b) insight in the role of clothing in the self-concept, conformity and individuality.
c) understanding of clothing symbolism.
d) insight in the depicting of values, attitudes and interests through clothing.
e) an overview of the use of theoretical perspectives in the studying of clothing.
f) a thorough knowledge about tailoring techniques and – principles.
g) mastered the practical techniques required to construct a coat or jacket.

KLE424 (16 credits) – Apparel industry
(Department of Consumer Science)
Three lectures per week during the second semester.
One examination paper of two hours.
International fashion centres. Design, financing, production and distribution in the apparel industry. Wholesale and retail. Fashion promotion.
After the successful completion of this module the student should have:
a) a thorough knowledge of the functioning of the fashion industry in general,
b) insight in the different steps applicable to the manufacturing of a fashion article,
c) the ability to design a pattern and to apply style variations.

KLE444 – Pattern design
(Department of Consumer Science)
One lecture and one practical of five hours per week in the second semester.
One examination paper of two hours.
Module 1
Flat pattern design: principles and guidelines. Computer based pattern design.
Module 2
Draping: principles and guidelines: Application of draping principles and guidelines in the planning and construction of an article.
After the successful completion of this module the student should have:
a thorough knowledge of the principles and guidelines applicable to draping,
the ability to apply the draping principles and guidelines in draping an article and constructing it,
the ability to design a pattern and to apply style variations.

MBG214 (16 credits) – Human Molecular Biology of Dietetics
This is a service course and is only available to the BSc Dietetics.
(Department of Haematology and Cell Biology)
Three lectures per week.
One exam paper of three hours.
Composition of the human genome at macro level, gene inheritance of metabolic disorders, the interaction of complex traits, the regulation of genes involved in thalassemia analyses, galactosemia and phenylketonuria, as well as other nutritional disorders and pharmacogenetics.
After successful completion of this module the student should have:
a) an understanding of the composition of the human genome at macro level,
b) an understanding of gene inheritance resulting in syndromes and diseases,
c) an understanding of the genes associated with carbohydrate related disorders,
d) an understanding of the genes associated with amino acid related disorders,
e) a basic understanding of pharmacogenetics.

MBG314 (16 credits) – Human Molecular Biology of Nutritional Disorders
(Department of Haematology and Cell Biology)
Two lectures and three hours practical per week. Study assignments and directed learning.
One exam paper of three hours.
Composition of the human genome at macro level, gene inheritance of metabolic disorders, the interaction of complex traits, the regulation of genes involved in thalesemia analyses, galactosemia and phenylketonuria, as well as other nutritional disorders and pharmacogenetics.
After successful completion of this module the student should have:
a) an understanding of the composition of the human genome at macro level,
b) an understanding of gene inheritance resulting in syndromes and diseases,
c) an understanding of the genes associated with carbohydrate related disorders,
d) an understanding of the genes associated with amino acid related disorders,
e) a basic understanding of pharmacogenetics.

MBG334 (16 credits) – Human Molecular Biology of Chromosomes
(Department of Haematology and Cell Biology)
Two lectures and three hours practical per week. Study assignments and directed learning.
One exam paper of three hours.
Molecular basis of chromosomal abnormalities and prenatal screening, autosomal and sex chromosomal linked aberrations, population biology, natural selection of genetic disorders, the human genome project and gene therapy.
After successful completion of this module the student should have:
a) an understanding of the molecular basis of chromosomal abnormalities
b) an understanding of autosomal and sex chromosomal linked aberrations,
c) an understanding of population biology and natural selection of genetic disorders,
d) an understanding of the human genome project and gene therapy.

MBG324 (16 credits) – Human Molecular Biology of Cancer
(Department of Haematology and Cell Biology)
Two lectures and three hours practical per week. Study assignments and directed learning.
One exam paper of three hours.
Molecular basis of cellular development and differentiation, malignancies of the cell cycle, mutagenesis and DNA repair systems, oncogenes and tumour suppressor genes, gate keeper and caretaker genes and gene fusions resulting in lymphoma and leukemia.

After successful completion of this module the student should have:
a) an understanding of the development and differentiation of cells in the human body,
b) an understanding of malignancies of the cell cycle,
c) an understanding of mutagenesis and DNA repair systems
d) an understanding of oncogenes and tumour suppressor genes,
e) an understanding of gate keeper and caretaker genes,
f) an understanding of gene fusions resulting in lymphoma and leukemia.

MBG344 (16 credits) – Human Molecular Biology of Immunology and Haemostasis
(Department of Haematology and Cell Biology)
Two lectures and three hours practical per week. Study assignments and directed learning.
One exam paper of three hours.
Molecular basis of the immune system, antigen structure, recognition and function, as well as applications in forensics. The molecular basis of haemostasis, inherited bleeding tendencies, thrombosis and platelet disorders.
After successful completion of this module the student should have:
a) an understanding of the molecular basis of the immune system,
b) an understanding of antigen structure, recognition and function,
c) an understanding of the application of immunogenetics in forensics,
d) an understanding of the molecular basis of haemostasis,
e) an understanding of the molecular basis of inherited bleeding tendencies, thrombosis and platelet disorders.

MCB214 (16 credits) – Introduction to Microbiology for health sciences
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and one three-hour practical per week in the first semester.
One examination paper of three hours.
The introductory module to microbiology gives a basic overview of the historical development of microbiology, including the classification, cell structure, and characteristics of higher protists (algae, protozoa, fungi) and lower protists (bacteria, cyanobacteria, rickettsia and viruses). Microbial symbiotic relationships that occur in lichens, mycorrhizae, nitrogen fixation and in the rumen are discussed in more detail. The module also deals with basic virology which includes structure, properties and replication of bacteriophages, animal viruses and plant viruses. The growth and survival of microorganisms, factors affecting cell growth and death, and microbial growth control through antimicrobial agents, sterilization and disinfection are discussed. Principles of immunology (immunization and types of immunity) are also included in this module.
After completion of the module, the student the student is expected to have:
a) basic knowledge of the development of microbiology
b) basic knowledge of different groups of microorganisms and their symbiotic relationships
c) an overview of viruses
d) hands-on experience to work aseptically and to differentiate between important microorganisms
e) enough background to understand microbial cell growth and death
f) the necessary insight on how to control and eliminate microbial growth
g) basic knowledge of immunity.

MCB224 (16 credits) – Pathogenic microorganisms
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and one three-hour practical per week in the second semester.
One examination paper of three hours.
The basic concepts of epidemiology and an introduction to the major groups of pathogenic microorganisms will be discussed, as well as the occurrence and spread of pathogens such as bacteria, fungi, protozoa and viruses. The different mechanisms of disease transmission including air-transmission, contact transmission, and food- and water-borne transmissions will also be discussed. This module also handles the methods used to control pathogens inside and outside the body. Different physical (temperature, radiation, and filtration) and chemical, (disinfectants and antiseptics) control measures for application outside the body are discussed. The module also covers the control of pathogens inside the body with the aid of immunization and treatment with antibiotics.
After completion of the module the student shall:
a) know how diseases are transmitted and spread
b) be familiar with important diseases that affect humans
c) have knowledge on how to fight microorganisms outside the body
d) understand the principles of immunization and potential problems that can be encountered with immunization
e) understand the principles of antibiotic treatments and antibiotic resistance.

MKB216 (24 credits) – Introduction to Microbiology
(Department of Microbial, Biochemical and Food Biotechnology)
Three lectures per week during the first semester.
One four hour practical per week in the first semester.
One examination paper of three hours.
Microbiology plays an important role in our everyday life. Some microorganisms cause disease while others are beneficial. This module covers the history of microbiology, evolutionary patterns, classification as well as factors influencing microbial growth and death. Mechanisms used by microorganisms for growth, reproduction and exchange of genetic information will be introduced. Basic concepts of human-microbial interactions and immunology are included as well as viral and prokaryotic diversity. Positive and negative influences that microorganisms have on the daily life of humans worldwide will be discussed. Knowledge of the basic methodology of isolating, handling and investigating the properties of microorganisms is crucial to microbiologists as well as workers in related disciplines that require these skills. In this module, students learn to prepare and sterilize microbiological media and to isolate and culture microorganisms on or in these media. They also investigate both stained and living preparations of various microorganisms microscopically. Aspects of the metabolism of microorganisms are investigated. The effects of environmental conditions as well as inhibitors (including antibiotics) on microorganisms are demonstrated.

After successful completion of this module the student should be able to:
a) describe the development of microbiology and explain why this subject is important,
b) describe the evolutionary development of microbes and their associations with higher organisms such as plants and animals,
c) the classification of algae, protozoans, bacteria, viruses and fungi and explain how they influence us,
d) describe the influence of the environment on microbes,
e) describe the cultivation and control of microorganisms,
f) describe the replication and flow of genetic information,
g) describe the control of the expression of genetic information by prokaryotes,
h) describe how prokaryotes transfer genetic information,
i) describe the interaction between humans and pathogenic microbes,
j) describe how the human body fights infection caused by pathogenic microorganisms,
k) describe the difference between viruses and other microorganisms,
l) describe the replication of viruses in hosts,
m) describe how viruses cause disease in humans,
n) the classification of prokaryotes based on phylogeny, morphology and physiology,
o) describe how prokaryotes influence humans.
p) perform basic microbiological techniques.
q) isolate microorganisms and investigate their basic properties.
r) accurately carry out experiments according to instructions and collect and report data.
s) interpret data collected in the light of existing knowledge on the level of introductory microbiology.
t) work together as member of a team.

MKB226 (24 credits) – Microbial diversity and Ecology
(Department of Microbial, Biochemical and Food Biotechnology)
Three lectures per week during the second semester.
Four hour practical per week during the second semester.
One exam paper of three hours
There is a tremendous diversity of microorganisms on earth, which play important roles in the environment and can either be harmful or useful to man. The main objective of this module is to introduce the student to the diversity of viruses and prokaryotes, which occur in a wide variety of environments. The overall characteristics of viruses and how they replicate will be covered as well as the techniques used to study viruses. Viruses of prokaryotes (bacteriophages) and of fungi, plants and animals will be covered. The difference between classification, identification and nomenclature of bacteria will be discussed. Different methods and approaches to identify bacteria will be investigated. The phenotypic classification scheme as well as the molecular phylogenetic scheme will be covered. The basic rules with respect to the naming of bacteria will be discussed. To fully understand the diversity of microorganisms in diverse environments, the basic principles of microbial ecology, which includes understanding the biotic and a-biotic factors which make up an environment will be covered. The different methods which are used to study microbes in the environment will be covered. Nutrient cycles in the environment is important as well as the interaction between the microbes and different substrates in the environment. Specific environments, such as extreme environments, marine environments, freshwater environments and soil will be covered. The specific use of microbes in the environment during bioremediation, water purification and bio-leaching will be covered. To fully understand the diversity of viruses and prokaryotes in the different hosts and environments, the student must gain an understanding of the techniques used to isolates and identify viruses such as bacteriophages and animal viruses. The student should also understand the techniques used to identify viruses. The identification of bacteria is a fundamental skill that a microbiologist should have. The majority of this module will be dedicated to educating the student in the methods used to identify bacteria. The student will also be expected to isolate specific microorganisms from selected environments and to identify them through the use of selective and non-selective media.
After successful completion of this module the student should be able to:
a) name and describe viruses from different hosts, and describe how they replicate.
b) describe the techniques which are used to isolate and identify viruses.
c) to differentiate between classification, identification and nomenclature of prokaryotes.
d) describe the principles of microbial ecology and describe and explain the different techniques used to study microbes in the environment.
e) describe the role which microbes play in the environment through the cycling of nutrient and interactions with each other.
f) isolate and identify viruses.
g) culture bacteria in pure culture and store cultures.
h) use different techniques, from Gram staining to commercial kits, for the identification of bacteria.
i) isolate and identify specific microbes from selected environments through the use of selective and non-selective media.

MKB314 (16 credits) – Microbial growth, nutrition and death
(Department of Microbial, Biochemical & Food Biotechnology)
Two lectures and a three-hour practical per week during the first semester.
One examination paper of three hours.
A microbiologist should be conversant with the quantitative enumeration techniques for microorganisms and be able to describe microbial growth and death in terms of the applicable kinetic parameters. These skills are often required in microbiological research and in the operation of industrial bioprocesses. This module deals with the principles of and methods for the quantitative determination of microbial concentration, growth and death and the fundamental kinetics that is involved. The principles of microbial nutrition and the effects of various physical and chemical antimicrobial agents are also covered. The practical section of the module deals with the various enumeration methods, the construction of microbial growth and survival curves and the calculation of kinetic parameters. Bacterial isolations on selective and differential media are also done.
After successful completion of this module the student should:
a) have a sound knowledge of the techniques used for microbial enumeration, together with the ability to choose the most appropriate method.
b) comprehend the fundamental microbial growth and death kinetics and the underlying principles, with the ability of calculating growth and death rates as well as sterilisation times.

c) have a knowledge of antimicrobial agents, their mechanisms of action and their applications.
d) have a knowledge of the nutrients required for microbial growth, together with the ability to formulate microbial culture media.
e) be capable in the use of selective and differential media for microbial isolations and counts.
f) be experienced in the use of various techniques, including microscopy, for the quantitative determination of microorganisms.
g) be proficient in the construction of growth and survival curves from experimental data and in the use of graphical and mathematical techniques for the calculation of kinetic parameters.
h) have the ability to design experiments related to microbial growth and death and analyse the results.

MKB324 (16 credits) – Microbial Physiology
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and three hours practical per week during the second semester.
One examination paper of three hours.
The study of physiology is defined as the study of the normal activities of an organism. Since important biotechnological processes are based on the activities of microbes, knowledge about microbial physiology forms the basis for the understanding and improvement of many biotechnological processes. This module covers basic metabolism, the breakdown of naturally occurring compounds by microorganisms and fermentative metabolism. Metabolic diversity among microorganisms, respiration in the absence of oxygen (anaerobic respiration), microbial life dependent upon inorganic energy (chemolithotrophy), microbial life dependent upon light energy (photosynthesis), mechanisms by which microorganisms assimilate elements and mechanisms by which molecules cross membranes in microorganisms (membrane transport) are covered. The metabolic regulation of the pathways involved in these processed are also addressed. The emphasis of this module is on bacterial metabolism.
After the successful completion of the module the student should be able to:
a) be able to describe all major aspects of the basic chemoheterotrophic metabolism of microorganisms.
b) be able to describe how substrates other than simple sugars are utilized by micro-organisms.
c) understand explain the reasons why fermentation occurs in microorganisms and describe examples of fermentative metabolism.
d) be able to describe all major aspects of microbial metabolic diversity.
e) be able to critically compare different classes of microbial metabolism.
f) be able to describe the assimilation of elements by microorganisms and its relationship to catabolism.
g) be able to describe how molecules cross microbial membranes and to compare different mechanisms of transport.
h) be able to think critically about problems involving microbial metabolism and to apply knowledge to problem solving.

MKB334 (16 credits) – Microbial eukaryotic diversity and ecology
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and a three hour practical per week during the first semester.
One examination paper of three hours.
Fungi represent an important part of microbial ecology; therefore their role, survival, interactions with other microorganisms and adaptation to the environment are of great value. During this module, an intensive study will focus on the morphology and growth of specialized moulds. The multiplication and life cycles will also be incorporated. The ecology and general value of moulds, their taxonomical status and contribution towards food products will also be studied. In this module yeasts are also covered. These micro-organisms are important from a biotechnological point of view since they are used in the production of beer, wine, bread and other products. In this module the main phenotypic characteristics of these fungi are investigated as well as application in yeast systematic. Morphological and physiological characteristics will be evaluated as rapid identification procedures in comparison to molecular methods such as RFLP analysis and others. Bioprospecting studies based on yeast systematics and ecology will be undertaken in order to select yeasts from nature which can produce valuable products.
After successful completion of this module, the student should have:
a) an in-depth knowledge of the survival and adaptation of fungi,
b) the necessary background about the ecology and value of molds,
c) a good understanding of the taxonomy of molds,
d) a thorough knowledge of yeast systematics,
e) in depth knowledge of current classification procedures and industrial applications,
f) skills to select certain yeasts of interest from nature.

MKB344 (16 credits) – Pathogens and immunity
(Department of Microbial, Biochemical and Food Biotechnology)
Two lectures and a three hour practical per week during the second semester
One exam paper of three hours.
One of the main problems associated with microorganisms is that they cause diseases in all living systems. This module will concentrate on animal diseases. The interaction between the pathogen and the host will be investigated as well as the requirements which a microorganism must adhere to in order to become pathogenic. The difference between the normal microbiota and pathogens will be discussed. Aspects of non-specific host defence mechanisms as well as other control methods, through the use of antibiotics and vaccines, will be covered, as well as the immune system and methods of vaccine production. An introduction to epidemiology, as well as the methods used for the laboratory-based diagnosis of disease-causing agents will be presented. This will include the isolation and identification of viruses and bacteria as well as the detection of antibodies. In the last part of this module, selected important diseases of man, poultry, avian species, fish and insects will be covered as well as the role that microbiologists can play in the control of these diseases through different diagnostic approaches as well as the development of treatments. Aspects related to protection against biological weapons will also be covered.
After successful completion of this module the student should have:
a) a thorough understanding of why certain microorganisms become pathogenic while other do not.
b) a thorough understanding of the pathogen-host interaction.
c) a thorough understanding of how the host protects itself against attack by microorganisms through specific and non-specific host defences.
d) a thorough understanding of how pathogens spread in a community and the principles of epidemiology.

e) A thorough understanding of the techniques used for the diagnosis of diseases in the different hosts through the isolation and identification of the causative agent, or the detection of antibodies by serological techniques.
f) an understanding of some of the more important diseases which are caused by microbial pathogens in various hosts.
g) be capable of carrying out various isolation and identification methods from bacterial isolation to PCR.
h) be capable of detecting antibodies against specific pathogens in serum samples as well as determining the levels of antibodies in these samples.

MKB364 (16 credits) – Microbial biotechnology and process engineering
(Department of Microbial, Biochemical & Food Biotechnology)
Two lectures and a three hour practical per week during the second semester.
One examination paper of three hours.
For the development, scale-up and industrial operation of microbial bioprocesses a fundamental knowledge of bioreactor engineering, sterilisation principles and downstream processing are required. This module deals with the fundamentals of bioreactor design, sterilisation principles and process control of mainly liquid, but also of solid state bioprocesses. Sterilisation kinetics as applied in industry is an important part of this module. This module also includes the development of traditional biotechnology into modern biotechnology, the principles and impact of genetic engineering as well as the variety of applications of biotechnology. Various fermentation processes for the production of food, pharmaceutical and chemical products are also introduced. Cell- and enzyme immobilisation, biotransformation as well as several aspects of product recovery and purification are also included.
After successful completion of this module the student should:
a) be familiar with the history of biotechnology.
b) have knowledge of the applications of biotechnology in agriculture and food production, in environmental management and in the chemical and pharmaceutical industries.
c) understand the legal issues in respect of biotechnology and intellectual property.
d) be familiar with the role of biotechnology in the South African economy.
e) understand the principles of bioprocess engineering, be knowledgeable of the features of various types of bioreactors and be able to do the basic calculations relevant to mass transfer in bioreactors.
f) understand and be able to apply the principles of cell and enzyme immobilisation and biotransformation.
g) have a sound knowledge of sterilisation kinetics and be able to calculate the efficiency of sterilisation processes.
h) be familiar with the principles of downstream processing.

NEC302 (8 credits) – Natural Science Education Community Service
One contact session (lecture or tutorial) each week during the first semester. Seven three-hour practical sessions during the first and second semester. Continuous evaluation will be applied, including a semester test and a reflection report. There is no examination. Students must apply for selection in advance at the Physics department.
Students will be introduced to the basic theory of community service learning. Educational projects at the Boyden Science Centre and other UFS facilities, combined with visits to selected schools, comprise the practical component of this module.
After successful completion of the module the student will be able to:
a) Link basic popular science topics (for instance astronomy and environment) to the natural science subject of his/her choice;
b) determine community needs with regard to Natural Sciences by completing a situational analysis of target populations (special focus on grade 10 – 12 learners and their natural science educators);
c) identify and liaise with potential partners in the community in order to address the identified needs;
d) plan and execute a specific service to the identified community in collaboration with the partners using University facilities as a platform (for instance the Boyden Science Centre);
e) evaluate (follow-up) the impact of the service and determine the future of the partnership;
f) re-implement, having reflected on reported evaluation results, thus continuing a cycle of action research.

PLK212 (8 credits) – Molecular ecology and evolution of higher plants
(Department of Plant Sciences)
Two lectures per week (First semester)
One examination paper of three hours
During this module, the two components of Molecular Ecology are presented with the first being basic Molecular Biology and the second being Ecology. During the first, students will learn of the DNA double helix, DNA replication, gene expression and the nature and occurrence of mutations. Secondly, the influence of the environment and DNA mutations on the development of new plant species will be discussed. Molecular techniques that can distinguish between different plant populations on DNA level will finally be discussed as well as the applications of Plant Molecular Ecology.
After the successful completion of the module, the student should be able to understand and explain the following:
a) DNA structure, DNA replication, RNA transcription and RNA translation;
b) how mutations are formed and which natural mechanisms exist to correct mutations;
c) which techniques can be used to distinguish between populations on DNA level;
d) which factors contribute to the differences between populations;
e) what phylogeography is and which factors contribute to it;
f) the importance and applications of Plant Molecular Ecology.

PLK214 (16 credits) – Plant structure
(Department of Plant Sciences)
One lecture and five hour practical per week throughout the first semester.
One examination paper of three hours.
Plant anatomy: Study of cell wall, ergastic substances (starch grains, crystals etc.), ovule and embryo sac, fertilization and development of embryo, tissues (parenchyma, collenchyma, sclerenchyma, epidermis, periderm, xylem, phloem), secretory structures and organs (root, stem and leaf).
External morphology of plants: Roots, stems and leaves; modifications of plant organs as ecological adaptations; structure of inflorescences and flowers, pollination, fertilization; development, structure and distribution of fruits and seeds, plant organs and structures of economic importance.

Introduction to microscopy: Preparation of material for investigations with light (LM) and scanning electron microscope (SEM).
After the successful completion of the module the student should:
a) have a basic knowledge of the structure, function and relationship of tissue types as well as the structure of organs.
b) a comprehensive knowledge of the morphology of plant organs as well as the ecological adaptations of plants.
c) knowledge of the basic techniques of plant micro-technique.

PLK224 (16 credits) – Plant growth and developmental physiology
(Department of Plant Sciences)
Three lectures per week throughout the second semester.
One examination paper of three hours.
Water balance (absorption, transpiration, transport), mineral nutrition (essential elements, absorption, ion traffic) and transport of metabolites (phloem transport).Growth regulators, plant movements, photomorphogenesis, biological clock, photoperiodism and the effect of temperature on growth and development.
After successful completion of the module the student should have a thorough knowledge of:
a) plant-water relations.
b) plant nutrition.
c) absorption and transport mechanisms in plants.
d) the effect of environmental conditions (e.g. light, temperature, day length) and internal factors (e.g. growth regulators, biological clock) on the growth and development of plants which contribute to a better understanding of the functioning of plants.

This knowledge is important and of practical value in the plant-related industries such as agriculture, horticulture, nurseries, forestry, nature reservation, seed and fertilizer companies etc. as well as teaching and research professions.

PLK262 (8 credits) – Introductory Plant Biotechnology (practical)
(Department of Plant Sciences)
Five hours practical per week throughout the second semester (practical is introduced by an applicable lecture).
Evaluation by means of reports, assignments, class tests and an end assessment.
Plant propagation: Alleviation of seed dormancy, vegetative reproduction by means of specialized plant organs, artificial plant propagation (cuttings, grafting, layering), plant tissue culture techniques (micro propagation, embryo cultures, multiplication of transformed plants).
Alternative cultivation of plants: Nutrient cycles, uptake and importance of plant nutrients, organic and hydroponic cultivation of plants.
Secondary products in plants: Economic and medicinal importance.
After successful completion of the module the student should have:
a) a basic knowledge of seed dormancy and the manipulation thereof.
b) a basic knowledge of vegetative reproduction by plants.
c) an understanding of the techniques used to artificially reproduce plants.
d) a basic knowledge of plant nutrients.
e) a basic knowledge of hydroponic systems and organic cultivation of plants.
f) a basic knowledge of the economic and medicinal value of secondary plant products.

PLK314 (16 credits) – Evolution and taxonomy of higher plants (includes a field excursion)
(Department of Plant Sciences)
Two lectures and a three hour practical per week throughout the first semester.
One examination paper of three hours.
Origin of the flowering plants, phylogeny, diversity of the South African flowering plants, economical importance of the flowering plants, sources of taxonomic information including micromorphology, plant taxonomic principles, plant nomenclature, preparation of herbarium specimens, use of the herbarium and methods of plant identification.
After successful completion of the module the student should:
a) have knowledge of the important South African flowering plant families and their economic importance.
b) have a basic knowledge of nomenclature, identification and phylogenetic classification (including cladistic analyses techniques) of plants.
c) be able to collect, process and name herbarium specimens and use the herbarium.
d) have a basic knowledge of scanning electron microscope characteristics of leaf surfaces and pollen.

PLK324 (16 credits) – Plant metabolism
(Department of Plant Sciences)
Two lectures and a three hour practical per week throughout the second semester.
One examination paper of three hours.
Plant respiration: cytosolic and mitochondrial reactions, measurement of plant respiration, fermentation, regulation of plant glycolysis with special reference to key enzymes, the physiological role of the alternative oxidation pathway in plants, role of Q-cycle in energy production, manipulation of plant respiration and the oxidative pentose phosphate pathway (OPP pathway).
Photosynthesis: the chloroplast and associated pigments, photochemical and non-photochemical reactions of photosynthesis, photophosphorylation (cyclic & non-cyclic), C_3-reduction cycle, photorespiration, C_4- and CAM-photosynthesis. The methodology in determining photosynthetic rate through fluorescent techniques.
Nitrogen metabolism: Fixation, assimilation, transamination, conversion in developmental processes and the respiratory nitrogen cycle.
After the successful completion of the module the student should:
a) have a thorough knowledge of respiratory metabolism in plants and how it can be manipulated in food production.
b) be able to apply techniques to determine and manipulate the respiration rate in plants.
c) have a thorough knowledge of the light dependent and light independent reactions of photosynthesis, cyclic and non-cyclic photophosphorylation, role of the Q-cycle in energy production, photorespiration, C_4 and CSM plants.
d) be able to apply fluorescent techniques to determine photosynthesis and primary production in plants.
e) have a basic knowledge of nitrogen metabolism in plants.

PLK334 (16 credits) – Ecology and environmental management of terrestrial and aquatic ecosystems (includes a field excursion)
(Department of Plant Sciences)
Two lectures and three hours practical per week during the first semester.
This module deals with African biogeography and environmental factors determining distribution, structure and species composition of land and aquatic ecosystems.
Vegetation science deals with the structure and composition of plant communities. The vegetation is classified into ecologically recognizable units. Quantitative analyses, classification and ecological interpretation techniques, biomonitoring techniques of land ecosystems, as well as rehabilitation methods will be discussed.
Limnology includes the study of types of freshwater bodies, water availability, physical qualities, chemical qualities, nutrients, biodiversity, productivity and pollution of aquatic ecosystems.
A field excursion forms part of this course during which the student will be exposed to the plant biodiversity of South Africa. Identification of species and plant survey techniques will be explained and the different environmental factors, influencing vegetation, will be pointed out.
After the successful completion of the module the student should be able to:
a) discuss the biogeography of Africa and southern Africa in particular.
b) apply basic ecological principles.
c) discuss ecological interactions and factors controlling life in aquatic and terrestrialecosystems.
d) discuss the origins of ecosystems and current changes (global warming, ozoneloss/build-up, desertification, deforestation, etc.) that influence or threaten their existence.
e) know and apply techniques to analyse terrestrial and aquatic ecosystems.
f) interpret and describe the relevant terrestrial and aquatic data in order to apply the relevant ecosystem management techniques such as biomonitoring and rehabilitation of ecosystems.
g) discuss conservation and utilization of resources.

PLK344 (16 credits) – Plant defence and biotechnology
(Department of Plant Sciences)
Two lectures and a three hour practical per week throughout the second semester.
One examination paper of three hours.
The defence mechanisms of plants against biotic (pathogens and insects) and abiotic (drought, heat, cold, ozone etc.) stress factors on physiological-biochemical level: Constitutive and induced defence, structural and biochemical defence, hypersensitive reaction, systemic acquired resistance, signal mechanisms and manipulation of resistance. Biotechnological application of plants: e.g. to perform chemical reactions and to produce special products of industrial and pharmaceutical importance.
After successful completion of the module the student should:
a) know the natural defence mechanisms in plants which result in resistance.
b) have a good insight in the potential and scope of the production and various products from plants.
This knowledge is important for the manipulation of resistance and is of practical value to control stress factors. In addition, fresh insights obtained can be helpful in the alternative economic uses of plants.

PLK354 (16 credits) – Plant transformation and Biotechnology
(Department of Plant Sciences)
Two lectures and a three hour practical per week during the first semester.
One examination paper of three hours.
During the module the genetic manipulation, analysis and use of transgenic crops will be discussed based on an example. The emphasis will be on the different techniques that will used. By using recently published research papers, the relevance of the course information is ensured.
After successful completion of the module the student should be able to:
a) describe the different techniques used for the cloning of genes and transformation of plants.
b) explain how transgenic plants are analysed.
c) explain the value of transgenic crops for the industry.

PSYxyz – Psychology
For MODULE CONTENT see Yearbook of the Faculty of Humanities.

RIS114 (16 credits) – Introduction to computing and problem solving
(Department of Computer Science and Informatics)
Three lectures and a three-hour practical per week in the first semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
A student should be well acquainted with the professional implementation of computerised solutions in an object-oriented, high-level programming environment. The module provides an introduction to problem solving, algorithms, classes, objects, properties and methods. Control structures, e.g. selection and iteration, and input and output are also covered.
After the successful completion of the module the student should:
a) have a thorough knowledge of the basic principles of object oriented programming, i.e. classes, objects, properties and methods.
b) have a thorough knowledge of basic control structures,
c) be able to solve problems in an object-oriented, high-level programming environment.
[Two of the 16 credits are allocated to critical (generic) outcomes with respect to computer skills, problem solving, numerical skills and written reasoning in this module.]

RIS154 (16 credits) – Introduction to Computer Hardware
(Department of Computer Science and Informatics)

Three lectures and one three-hour practical per week in the first semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
The content of the module (which correlates with the A+ syllabus) will entail the following:
Section 1: Computer basics , Tools and safety, Inside the PC, Bus architecture, Memory overview, Microprocessors, Disk storage, Input/output devices, Printers, Miscellaneous hardware, Local Area Networks, Troubleshooting, Customer service
Section 2: Operating system overview, Windows & Linux, Quantifying memory, Installing Windows & Linux, Running Windows & Linux, Networking Windows & Linux, Troubleshooting
Section 3: Basic electronics, Boolean gates and operators
Section 1: Servicing and supporting personal computers
Upon successful course completion, students will be able to provide technical support and maintain and service personal computers. They will also be able to:

- recognize essential components of a PC system, identify and understand PC peripherals and understand how to safely use common and specialized tools,
- identify and understand power requirements, bus architectures, different types of memory and microprocessors, various types of disk storage, input/output ports, cable restrictions and different types of printers and how to install them,
- identify multimedia components, understand the basic components of local area networks (LANs) and the differences between peer-to-peer and client/server LANs,
- understand and identify LAN topologies, Ethernet, Token Ring, and ARCnet protocols,
- identify and correct common hardware problems and use software and hardware diagnostic tools,
- set up PCs in the proper environment, troubleshoot PC components and peripheral devices and set system interrupts.

Section 2: Supporting Microsoft Windows
Upon successful course completion, students will be able to provide technical support and maintain and service personal computers and the related operating systems. They will also be able to:

- identify the major desktop components system files and interfaces and their functions,
- demonstrate the ability to use command-line functions and utilities to manage the operating system and manage files and directories,
- identify procedures for installing/adding a device and configuring drivers and identify procedures necessary to optimize the operating system,
- recognize common operational and usability problems and determine how to resolve them,
- understand various elements of the Microsoft Windows 2000 environment, including WIN.COM, .INI files, .DLL files, drivers, and font files,
- set up e-mail and configure Web browsers,
- understand viruses and virus types.

Section 3: The underlying electronics of computer hardware
Upon successful course completion, students will understand the basic electronic principles of Boolean logic.

RIS124 (16 credits) – Advanced programming and problem solving
(Department of Computer Science and Informatics)
Three lectures and one three-hour practical per week in the second semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
This module is a continuation of RIS114 and deals with information systems and problem solving in business and scientific environments. Advanced object oriented concepts, debugging, storing data in files and access to simple databases.
After the successful completion of the module the student should:
a) be able to solve programming problems using a modern, object oriented, high-level programming environment,
b) be able to program professionally, to design programs and debug them,
c) have a thorough knowledge of methods and parameter transfer, debugging techniques, arrays, file handling and database access,
d) be able to implement simple interfaces, with prompts, sentinels and error conditions.
[Two of the 16 credits are allocated to critical (generic) outcomes with respect to computer skills, problem solving, numerical skills and written reasoning.]

RIS134 (16 credits) – Introduction to computers and problem solving: Part 1
(Department of Computer Science and Informatics)
Three lectures and one three-hour practical per week in the first semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
This module provides an extended introduction into the world of computer programming and is aimed at students who do not intend to take RIS modules in the second or third year of study.
The module deals with aspects that include the origins and development of the computer, the basic working of a computer, computerised problem solving and an introduction of algorithms, control structures, classes, objects, properties and methods using a high-level programming language.
After the successful completion of the module the student should:
a) have a basic knowledge of the working of a computer,
b) have a thorough knowledge of the basic principles of object oriented programming, i.e. classes, objects, properties and methods,
c) be able to do basic problem solving in an object oriented, high-level programming environment.
[Two of the 16 credits are allocated to critical (generic) out-comes with respect to computer skills, problem solving, numerical skills and written reasoning in this module.]
[RIS134 does not allow admission to RIS124 and RIS164.]

RIS144 (16 credits) – Introduction to computers and problem solving: Part 2
(Department of Computer Science and Informatics)
Three lectures and one three-hour practical per week in the second semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
The module is a continuation of RIS134 and deals with the use of control structures, classes, objects, properties and methods to do computerised problem solving in a high-level programming language.
After the successful completion of the module the student should:
a) have a thorough knowledge of control structures, e.g. selection and iteration,
b) be able to do basic problem solving in an object oriented, high-level programming environment,
c) basic database access.
[Two of the 16 credits are allocated to critical (generic) out-comes with respect to computer skills, problem solving, numerical skills and written reasoning in this module.]
[The two modules, RIS134 and RIS144 together, are regarded as the equivalent of RIS114]
[RIS144 does not allow admission to RIS214.]

RIS164 (16 credits) – Introduction to the Internet and Web Page Development
(Department of Computer Science and Informatics)
Three lectures per week and one three-hour practical per week in the second semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
The development of good web pages requires that the programmer has knowledge of various web aspects and technologies. This includes the working of the Internet, graphical interfaces, Internet protocols and web page development.
After successful completion of this module the student should be able to:
a) demonstrate knowledge of the evolution of the Internet and the Web,
b) conduct Internet searches,
c) recall the working of Internet protocols,
d) apply client-side scripting and style sheets to develop a complete web site.

RIS182 (8 credits) – Visual Basic for Applications (VBA) with the focus on Excel
(Department of Computer Science and Informatics)
One two-hour lecture and one three-hour practical session per week in the second semester.
Continuous evaluation (on individual as well as group level) will be applied in this module and no special examinations will be granted.
This module presents concepts to insert text strings as macros; automate frequently performed tasks; automate repetitive operations; creating a custom command, toolbar button, menu command, front end, new worksheet functions; create complete macro-driven applications.
After the successful completion of this module, the student should be able to:
a) develop Excel utilities with VBA,
b) create a user-form with VBA,
c) create interaction of a VBA-application with other applications,
d) apply VBA to automate aspects of Excel, such as Budgeting, Forecasting and Analysing scientific data.

RIS214 (16 credits) – Data structures
(Department of Computer Science and Informatics)
Two lectures and one three-hour practical per week in the first semester.
One examination paper (written and/or practical) of three hours.
This is a promotion module.
Advanced programming requires an understanding of data structures and the professional implementation thereof.
After the successful completion of the module the student should:
a) be able to discuss and implement classes, objects, inheritance and polymorphism,
b) discuss what data structures are and how to use them,
c) be familiar with recursion and its use,
d) be able to implement and use lists, stacks and queues,
e) be able to implement and use binary trees,
f) understand how to design and modify data structures to solve a problem.

RIS264 (16 credits) – Software Design
(Department of Computer Science and Informatics)
Two lectures and one two-hour practical per week in the second semester.
One examination paper (written and/or practical) of three hours.
This is not a promotion module.
This module entails an introduction to UML and to class types(“patterns”). Various patterns are discussed and analysed in detail. Various sub-patterns of patterns will be covered. Practical work includes the implementation of patterns in various applications.
After successful completion of the module, the student should be able to:
a) use UML in order to present class diagrams,
b) explain the necessity of patterns,
c) identify, implement and apply various patterns,
d) combine patterns to design and implement applications.

RIS224 (16 credits) – User interfaces
(Department of Computer Science and Informatics)
Two lectures and one two-hour practical per week in the second semester.

One examination paper (written and/or practical) of three hours.
This is a promotion module.
If the potential computer user is not accommodated throughout the design process of a computer system, the system will not be used and money and energy will be wasted. This module provides the user with an introduction to Human-Computer Interaction (HCI). Aspects that are covered include usability, human factors, models of interaction, data collection, the design of user interfaces, visual interfaces and the evaluation of interfaces.
After the successful completion of the module the student should:
a) have a thorough knowledge of the principles of Human-Computer Interaction,
b) be able to explain the role of the computer user in the design of computer systems,
c) be able to design a user-friendly visual interface by applying all the factors that determine a user-friendly interface,
d) be able to evaluate a user interface while considering all the role-players.

RIS242 (8 credits) – Information Technology Service Learning
(Department of Computer Science and Informatics)
Continuous assessment is applied in this module and no special examinations are allowed.
This module enables the students to serve the community by ploughing back the IT knowledge gained during their studies. While serving the community the students will learn how to work with people with varying computer literacy skills or levels. By teaching or helping others, their own knowledge will be expanded.
After successful completion of the module the student should:
a) have served the community with relevant IT skills,
b) have learnt from the practical experience of working with people in the community.

RIS314 (16 credits) – Introduction to databases and database management systems
(Department of Computer Science and Informatics)
Two lectures and one three-hour practical per week in the first semester.
One examination paper (written and/or practical).
This is not a promotion module.
This module deals with database concepts, design and implementation concepts, transaction management and concurrency control, distributed database management systems, object-oriented databases and database programming.
After successful completion of the module the student should be:
a) knowledgeable about the fundamental principles of databases,
b) able to design and implement a database
c) able to develop applications that make use of databases.

RIS324 (16 credits) – Software engineering
(Department of Computer Science and Informatics)
Two lectures and one three-hour practical per week in the second semester.
One examination paper (written and/or practical) of three hours.
This is not a promotion module.
This module provides the student with an introduction to Software engineering. Aspects covered are requirement definition, program design, programming practice, programming languages, tests and debugging, documentation, maintenance, and aids.
After the successful completion of the module the student should:
a) have a thorough knowledge and understanding of the principles of Software engineering,
b) have a thorough theoretical knowledge of aspects of Software engineering in order to apply it,
c) have knowledge of the management of a project and be able to apply it,
d) be able to successfully participate as a member of a team.

RIS334 (16 credits) – Internet Programming
(Department of Computer Science and Informatics)
Two lectures and one three-hour practical per week in the first semester.
One practical examination (written and/or practical).
This is not a promotion module.
This module deals with server-side Internet programming and web management.
After successful completion of this module the student should be able to:
a) do server-side Internet programming,
b) develop web applications that utilise databases,
c) publish websites.

RIS344 (16 credits) – Computer networks
(Department of Computer Science and Informatics)
Two lectures and one three-hour practical session per week in the second semester.
One examination paper (written and/or practical) of three hours.
This is not a promotion module.
This module provides the student with an overview of network concepts. Aspects that are covered are network architecture, low-level network technologies, coupling techniques, Internet work concepts, end-to-end protocols, stacking and resource allocation, security, and network applications.
After successful completion of this module the student should be:
a) familiar with the fundamental principles of computer networks,
b) able to distinguish among networks in general use,
c) able to set up simple networks,
d) able to identify errors on networks,

SDH414 (16 credits) – Consumer studies: Learning programme and teaching methods
(Department of Consumer Science)
One lecture and a practicum of three hours per week in the first semester.
One examination paper of two hours.
The methodology of home economics concerns the studying of learning programmes, teaching methods, the use of visual aids and the organizing of the laboratory. : Departmental prescriptions, assessing and projects. After the successful completion of this module the student should have:
a) a thorough knowledge of the learning programmes, teaching methods, visual aids and assessing of the subject.
b) an overview of the subject contents of the school handbooks.
e) the skills to do a practical demonstration
d) the ability to motivate the students.
e) the ability to organize a laboratory.
f) understand the departmental prescriptions.
g) do assessing.
h) explain the projects and give the necessary guidance to the students to complete it successfully.

SDH414 (16 credits) – Consumer studies: Learning programme and teaching methods
(Department of Consumer Science)
One lecture and one practicum of three hours per week in the second semester.
One examination paper of two hours.
This module contains: Educational methods and visual aids, compiling of work themes, administration of a laboratory and judging.
Teaching methods and aids. The contents of this module: The professional position of the teacher, educational methods and visual aids, learning problems and discipline
After the successful completion of this module the student should be able to:
a) have a thorough knowledge of educational methods.
b) use different kinds of visual aids successfully.
c) have the ability to compile work schemes.
d) organize the administration of the laboratory.
e) a thorough knowledge to judge articles and products.
f) have a thorough knowledge of the position of the professional teacher.
g) analyse learning problems and give the necessary guidance to the student.
h) discipline the students.

SILxyz – Psychology
For MODULE CONTENT see Yearbook of the Faculty of Human Sciences.

STK114 (16 credits) – Introduction to Statistics (I)
(Department of Mathematical Statistics and Actuarial Science)
Three lectures and one three-hour practical and four hours of self-study per week during the first semester.
One three-hour examination paper.
Elementary calculations, elementary interest calculations. Index numbers, time series. Introduction to Statistics and collection of data.
After successfully completed the model the student must be able to:
a) do the basic mathematical operations, calculate the different types of interests and annuities, calculate and interpret index numbers, interpret time series graphically and analyse the data to predict future values, understand what statistics are, collect data by means of different techniques and design a questionnaire to collect data, and
b) have the skills to do mathematical calculations, distinguish between different types of data, collect data, make decisions regarding the methods used to collect data, be familiar with the different steps in the research process.

STK124 (16 credits) – Introduction to Statistics II
(Department of Mathematical Statistics and Actuarial Science)
Three lectures and one three-hour practical per week and four hours of self-study per week during the second semester.
One three-hour examination paper.
The organising, graphical presentation and description of data. Elementary principles of probability. Confidence intervals, hypothesis testing, correlation, regression, contingency tables, and analysis of variance.
After successfully completed the model the student must be able to:
a) organise data, graphically present data and apply statistical techniques to make interpretations, calculate probabilities for different distributions, determine confidence intervals and do hypothesis tests, determine the relationship between variables, interpret the relationship and present it graphically, and
b) have the skills to solve problems, follow the steps of the research pro-cess, make decisions regarding the statistical methods to be applied, analyse data and make logical conclusions from the results.

STK216 (24 credits) – Multiple Regression Analysis
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours self-study per week during the first semester.
One three-hour examination paper.
Simple linear regression and correlation, matrix notation and matrix calculations Multiple regression, multiple coefficient of determination, nested models, and stepwise regression. PRESS and Mallows' C_p-statistic, model building with quantitative and qualitative independent variables.
After successfully completed the module the learner will be able to:
a) understand and apply the basic principles of linear regression,
b) formulate and solve multiple linear regression problems with matrix algebra,
c) use and interpret computer printouts from statistical analysis packages,

d) do model selection by means of stepwise regression, the C_p-statistic and the PRESS statistic, and

e) build first-order and second-order models with different numbers of quantitative independent variables, build models with different numbers of qualitative independent variables and build models with both quantitative and qualitative independent variables.

STK226 (24 credits) – Multiple Regression: Variance- and time series analysis
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours of self-study per week during the second semester.
One three-hour examination paper.
Tests for influential observations and outliers. Multicollinearity, data transformations, residual analysis, time series analysis and forecasting. Autoregression models, two-factor factorial experiments and more complex factorial designs.
After successfully completed the module the learner will be able to:
a) identify and recognise potential problems that might be encountered when constructing a model,
b) test for influential observations and outliers,
c) use residuals to detect departures from the model assumptions,
d) fit time series models to time series data and to forecast with time series autoregressive models,
e) compare mutual treatment averages using multiple comparison procedures, and
f) analyse data collected from designed experiments and to understand the relationship of the analysis of variance to regression analysis.

STK316 (24 credits) – Special Probability distributions and Mathematical expectation
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, three hours practical and four hours of self-study per week during the first semester.
One three-hour examination paper.
Introduction to probability, probability distributions and probability densities. Mathematical expectation and special probability distributions.
After successfully completed the module the learner will be able to:
a) be familiar with discrete random variables, probability distributions, continuous random variables, probability density functions, multivariate-, marginal- and conditional distributions, and
b) determine the expected values and moments of a random variable, to understand the concept of moment-generating functions, product moments, moments of linear combinations of random variables, conditional expectations and also understand the most prominent occurrence probability distributions and their parameters in statistical theory.

STK332 (8 credits) – Applied Statistics I
(Department of Mathematical Statistics and Actuarial Science)
One2-hour lecture per week
One 3-hour practical exam
a) The aim of this module is to give successful candidates the skills needed to:
b) Be proficient in the use of statistical programming packages such as SAS and R.
c) Program, apply, and evaluate basic statistical methods within a data analysis procedure.
On completion of the module the student should be able to:
a) Utilise statistical software packages, namely SAS and R, in order to input, transform, summarise, and visually present multivariate data.
b) Understand, program, and apply basic statistical analysis models (analysis of variance, regression, and hypothesis testing, for example) within the selected statistical software packages.
c) Analyse the results of the statistical output.
d) Evaluate the validity of the statistical methods applied, based on the analyses.

STK326 (24 credits) – Special Probability densities, functions of random variables and Estimation theory.
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, three hours practical and four hours of self-study per week during the second semester.
One three-hour examination paper.
Probability densities, functions of random variables, sampling distributions and estimation theory.
After successfully completed the module the learner will be able to:
a) be familiar with some probability densities that figure most prominently in statistical theory, the techniques used in functions of random variables, and

b) to understand sampling theory, χ^2-, *t*– and *F* – distributions and to understand and apply estimation theory and estimation methods.

STK342 (8 credits) – Applied Statistics II
(Department of Mathematical Statistics and Actuarial Science)
One2-hour lecture per week
One 3-hour practical exam
The aim of this module is to give successful candidates the skills needed to:
a) Be proficient in the use of statistical programming packages such as SAS and R.
b) Program, apply, and evaluate both basic and more advanced statistical methods within a data analysis procedure.
c) Create detailed data analysis reports.
On completion of the module the student should be able to:
a) Show proficiency in utilising statistical software packages, namely SAS and R.
b) Understand, program, and apply basic and advanced statistical analysis models within the selected statistical software packages.
c) Analyse the results of the statistical output.

d) Evaluate the validity of the statistical methods applied, based on the analyses.
e) Create statistical reports on the analysis of a given data set, and the application and evaluation of a statistical method, in a manner simple enough to be understood by the lay person, but technical enough to interest a field expert.

TSK324 (16 credits) – Textile fibres. Textile fabric construction and finishes
(Department of Consumer Science)
Three lectures and one practical of two hours per week during the second semester.
One examination paper of two hours.
The properties of textile fibres and fabrics determine their suitability towards a specific product. Textile fibres are classified according to their source of origin or manufacture. The macro- and microstructure, physical and chemical properties and construction and finishing influence the uses and maintenance of different textile fabrics.
After the successful completion of this module the student should be capable:
a) to identify the textile fibre.
b) evaluate the possible uses of the textile fibre according to the properties.
c) to prescribe the care and maintenance for the specific textile product.
d) to explain the textile fibre performance in terms of the structure and the physical and chemical properties.

TSK424 (16 credits) – Weaving. Surface enrichment of fabrics
(Department of Consumer Science)
One lecture and two practicals of three hours per week in the second semester.
Weaving, knitting and crocheting. Surface enrichment of fabrics.
After successful completion of this module the student should:
(a) be able to weave on a loom,
(b) understand and demonstrate the principals of weaving,
(c) identify and apply different types of embroidery stitches,
(d) have a basic knowledge of knitting and crocheting.

VBW124 (16 credits) – Ergonomics. Apparatus studies
(Department of Consumer Science)
Three lectures and one practical of three hours per week during the second semester.
One examination paper of two hours.
Ergonomics: Work, worker and work place are studied. Productivity.
Study of apparatus which include the selection, use and maintenance of household apparatus.
After the successful completion of this module the student should have:
(a) a thorough knowledge of ergonomics which include the worker, work and workplace,
(b) a thorough knowledge of productivity. What it is and how it could be improved,
(c) a thorough knowledge of household apparatus concerning selection, use and maintenance,
(d) practical experience about the use of household apparatus,
(e) the practical knowledge to use apparatus and workstations in an ergonomically way,
(f) the ability to be a more productive worker.

VBW312 (8 credits) – Resource management
(Department of Consumer Science)
Two lectures per week in the first semester.
One examination paper of two hours.
Management and decision-making processes in the family as well as the using of resources available to the family are of importance. Different forms of management and decision-making are discussed. The handling of the family's finances are discussed with special attention to aspects as the use of credit, personal financial management, protection planning, retirement planning and health planning.
After the successful completion of this module the student should have:
(a) a thorough knowledge of the different management and decision-making process,
(b) a thorough knowledge about how to manage the family's finances.

VBW324 (16 credits) – Consumer study
(Department Microbial, Biochemical and Food Biotechnology)
Three lectures per week in the second semester.
One examination paper of two hours.
A study is made of the diversity in the market and how the market is segmented. The motivation and behaviour of the consumer are investigated as well s the perception and learning processes.
After the successful completion of this module the student should:
(a) have a thorough knowledge about the diversity in the market and how the market can be segmented,
(b) have a basic knowledge about the consumers behaviour and how to motivate them,
(c) be aware of the perceptions of the consumer, attitude formation and how to change this attitude,
(d) recognise the influence of social class, culture, sub-culture and cross-culture on the consumer and should know how to manage it.

VBW414 (16 credits) – Community development
(Department of Consumer Science)
Two lectures and one practical of four hours in the first semester.
One examination paper of two hours.
Module 1
The communication process. Method of presentation. Teaching aids. Evaluation.
Students that successfully complete this module will be able to:

a) demonstrate and understand the communication process,
b) apply different presentation methods,
c) compile and apply teaching aids,
d) evaluate and distinguish between different articles and products

Module 2

Community development with regard to individuals, families and groups. Program and project planning.
After the successful completion of this module the student should have:
a) a thorough knowledge of the factors which must be taken into account in community development and program planning,
b) the ability to develop and implement a successful project,
c) the ability to evaluate a project after it has been completed (and make the necessary adjustments if necessary).

VBW432 (8 credits) – Professional ethics: Consumer Science
(Department of Consumer Science)

Two lectures per week during the first semester.
One examination paper of two hours.
Consumer Science in the community. The professional consumer scientist and professional etiquette. Marketing of Consumer Science. The professional association. Career opportunities. The curriculum vitae and work interview. Meeting procedures. Seminar.
After the successful completion of this module the student should have:
a) an overview of the development of Consumer Science as a subject,
b) a thorough knowledge of Consumer Science as a career,
c) knowledge of professionalism and etiquette,
d) knowledge of compiling a curriculum vitae, applying for a job and the job interview.

VBW434 (16 credits) – Consumer science
(Department of Consumer Science)

Two lecturer per week during the first semester.
One examination paper of two hours.
The application of gained knowledge in the business (interior, food, clothing).
After the successful completion of this module the student should have:
a) a thorough knowledge of the factors that will influence the planning and setting of a studio,
b) the ability to analyse and solve design problems,
c) a thorough knowledge to make a success of the financial planning,
d) the insight to realise that professional growth is of utmost importance.

VBW424 (16 credits) – Research methodology
(Department of Consumer Science)

One lecture and practical of three hours per week during the second semester.
One examination paper of two hours.
The selection and conduct of a research project should be responsible and well planned. Consumer Science students should be aware of the principles of research and the different kinds of research that can be done in Consumer Science.
After the successful completion of this module the student should be able to:
a) select a research topic,
b) write a research proposal,
c) compile relevant literature,
d) conduct a research project,
e) write a research report.
f) define quality assurance
g) identify product attributes that contribute to product quality
h) distinguish between standards and specifications.

VDG314 (16 credits) – Nutrition

First semester: 2 theoretical lectures/week; practical self-study (3 hours/week).
Tests, Practicals and Examination: 2 test, practicals – form module mark of 100%. 1 Examination paper: 150 marks; 3 hours.
Content:
Nutrition information, dietary guidelines, aids in dietary planning and nutritional status; digestion, absorption and assimilation of food; energy; carbohydrates – sugar, starch and fibre; lipids; protein; vitamins; and water, minerals and trace elements. After completion of this module, you will be able to use dietary guidelines to evaluate the nutrient content of diets.

VDS214 (16 credits) – Food preparation
(Department of Consumer Science)

Three lectures and a three hour practical per week.
One examination paper of three hours.
Measuring and recipe science: practical application of principles. WATER: latent and specific heat. Conventional heat and microwave heat transfer. COOKING METHODS: dry and moist heat. Fruit, vegetables, legumes and nuts. Natural colour pigments. Lipids as applied to food preparation. Salads and salad dressings. Protein as applied to food preparation. Gelatine and gelatine dishes. Milk and milk products. Cheese and cheese products. Eggs and egg dishes. MEAT: selection, storage and cooking. POULTRY: selection, storage and cooking. FISH: classification, selection, Storage and cooking. SOUP: classification and preparation.
Practical work
Food preparation concerning aspects of the theory.

VDS224 (16 credits) – Food preparation
(Department of Consumer Science)

Three lectures and a three hour practical per week.

One examination paper of three hours.
Measuring and recipe science: practical application of principles. Terminology of food preparation. Carbohydrates as applicable to food preparation. Cereals, cereal products and sauces. BAKING: ingredients, batter and kinds of dough. SUGAR: classification, properties and uses. SUGAR COOKERY: crystalline and amorphous sweets. PRINCIPLES OF MEAL PLANNING: food groups. Daily menu plan with portion sizes. Herbs and spices.
Practical work
Food preparation with regard to aspects of the theory.

VDS344 (16 credits) – Food preservation and meal planning
(Department of Consumer Science)
Three lectures and a three hour practical per week.
One examination paper of three hours.
Preserving. Freezing of food. Packaging of food. Meal planning: menus and application of economic and gastronomic principles. Art of entertaining: formal and informal. International eating habits.
Practical work
Preserving. Planning and preparation of meals and receptions.

VGM314/334 (16 credits) – Quantity nutrition
One theory lecture and one practical of two hours per week in the first semester.
Continued evaluation and one examination paper of two hours).
Content:
The development of large-scale food services. Different food systems and the use of sophisticated food distribution systems. Institutional kitchen planning. The evaluation of food systems. Detail planning of large-scale foodservice units. Specific planning aspects to consider when planning a food service unit. Hygiene and safety measures in food service units.

VGM324/344 (16 credits) – Quantity nutrition
Two theory lectures and one practical of 3 hours per week in the second semester.
Continued evaluation and two written exam papers of two hours).
Content:
Selection, buying and storing of food. Quantity food preparation. Preparation of meat, fish, eggs, dairy products, vegetables, salads, sandwiches and desserts. Foodservice equipment: general principles, choice of quantity foodservice equipment, metals and materials. Mechanical equipment, cooking and serving equipment. Refrigerators and freezers, extractor fans, work tops and transport equipment. Mobile equipment. Cleaning equipment. Specification and standards.
Leadership and management. Decision making process. Marketing. Human resource management. Material management. Workflow, operational procedures and production planning. Implementing policy in management. Productivity. Quality control. The budgeting process. Business plans. Financial management. Managing information. Managing change.

VWSxyz – Food Science
For MODULE CONTENT see Yearbook Part 4: Agricultural Sciences.

WDK224 – Grassland Science
For MODULE CONTENT see Yearbook Part 4: Agricultural Sciences.

WKS114 (16 credits) – Introductory Statistics
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours of self-study per week during the first semester.
One three-hour examination paper.
Descriptive Statistics, introduction to probability, and probability distributions. Hypotheses testing.
After successfully completed the module the learner will be able to:
a) understand and apply the basic principles of statistics, make estimations by means of confidence intervals and testing of hypotheses, and
b) have the skills to solve problems, make decisions regarding the methods to be applied, analyse data and make logical conclusions from the results.

WKS124 (16 credits) – Introductory Probability theory
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours of self-study per week during the second semester.
One three-hour examination paper.
Stochastic variables, distribution theory, joint-, marginal- and conditional distributions. Expected values.
After successfully completed the module the learner will be able to:
a) be familiar with continuous random variables, conditional distributions and functions of random variables with joint distributions, determine the expected value, variance, covariance and correlation of random variables, and
b) have the skills to logically approach problems, formulate problems analytically, quantify available information, interpret and make conclusions.

WKS216 (24 credits) – Sample distribution theory and Introductory inference
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours of self-study per week during the first semester.
One three-hour paper.
Limit theorems, ^{2}-, *t*- and *F*- distributions. Sampling theory. Estimation of parameters.
After successfully completed the module the learner will be able to:
a) use the central limit theorem and construct distributions from the normal distribution, and
b) estimate parameters from various other distributions.

WKS226 (24 credits) – Inference (I)
(Department of Mathematical Statistics and Actuarial Science)
Three lectures, one three-hour practical and four hours of self-study per week during the second semester.
One three-hour paper.
Interval estimation. Hypotheses testing. Decision theory. Bayes inference.
After successfully completed the module the learner will be able to:
a) test hypotheses,
b) perform fitting tests and pair-wise tests, and
c) analyse categorical data, and understand decision theory and Bayes inference.

WKS314 (16 credits) – Inference (II)
(Department of Mathematical Statistics and Actuarial Science)
Two lectures, one three-hour practical and five hours of self-study per week during the first semester.
One three-hour paper.
Theory of hypothesis testing. Derivation of tests and the properties of tests. Approximate tests. Tests for categorical data. Contingency tables. Theory of confidence intervals. Properties of good confidence intervals. Pivotal quantities and the derivation of confidence intervals. Approximate confidence intervals.
After successfully completed the module the learner should have:
a) a thorough knowledge of the properties of the standard distributions in statistics,
b) an understanding of the basic principles of classical hypothesis testing,
c) the ability to derive tests for the parameters of most standard distributions, and
d) the ability to apply statistical tests and confidence intervals in practice and to interpret the results.

WKS324 (16 credits) – Multivariate Analysis
(Department of Mathematical Statistics and Actuarial Science)
Two lectures, one three-hour practical and five hours of self-study per week during the second semester.
One three-hour paper.
General principles of matrix theory. Matrix differentiation. Multivariate normal distribution. Wishart distribution. Estimation of parameters. Hypotheses testing about mean vectors. Mean vectors. Multivariate correlation and regression theory.
After successfully completed the module the learner should have:
a) an understanding of the use of matrix theory in statistics,
b) the ability to derive and apply multivariate tests,
c) the ability to analyse multivariable data, and interpret the results, and
d) the ability to calculate and test multiple regression and correlation.

WKS334 (16 credits) – Multiple Regression
(Department of Mathematical Statistics and Actuarial Science)
Two lectures, one three-hour practical and five hours of self-study per week during the first semester.
One three-hour paper.
Review of simple regression, multiple regression and matrix algebra, analysis of variance and quadratic development. Theoretical aspects of multiple regression and model building. Variable selection, polynomial regression, influential observations, outliers and residual analysis.
After successfully completed the module the learner should have:
a) a thorough knowledge of the application of matrix algebra and theoretical aspects of multiple regression,
b) a thorough understanding of least squares theory – most commonly used statistical procedure for estimating the parameters of a regression model,
c) the ability to formulate multiple regression problems and to solve them using matrix algebra, and
d) thorough knowledge of computer packages and printouts and the ability to interpret the results.

WKS344 (16 credits) – Time series analysis and generalised linear models.
(Department of Mathematical Statistics and Actuarial Science)
Two lectures, one three-hour practical and five hours of self-study per week during the second semester.
One three-hour paper.
Generalised linear models (GLM) and time series models. After successfully completed the module the learner should have:
a) the ability to explain the fundamental concepts of a generalised linear model (GLM) and to describe how a GLM may apply, and
b) the ability to define and apply the main concepts underlying the analysis of time series models.

WTW114 (16 credits) – Calculus
(Department of Mathematics and Applied Mathematics and Actuarial Science)
Four lectures and three hours practical per week in the first semester.
One three-hour paper.
Contents: The real numbers. Functions. Limits and continuity. Differentiation: theory, techniques and applications. The Mean Value theorem. Sketching curves. Inverse functions. Transcendental functions. Integration: theory, techniques and applications.
Outcome: Successful students will be able to demonstrate their skill with calculus, using mathematically logical arguments, by solving problems and by application of the theory.

WTW124 (16 credits) – Algebra and differential equations
(Department of Mathematics and Applied Mathematics)
Four lectures and three hours practical per week in the second semester.
One three-hour paper.

Contents: The binomial theorem. Complex numbers. Introductory linear algebra: Systems of linear equations, matrices, determinants, vectors in R^2 and R^3, lines and planes, Conic sections. Multivariable functions. Partial derivatives. Elementary differential equations.
Outcome: Successful students will be able to describe the introductory theory of linear algebra, complex numbers, conic sections and differential equations, and will be able to solve problems.

WTW134 (16 credits) – Calculus
(Department of Mathematics and Applied Mathematics)
Three lectures and three hours practical per week in the first semester.
One three-hour paper.
Contents: Functions, graphs, limits, continuity and the derivative. Polynomial, trigonometric, exponential and logarithmic functions. Differentiation. Critical points and local maxima and minima. Introduction to modelling. The definite integral. Integration techniques.
Outcome: Successful students will be able to demonstrate their skill with basic calculus by solving problems and by application of the theory.

WTW144 (16 credits) – Calculus and linear algebra
(Department of Mathematics and Applied Mathematics)
Three lectures and three hours practical per week in the second semester.
One three-hour paper.
Contents: Further integration, elementary differential equations, systems of linear equations, matrices, complex numbers.
Outcome: Successful students will be competent with integration and with the solution of systems of linear equations.

WTW142 (8 credits) – Introductory calculus and statics
(Department of Mathematics and Applied Mathematics)
Two lectures and one hour practical per week during the second semester.
One two-hour paper.
Contents: Calculus: polynomial, trigonometric, exponential and logarithmic functions, curve sketching, the function concept, an outline of differentiation and integration.
Statics: forces and moments, stress and strain, shear force and bending moment, trusses.
Outcome: Students master basic differentiation, integration and strength of materials, and can use calculus to solve construction problems.
Note: This module is meant for Architecture, Quantity Surveying and Construction Management students.

WTW154/WTV154 (16 credits) – Basic Mathematics
Three lectures and three hours practical per week in the first semester.
One two-hour paper.
Contents: Development of skills with arithmetic and mathematical calculations. Real numbers, algebraic expressions. Algebraic and graphical solution of equations. Logarithms and exponents. The use of a pocket calculator. Basic geometry and elementary trigonometry, the calculation of areas and volumes. Simple and compound interest. Grouping of data and descriptive statistics.
Outcome: Students have developed basic skills with algebraic manipulations and with mathematical techniques.

WTW164/WTV164(16 credits) – Pre-calculus
WTV194 (Year module) (16 credits) – Pre-calculus
Three lectures and three hours practical per week in the second semester.
One two-hour paper.
Contents: Algebra overview. Functions and graphs. Algebraic, linear, quadratic and polynomial functions. Trigonometric functions and trigonometry. Exponential and logarithmic functions.
Outcome: Students are familiar with the elementary functions and their graphs and have a good basis for a calculus module.
Note: This module gives access to WTW114.

WTW174 (16 credits) – Pre-calculus I
Contents: Number systems and proving theorems by induction; arithmetic and geometric series; simple and compound interest, depreciation, inflation; ratio and proportion; exponentials and logarithms and the exponential and logarithmic laws; graphs of lines, parabolas, circles and hyperbolae; factoring of algebraic expressions; principles of geometry; principles of trigonometry and solving triangles; applications and modelling.
Outcome: After completing this module, a student will be able to do some basic modelling, using the mathematical concepts above.
One three hour examination paper

WTW184 (16 credits) – Pre-calculus II
Contents: Definition of a function, domain and range; symmetry; even and odd functions; translating and combining functions; composite functions; inverse functions; linear and quadratic functions; power functions and polynomials; rational functions and their properties; exponential and logarithmic functions; the exponential and logarithmic laws; the trigonometric functions and their inverses; trigonometric identities; limits and continuity; basic statistics and probability theory.
Outcome: BEd students will have a thorough understanding of the mathematics contained in this module, and be able to teach learners the same on secondary school level; after completing this module, a student will have sufficient knowledge of Pre-calculus mathematics in order to proceed to calculus.
One three hour examination paper.

WTW214 (16 credits) – Vector analysis
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the first semester.
One three-hour paper.

Contents: Vector functions: limits, derivatives and integrals. Curves: parameterization, tangent vectors, arc length. Multivariable functions: quadratic surfaces, partial derivatives, limits, continuity, differentiability, gradients and directional derivatives, the Mean Value theorem, the chain rule for partial derivatives, tangent planes. Multiple and line integrals: Theory and applications.
Outcome: Students understand the theory and applications of more advanced calculus, including vector calculus, multivariable functions, line integrals and surface integrals.

WTW224 (16 credits) – Linear algebra
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical in the second semester.
One three-hour paper.
Contents: Real vector spaces: basis, dimension, subspace. Linear mappings: kernel, image, representation of a linear mapping as a matrix, inverse. Inner product and orthogonality: orthogonal bases, rank, bilinear mappings, quadratic forms. Determinants. Eigenvalues and eigen-vectors: characteristic polynomial of a linear mapping, symmetric matrices, diagonalisation. The Cayley-Hamilton theorem.
Outcome: Students understand the theory of linear algebra, i.e., they understand the algebra of abstract vector spaces which includes linear mappings, inner products, orthogonality, quadratic forms, symmetric matrices and diagonalisation.

WTW234(16 credits) – Mathematical modelling
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the first semester.
One three-hour paper.
Contents: Principles of modelling. Optimisation models. Dimensional analysis. Physical, chemical, biological and financial models. Modelling assignment.
Outcome: Students have a basic understanding of the methodology of mathematical modelling, as well as of the relevant mathematical background related to it, such as the use of difference equations and differential equations, proportionality, dimensionality, curve fitting techniques and elementary optimisation techniques. Students are also conversant with a number of case studies.

WTW244 (16 credits) – Ordinary differential equations
(Department of Mathematics and Applied Mathematics)
Two lectures and three hours practical per week in the second semester.
One three-hour paper.
Contents: Non-linear first order differential equations: substitution techniques, exact equations, integration factors. Non-homogeneous second order differential equations with constant coefficients. Series methods. Systems of linear first order differential equations. Elementary eigenvalue problems. Applications in Physics, Chemistry, Biology and Medical Science such as mixtures, mechanical vibrations, electronic circuits and resonance problems.
Outcome: Students can solve various non-linear first order differential equations, linear second order differential equations with constant coefficients, as well as some with non-constant coefficients. Students are skilled in certain basic applications of ordinary differential equations.

WTW254(16 credits) – Scientific Computing
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the first semester.
This module is evaluated continuously.
Contents: Programming with Matlab. Scientific computing. Introductory numerical techniques.
Outcome: Students can implement mathematical formulas, computations and algorithms on a computer and use it to solve problems numerically.

WTW264(16 credits) – Sequences and series
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the second semester.
One three-hour paper.
Contents: Sequences of real numbers: convergence, limits, boundedness, indeterminate forms, L'Hospital's rule. Improper integrals. Infinite series: tests for convergence, absolute and conditional convergence. Taylor series. Power series: intervals of convergence. Fourier analysis.
Outcome: Students understand the basic theory of sequences and series of real numbers. They can apply the theory by determining the power series expansion and intervals of convergence of functions.

WTW314 (16 credits) – Complex analysis
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the first semester.
One three-hour paper.
Contents: The complex numbers. Functions of a complex variable. Limits, continuity and differentiability. The Cauchy-Riemann equations. Power series. Analytic functions. Cauchy's theorem. Residue theory and applications.
Outcome: Students understand the basic theory of complex functions (which includes residue theory and applications).

WTW324 (16 credits) – Real analysis
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the second semester.
One three-hour paper.
Contents: Axiomatic construction of the real numbers. Sequences of real numbers. The Weierstrass-Bolzano theorem. Limits and continuity. The intermediate value theorem. The Riemann integral.

Outcome: Students understand the basic theory of the field of real numbers. Continuity, differentiability and Riemann integrability of real functions form part of this module.

WTW334 (16 credits) – Discrete Mathematics
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the first semester.
One two-hour paper.
Contents: Logic, method of proof, set theory, functions and relations, elementary number theory, induction, recursion, effectivity of algorithms.
Outcome: Students understand the foundation of mathematics and know when sentences are logically equivalent. Notions such as countability and infinity are mastered. Students will have enough background to study and understand the theory of algorithms.

WTW344 (16 credits) – Algebra
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the second semester.
One three-hour paper.
Contents: Groups: semi groups, finite and infinite groups, subgroups, Lagrange's theorem, cossets, conjunction, homomorphisms. Rings: polynomials, arithmetic modulo n, integral domains, fields, Euclidian domains, ideals, homomorphisms, principal ideal domains, unique factorisation domains, factorising in Q[x]. Geometric constructions.
Outcome: Students understand notions around certain algebraic structures such as groups, rings and fields, as well as applications thereof. They can also determine the possibility of certain geometric constructions. Furthermore, students will have enough background to study coding theory.

WTW364 (16 credits) – Industrial Mathematics
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the second semester.
One three-hour paper.
Contents: Introduction to linear programming. Actual problems from industry with the necessary mathematics to model it mathematically and solve the models. Communication of results. Project.
Outcome: Students can solve simple programming problems. They are familiar with several actual problems from industry and are able to solve similar simple problems themselves and communicate results.

WTW374 (16 credits) – Numerical analysis
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the first semester.
One two-hour paper.
Contents: Non-linear equations in one variable: iterative methods, error analysis. Polynomial interpolation: Hermite interpolation and error estimation. Numerical differentiation and integration. Initial-value problems in ordinary differential equations: elementary theory, Runge-Kutta and multistep methods, stability.
Outcome: Students can implement the theory of numerical techniques such as the iterative solution of non-linear equations, interpolation, numerical differentiation and integration, and the numerical solution of ordinary differential equations on a computer. They can perform accuracy and reliability tests.

WTW384 (16 credits) – Dynamical systems
(Department of Mathematics and Applied Mathematics)
Two lectures and two hours practical per week in the second semester.
One three-hour paper.
Contents: Elementary stability considerations in systems of linear first order ordinary differential equations: chemical, medical, biological and other applications. Systems of non-linear first order ordinary differential equations. Local stability and the classification of fixed points: Applications to biological and medical models. Global stability and limit cycles: Forced non-linear oscillations. First order perturbation techniques. Applications of ordinary differential equations.
Outcome: Students can use phase diagrams to analyse equilibrium points and trajectories of non-linear ordinary differential equations. Students can use techniques from asymptotic analysis to obtain approximate solutions of such differential equations. Students can apply these techniques to manipulate models in Chemistry, Physics, Medical Science and Biology.

Annexure A: Transitional regulations

Module codes of Economic Management Sciences have changed. Contact the Faculty Manager (051 401 2173) for any inquiries.

Annexure B: Prerequisites

Module	Prerequisites
ANA216	BLG114 andANA124
ANA226	ANA216
ANA326	ANA216 and ANA226
ATW216	(WKS114 and WKS124) or (STK114 and STK124), and (WTW114 and WTW124) or (WTW134 and WTW144)
ATW226	ATW216
ATW246	60% in ATW216 and (WTW114 and WTW124)
ATW314	ATW226
ATW316	ATW246 and WKS226
ATW304	ATW226
ATW306	ATW246
BLG114	Grade 12 Life Sciences on performance level 5 or Physical Sciences on performance level 4
BLG124	BLG114
BLG144	BLG114
BOC216	Two of the following: BLG114, BLG124 or BLG144 and (CEM124 or CEM144 or CHE112+CHE132+CHE122+CHE142+CHE151+CHE161)
BOC226	BOC216
BOC314	BOC216
BOC334	BOC216
BOC324	BOC226
BOC344	BOC216
BRS121	BRS111
CEM124	CEM114
CEM144	CEM114
CEM214*	(CEM114 or CEM104 or CHE104 or CHE112+CHE142+CHE151) and (CEM124 or CEM194 or CHE194 or 60% pass CEM144 of CHE132+CHE122+CHE161) and (WTW114 or WTW134)
CEM232*	(CEM114) and (CEM124 or 60% pass CEM144) or (CHE112+CHE132+CHE122+ CHE142+CHE151+CHE161) and (WTW114 or WTW134)
CEM224	CEM124 or 60% pass CEM144 or CHE112+CHE132+CHE122+CHE142+CHE151+CHE161) and (WTW114 or WTW134)
CEM242	CEM232 and CEM214
CEM314	(CEM232 and CEM214 and CEM242) and (WTW124 or WTW144)
CEM324	CEM314
CEM334	(CEM232 and CEM214) and (WTW124 or WTW144)
CEM344	CEM224
CHE122	CHE132
CHE142	CHE112 + WTV154 or level 4 in NCS Mathematics
CHE151	CHE122 + CHE142 + WTV164 or WTW164
CHE161	CHE151
DRK214	Two of the following: BLG114, BLG124 or BLG144
DRK252	Two of the following: BLG114, BLG124 or BLG144
DRK262	Two of the following: BLG114, BLG124 or BLG144
DRK224	Two of the following: BLG114, BLG124 or BLG144
DRK314	Two of the following: BLG114, BLG124 or BLG144
DRK324	Two of the following: BLG114, BLG124 or BLG144
DRK334	Two of the following: BLG114, BLG124 or BLG144
DRK344	Two of the following: BLG114, BLG124 or BLG144
EECF62306	EECF61306
EECS71406	EECF61306
EECS72406	ECS623
ENT216	Two of the following: BLG114, BLG124 or BLG144
ENT226	ENT216 and two of the following: BLG114, BLG124 or BLG144
ENT314	ENT216
ENT354	ENT216
ENT324	ENT226
ENT334	ENT216
ENT344	ENT226
FFG216	BLG114 and CEM114 and (CEM124 or CEM144) or (CHE112+CHE132+CHE122+ CHE142+CHE151+CHE161)
FFG226	FFG216
FFG316	FGG216 and FGG226
FFG326	FFG216 and FFG226 and FFG316
FFG342	FFG216 and FFG226 and FFG316

* As a result of laboratory space and associated laboratory safety issues, numbers will be restricted to the 70 best students [maximum for which the laboratory is designed]. Completed first-year courses, as well as previous attempts to pass CEM214 and CEM232, will be used as primary criteria to select students.

FSK114	With (WTW114 or WTW134)
FSK124	Min. (FSK114 or FSK134) and Min. (WTW114 or WTW134)
FSK164	FSK154
FSK214	(FSK114 or 60% FSK134) and (FSK124 or 60% FSK144) and (WTW114 or WTW134) and (WTW124 or WTW144)
FSK224	(FSK114 or 60% FSK134) and (FSK124 or 60% FSK144) and (WTW114 or WTW134) and (WTW124 or WTW144)
FSK232	(With FSK214)
FSK242	FSK214
FSK264	FSK254 and (FSK114 or FSK134) and (FSK124 or FSK144)
FSK314	FSK214
FSK324	FSK314
FSK332	FSK214
FSK342	FSK332
FSK352	FSK232 and (With FSK314 and FSK332)
FSK362	FSK232 and (With FSK324 and FSK342)
FSK372	FSK214 and FSK242
FSK382	FSK314 and FSK332 and FSK372
GEN216	BLG114 + BLG124 + BLG144 (If not obtained, can apply for special permission from either the departmental chair or the Programme Director: Genetics. There is only room for 150 students in the class.)
GEN246	BLG114 + BLG124 + BLG144 (If not obtained, can apply for special permission from either the departmental chair or the Programme Director: Genetics. There is only room for 150 students in the class.)
GEN334	GEN216 + GEN246 (If not obtained, can apply for special permission from either the departmental chair or the Programme Director: Genetics. There is only room for 75 students in the class.)
GEN324	GEN216 + GEN246 (If not obtained, can apply for special permission from either the departmental chair or the Programme Director: Genetics. There is only room for 75 students in the class.)
GEN344	GEN216 + GEN246 (If not obtained, can apply for special permission from either the departmental chair or the Programme Director: Genetics. There is only room for 75 students in the class.)
GEN354	GEN216 + GEN246 (If not obtained, can apply for special permission from either the departmental chair or the Programme Director: Genetics. There is only room for 75 students in the class.)
GEO124	GEO114
GEO214	GEO124
GEO224	GEO114
GEO234	GEO114 or GLG114
GEO314	GEO214
GEO334	GEO234
GEO324	GEO224
GEO344	GEO214
GIS224	(GEO114 and GEO124) or (GLG114 and GLG124)
GIS324	GIS224
GLG124	GLG114
GLG202♦	GLG124 (only students in the Geology programmes)
GLG212♦	This module may only be presented simultaneously with GLG214 after both GLG114 and GLG124 were passed with an average mark of 55%
GLG214♦	CEM114 and this module may only be presented after both GLG114 and GLG124 were passed with an average mark of 55%
GLG222♦	This module may only be presented simultaneously with GLG224 after both GLG114 and GLG124 were passed with an average mark of 55%
GLG224♦	This module may only be presented after both GLG114 and GLG124 were passed with an average mark of 55%
GLG232♦	This module may only be presented after both GLG114 and GLG124 were passed with an average mark of 55%
GLG242	GLG114, (with GLG244)
GLG244	GLG114 or GEO114
GLG252♦	This module may only be presented after both GLG114 and GLG124 were passed with an average mark of 55%
GLG314♦♦	GLG214 and GLG212
GLG324♦♦	GLG224 and GLG222
GLG334♦♦	GLG124, GLG252 and (GLG224 and GLG222)
GLG344♦♦	GLG214 and GLG212 and GLG314 and GLG354 and GLG374
GLG354♦♦	GLG114 and CEM114 or CEM112+CEM142 and GLG214
GLG364♦♦	GLG114 and CEM114 or CEM112+CEM142 and GLG214
GLG374♦♦	GLG114 and CEM114 or CEM112+CEM142 and GLG214
GLG384♦♦	CEM114 and GLG214
HTG214	BLG114 and CEM114 and (CEM124 or CEM144) or (CHE112+CHE132+CHE122+ CHE142+CHE151+CHE161)
HTG224	HTG214

♦A maximum number of 60 students will be admitted to the second year due to laboratory constraints. These 60 students will be admitted according to academic excellence. Completed first-year modules, as well as previous attempts to pass GLG212, GLG214, GLG222, GLG224, GLG232, GLG252 and GLG202, will be used to select students.

♦♦A maximum number of 40 students will be admitted to the third year due to laboratory constraints. These 40 students will be admitted according to academic excellence. Completed second-year modules, as well as previous attempts to passGLG314, GLG324, GLG334, GLG344, GLG354, GLG364, GLG374 and GLG384, will be used to select students.

HTG304	HTG214 and HTG224
ISC354	ISC164 and (ATW226 or ATW246)
KLE444	KLE134
MBG214	BLG114
MBG314	This module may only be taken if both GEN216 and GEN246 have been completed successfully. An average mark of 60% for these modules is required.
MBG334	This module may only be taken if both GEN216 and GEN246 have been completed successfully. An average mark of 60% for these modules is required.
MBG324	This module may only be taken if both GEN216 and GEN246 have been completed successfully. An average mark of 60% for these modules is required.
MBG344	This module may only be taken if both GEN216 and GEN246 have been completed successfully. An average mark of 60% for these modules is required.
MKB216	Two of the following: BLG114, BLG124 or BLG144
MKB226	MKB216
MKB314	MKB216
MKB334	MKB226
MKB324	BOC226 and MKB216
MKB344	MKB216
MKB364	MKB314
PLK212	Two of the following: BLG114, BLG124, BLG144 or LWL114
PLK262	Two of the following: BLG114, BLG124, BLG144 or LWL114
PLK214	Two of the following: BLG114, BLG124, BLG144 or LWL114
PLK224	Two of the following: BLG114, BLG124, BLG144 or LWL114
PLK314	PLK214
PLK324	Min. (PLK224)
PLK334	Min. (PLK214)
PLK344	Min. (PLK224)
PLK354	PLK212
PNA322	PNA332
RIS114	With BRS111
RIS124	RIS114 or RIS144
RIS134	With BRS111
RIS144	RIS134
RIS164	RIS114 or RIS144 or Grade 12 Information Technology (IT) on performance level 5
RIS182	BRS111
RIS214	RIS124
RIS224	RIS124
RIS242	BRS111 + BRS121
RIS264	RIS214
RIS314	RIS214
RIS324	RIS224
RIS334	RIS164 and RIS214
RIS344	RIS224
ERKT61406	EACC61406 or EACC62406
SDH114	KLE134 of KLE124 and VDS214 or VDS224 and ITR224
SDH124	SDH114
STK216	STK124 or BMT124
STK226	STK216
STK316	(STK114 or WTW134) and (STK124 or BMT124)
STK326	Min. (STK316)
STK332	STK226
STK342	STK332
ETRG71407	EHRM51305 + EIOP52305
TRM314	TRM214
TRM324	TRM224
VBW414	(KLE112 and KLE132) or (VDS214 and VDS224)
VBW424	TSK324
WDK314	WDK224
WDK414	WDK224 or WDK314
WDK434	WDK224 or WDK314
WDK424	WDK224 or WDK314
WDK444	WDK224 or WDK314
WKS114	If the modules WKS114 are included in the learning programme, Mathematics HG = C is required. Alternatively (for senior students) a pass mark of at least 60% in WTW/WTV164 or WTV194 or WTW184 (Main Campus) or a pass in WTW134 is required.
WKS124	WKS114 and (WTW114 or 75% in WTW134)
WKS216	WKS124 and Min. (WTW124)
WKS226	WKS216
WKS314	WKS226

WKS324	WTW124 and Min. (WKS314)
WKS334	WTW124 and WKS226
WKS344	Min. (WKS314) and Min. (WKS334)
WTW114	If the modules WTW114 are included in the learning programme, Mathematics HG = B is required. Alternatively (for senior students) a pass mark of at least 70% in WTW/WTV164 or WTV194 or 60% in WTW184 (Main Campus) or a pass in WTW134 is required.
WTW134	Grade 12 Mathematics (HG) E or (SG) C or with performance level 5 or WTW184 (Main Campus) or WTW164 or WTV164
WTW124	Min. (WTW114)
WTW144	Min. (WTW114) or WTW134
WTW154 or WTV154	Grade 12 Mathematics with at least a (HG) E or (SG) C or with performance level 3
WTV164	WTW154 or WTV154
WTW164	WTW154 or WTV154
WTW174	Grade 12 Mathematics (HG) E or (SG) C or with performance level 4 or an average of at least 80 % in EGM114 and EGM124
WTW184	WTW174(Main Campus)
WTV194	Grade 12 Mathematics (HG) D or (SG) B or with performance level 4
WTW214	[WTW114 and Min. (WTW124)]
WTW234	(Min. (WTW114) or WTW134) and (Min. (WTW124) or WTW144)
WTW254	WTW124 or WTW144
WTW224	WTW124
WTW244	WTW124 or WTW144
WTW264	WTW114 and WTW124
WTW314	WTW124 and WTW214 and Min. (WTW264)
WTW334	WTW224 and WTW264
WTW374	WTW124 and WTW254
WTW324	WTW214 and Min. (WTW264)
WTW344	Min. (WTW224)
WTW364	WTW214, WTW244, WTW374 and Min. (WTW234)
WTW384	WTW244