

# Table of Contents

<b>GENERAL INFORMATION</b> .....	<b>2</b>
<b>THE FACULTY OF AGRISCIENCES</b> .....	<b>11</b>
<b>PROGRAMMES OFFERED</b> .....	<b>20</b>
<b>CROP PRODUCTION SYSTEMS</b> .....	<b>20</b>
<i>Bachelor's Programme</i> .....	<i>21</i>
<i>Honours Programme</i> .....	<i>24</i>
<i>Master's Programme</i> .....	<i>26</i>
<i>Doctoral Programmes</i> .....	<i>27</i>
<b>FOOD AND WINE PRODUCTION SYSTEMS</b> .....	<b>28</b>
<i>Bachelor's Programme</i> .....	<i>28</i>
<i>Honours Programme</i> .....	<i>31</i>
<i>Master's Programme</i> .....	<i>33</i>
<i>Doctoral Programmes</i> .....	<i>34</i>
<b>ANIMAL PRODUCTION SYSTEMS</b> .....	<b>34</b>
<i>Bachelor's Programme</i> .....	<i>34</i>
<i>Honours Programme</i> .....	<i>39</i>
<i>Master's Programmes</i> .....	<i>40</i>
<i>Doctoral Programmes</i> .....	<i>41</i>
<b>AGRICULTURAL ECONOMICS AND MANAGEMENT</b> .....	<b>42</b>
<i>Bachelor's Programme</i> .....	<i>42</i>
<i>Honours Programme</i> .....	<i>45</i>
<i>Master's Programme</i> .....	<i>46</i>
<i>Doctoral Programmes</i> .....	<i>46</i>
<b>FORESTRY AND NATURAL RESOURCE SCIENCES</b> .....	<b>46</b>
<i>Bachelor's Programme</i> .....	<i>47</i>
<i>Honours Programme</i> .....	<i>51</i>
<i>Master's Programmes</i> .....	<i>51</i>
<i>Doctoral Programmes</i> .....	<i>52</i>
<b>CONSERVATION ECOLOGY</b> .....	<b>53</b>
<i>Bachelor's Programme</i> .....	<i>53</i>
<i>Master's Programme</i> .....	<i>54</i>
<i>Doctoral Programme</i> .....	<i>54</i>
<b>AGRICULTURAL PRODUCTION AND MANAGEMENT*</b>	
<i>Bachelor's Programme</i>	
<i>*By virtue of a co-operation agreement between Stellenbosch University and the Western Cape Provincial Government, the Bachelor's programme in Agricultural Production and Management (BAgric) is presented by the Cape Institute for Agricultural Training: Elsenburg on the Elsenburg campus.</i>	
<i>All information about this programme is available from the Cape Institute for Agricultural Training: Elsenburg (tel. (021) 808 5451/3 or <a href="http://www.elsenburg.com">www.elsenburg.com</a>).</i>	
<b>SUBJECTS, MODULES AND MODULE CONTENT</b> .....	<b>56</b>
<b>COMPULSORY PRACTICAL VACATION WORK</b> .....	<b>115</b>
<b>UNDERGRADUATE EXCHANGE PROGRAMME</b> .....	<b>118</b>
<b>RESEARCH AND SERVICE BODIES</b> .....	<b>119</b>

# General Information

## STANDING INVITATION TO PAST STUDENTS

The Registrar cordially invites all past students of Stellenbosch University to notify him in writing of any change of address.

The Registrar also welcomes news of distinctions, academic or other, won by our past students, and would appreciate being informed of the titles of any of their publications. The Senior Director: Library Service would be equally happy to receive copies of such publications on behalf of the University Library.

## SUMMARY: LANGUAGE POLICY AND PLAN

The official Language Policy and Plan of the Stellenbosch University was approved by the Council of the University in 2002. The following summary is provided in the interests of brevity, but must be read in conjunction with, and is subject to, the full Language Policy and Plan. The full version is available at <http://www.sun.ac.za/taal>.

### A. Language Policy

1. The University is committed to the use and sustained development of Afrikaans as an academic language in a multilingual context. Language is used at the University in a manner that is directed towards its engagement with knowledge in a diverse society.
2. The University acknowledges the special status of Afrikaans as an academic language and accepts the responsibility to promote it. At the same time, it takes account of the status of English as an international language of communication and of isiXhosa as an emerging academic language.
3. The University distinguishes between the use of the three languages in the following manner:
  - Afrikaans is by default the language of learning and teaching at undergraduate level, while English is used to a greater extent at the postgraduate level;
  - isiXhosa is promoted as an emerging academic language. The University creates opportunities for students and staff to acquire communication skills in isiXhosa.
4. The institutional language of the University is, by default, Afrikaans, while English is also used, depending on the circumstances, as an internal language of communication. All three languages are used, where possible, for external communication.

### B. Language Plan

1. The Language Plan distinguishes between the implementation of the policy in learning and teaching situations and in the support services and management.
2. Choices between various language options may be made in learning and teaching situations, depending on the language abilities of the lecturer and the composition of the students and programme. These language options are arranged in a hierarchy. Reasons must be provided for deviating from the default option (see point 4 for details).  
In extraordinary and compelling circumstances the University may deviate from the language specification of a module or programme, on condition that any such deviation must be reviewed at the end of each semester to determine whether its continuation remains justified. The deans manage this process, reporting on it to the Executive Committee (Senate). The Language Committee must be informed of any deviation from the language specification of a module or programme and must be given the opportunity to enquire about such deviation, where necessary.
3. Three general guidelines apply with regard to the language of learning and teaching in class:

- Modules in which a language is taught are conducted mainly in the language in question (e.g. isiXhosa is taught mainly in isiXhosa, Mandarin in Mandarin) and tasks, tests and examinations are set and answered accordingly.
  - Questions papers in all other modules are set in Afrikaans and English and students may answer in Afrikaans or English.
  - Except in cases where the aim of the module is language acquisition or the study of the language, students may ask questions and expect answers in Afrikaans or English.
4. Departments choose and implement the various language specifications as follows (the above three points apply generally for all options):

### **A Specification\***

#### *Rationale*

Applies as the default mode for all undergraduate modules. No reasons need to be given for exercising this option.

#### *Characteristics*

- Teaching is mainly in Afrikaans
- Study material such as textbooks, notes, transparencies, electronic learning and teaching material may be in Afrikaans and/or English
- Study framework is in Afrikaans and English.

### **T Specification (bilingual classes)**

#### *Rationale*

Is used for classes where

- students' language competence requires greater use of English
- a programme offered is unique to the University
- multilingualism is important in the context of a specific occupation
- the lecturer does not yet have an adequate command of Afrikaans.

#### *Characteristics*

- Teaching is in Afrikaans for at least 50% of the time.
- Textbooks and reading matter are in Afrikaans and/or English.
- Study notes, transparencies and electronic learning and teaching material are fully in Afrikaans and English, or alternately in Afrikaans and English.

### **E Specification (English as the main medium of instruction)**

#### *Rationale*

Is used only in highly exceptional circumstances for

- programmes unique in South Africa
- programmes in which students do not have adequate language skills (foreign or English-speaking students)
- modules in which the lecturer does not have a command of Afrikaans
- regional co-operation and strategic aims necessitate English.

#### *Characteristics*

- Teaching is primarily in English.
- Textbooks and reading matter are in Afrikaans and/or English.
- Notes are in English with core notes in Afrikaans.
- Transparencies and electronic learning and teaching material are in English.

### **A & E Specification (separate 'streams' in Afrikaans and English)**

#### *Rationale*

Used only in most exceptional circumstances when academically and financially justified and attainable for

- modules with large numbers of students
- regional co-operation and attaining strategic goals
- programmes offered by satellite technology or interactive telematic education.

### *Characteristics*

- The characteristics of the A and E options apply respectively here.

\* For both of these options an academic language competence in Afrikaans and English is essential for successful study.

5. Afrikaans is the default language of communication for the support services and management. All official documents of the University are available in Afrikaans. 'Default' does not, however, mean 'exclusively': important policy documents are available in English and communication with staff is also conducted in English. Guidelines are provided for the language to be used at meetings. Documents relating to the service conditions for staff are available in Afrikaans, English and isiXhosa.
6. Written communication with students is conducted in Afrikaans and English, and recruitment is conducted, where possible, also in isiXhosa. Oral communication is conducted in Afrikaans or English, according to the language of preference of the student.
7. The corporate image of the University reflects the Language Policy and Plan.
8. A Language Committee is appointed by the Council to implement the Language Policy and Plan.
9. The Language Centre assumes the responsibility for the provision of and/or co-ordination of the relevant language support required for the effective implementation of the Language Policy and Plan.

## **CODE OF CONDUCT FOR LANGUAGE IN THE CLASSROOM**

This Code of Conduct has been drawn up in order to provide practical guidelines for understanding and implementing the Language Policy and Plan of the US, which was accepted by the University Council in 2002. The Council regards it as important that the Language Policy and Plan of the US should be implemented with integrity. The Code is offered as an aid for dealing constructively with possible difficulties or uncertainties. The core principle governing the day-to-day use of language on the campus is that all staff, students and clients of the University are responsible for language matters and may have the expectation that disputes will be approached and dealt with in a spirit of co-operation in which workable solutions are sought.

A distinction is drawn in the Code of Conduct between the responsibilities and expectations of staff and of students. Complaints on language matters of an academic nature will be dealt with in accordance with standard procedures.

The Language Policy and Plan sets the minimum language requirements for students studying at Stellenbosch University (Language Plan 2002:5):

As a general rule, students taking an A module or a T module require an academic language proficiency in both Afrikaans and English for effective study at the undergraduate level. A higher level of academic language proficiency is required for postgraduate study. Lecturers, especially with regard to their obligations to set and assess assignments, tests and question papers in English and Afrikaans, will be expected within a reasonable time from their appointment to develop sufficient receptive skills (listening and reading) in Afrikaans and English to be able to follow discussions in class, to set assignments and examination question papers in both languages and to be able to understand students' answers in both languages. They should also be capable of judging the equivalence of translations and of fairly assessing answers in Afrikaans and English.

### **Lecturers' Responsibilities**

Lecturers bear the responsibility of:

1. implementing the language specifications of the module being taught in accordance with the requirements of the Language Plan (see especially paragraph 3 of the Language Plan).

2. revising and adjusting the language specifications where necessary and according to the circumstances (new text books, other lecturers).
3. informing students briefly at the beginning of the teaching of the module, orally and in the module framework, of the choices and alternative for which the language specifications make provision.
4. ensuring that questions in assignments, tests and examinations have exactly the same content in English and Afrikaans.
5. developing sufficient language proficiency to be able to mark assignments, tests and examinations in Afrikaans and English, or making other satisfactory arrangements that it takes place.
6. ensuring that, in accordance with the guidelines for the T option (see 3.3.1.2 of the Language Plan), students' language proficiency is sufficiently developed, and the necessary measures are in place to ensure subject-specific language proficiency in Afrikaans and English.
7. striving at all times to act courteously and accommodatingly in situations involving language use (e.g. when questions are asked in English in a class where the language specification for the module is A).

### **Lecturers' Expectations**

Lecturers can expect students to:

1. take note of the characteristics of the language specification applicable to the specification laid down for the module. (See paragraph 3, Language Plan).
2. inform the lecturer of their needs with regard to academic language skills.
3. respect the spirit of the Language Policy and Plan, especially with regard to the development of skills in a language which is not their language of choice, by deliberately paying attention to it, taking part actively in class and working on their knowledge of subject terminology and subject discourse in both languages. This expectation applies especially to the T Specification for modules.

### **Students' Responsibilities**

Students bear the responsibility of:

1. ascertaining the language options for each module and noting especially the consequences; e.g. that translations will not be available in some instances.
2. being honest and open-hearted about their language skills and taking the responsibility for early and appropriate action if they should experience difficulties.
3. deliberately developing the receptive skills (listening and reading) in the language not of choice for learning and teaching by active participation in class.
4. buying and using the prescribed material (especially text books) to improve their language skills in the subject.
5. being courteous and accommodating, and acting accordingly, in situations where language use is at issue, e.g. with regard to the difficulties of the minority group in the class.
6. accepting that one or a few students, because of inadequacies in his/their language proficiency, may not exercise or try to exercise a right of veto with regard to the use of Afrikaans or English in the class situation.

### **Students' Expectations**

Students can expect that:

1. help with language skills development will be provided should their academic language proficiency in Afrikaans and/or English be inadequate.
2. they can ask questions and conduct discussions in Afrikaans or English (unless the other languages are required, as in language modules), taking into account their own and the lecturer's language proficiency.

3. Afrikaans and English versions of assignments and question papers will be available and will have the same content.
4. there will be a sensitivity for language difficulties, so that language errors made under examination conditions will be assessed with discretion.

### **NON-RACISM**

Stellenbosch University admits students of any race, colour, nationality or ethnic origin to all rights, privileges, programmes and activities generally accorded or made available to students of the University. The University does not discriminate on the basis of race, colour, nationality or ethnic origin in the implementation of its educational policies, its scholarship and loan programmes, or its sports programmes.

### **PLEASE NOTE**

1. In this publication any expression signifying one of the genders includes the other gender equally, unless inconsistent with the context.
2. Before making a final choice of modules (subjects), every student should closely consult the relevant timetables. Should it then become apparent that two modules fall in the same time slot on a particular timetable, the University will not allow registration as a student in both of them for the same year/semester since they will be an inadmissible combination.
3. The University reserves the right to amend the Calendar at any time. The Council and the Senate of the University accept no liability for any inaccuracies there may be in the Calendar. Every reasonable care has, however, been taken to ensure that the relevant information to hand as at 31 August 2005, the time of going to press, is given fully and accurately in the Calendar.
4. In the event of uncertainty or a dispute regarding information in Part 6 of the Calendar, the final interpretation will be based on the Afrikaans version.
5. Parts 1, 2 and 3 of the Calendar contain general information applicable to all students. Students are urged to note with special care the content of the Provisions relating to Examinations and Promotions in the "University Examinations" chapter of Part 1 of the Calendar.

### **CALENDAR CLASSIFICATION**

The University Calendar is divided into the following parts:

General	Part 1
Bursaries and Loans	Part 2
Student Fees	Part 3
Arts and Social Sciences	Part 4
Science	Part 5
Education	Part 6
Agrisciences	Part 7
Law	Part 8
Theology	Part 9
Economic and Management Sciences	Part 10
Engineering	Part 11
Health Sciences	Part 12
Military Science	Part 13

Afrikaans (Part 1 - 12) and English copies of the individual parts may be obtained from the Registrar on request.

## **COMMUNICATION WITH THE UNIVERSITY**

### **Student Number**

In dealing with new formal applications for admission, the University assigns a student number to each applicant. This number serves as the unique identification of the person concerned. However, the mere assignment of a student number does not imply that the applicant has been accepted for the proposed programme of study. You will be advised whether or not you have been accepted in a separate letter.

Once you have been informed of your student number you must please quote it in all future correspondence with the University.

### **Addresses at the Central Administration**

Correspondence on academic matters - i.e. study-related matters, bursaries, loans, etc. - should be directed to

The Registrar  
Stellenbosch University  
Private Bag X1  
MATIELAND  
7602

Correspondence on matters relating to finance and services, including services at University residences, should be directed to

The Executive Director: Operations and Finance  
Stellenbosch University  
Private Bag X1  
MATIELAND  
7602

### **Other official addresses**

The Dean  
Faculty of Agrisciences  
Stellenbosch University  
Private Bag X1  
MATIELAND  
7602

Division of Student Affairs (Non-academic matters)

Neelsie  
Private Bag X1  
MATIELAND  
7602

**USEFUL TELEPHONE AND FAX NUMBERS**

<b>Agrisciences</b>	<b>Telephone</b>	<b>E-mail</b>
The Dean	(021) 808 4737	agric@sun.ac.za asmk@sun.ac.za
Faculty Secretary (fax: (021) 808 3822)	(021) 808 4833	ghgamiet@sun.ac.za
<b>Departments and Chairs</b>		
Agricultural Economics: Prof N Vink	(021) 808 4899	nv2@sun.ac.za
Agronomy: Prof GA Agenbag	(021) 808 4852	gaa@sun.ac.za
Animal Sciences: Prof CW Cruywagen	(021) 808 4746	cwc@sun.ac.za
Conservation Ecology and Entomology: Prof MJ Samways	(021) 808 3728	samways@sun.ac.za
Food Science: Prof RC Witthuhn	(021) 808 3654	rcwit@sun.ac.za
Forest and Wood Science: Mr PA Ackerman	(021) 808 3298	packer@sun.ac.za
Genetics: Prof JT Burger	(021) 808 5858	jtb@sun.ac.za
Horticultural Science: Prof KI Theron	(021) 808 4762	kit@sun.ac.za
Plant Pathology: Prof A Viljoen	(021) 808 4797	altus@sun.ac.za
Soil Science: Dr JE Hoffman	(021) 808 4789	ehoffman@sun.ac.za
Viticulture and Oenology: Prof FF Bauer	(021) 808 4346	fb2@sun.ac.za
Institute for Wine Biotechnology: Prof FF Bauer	(021) 808 4346	fb2@sun.ac.za
<b>Major entities by campus</b>		
Cape Institute for Agricultural Training: Elsenburg	(021) 808 5450/1	(021) 884 4319
Graduate School of Business (Bellville Park)	(021) 918 4111	(021) 918 4112
Health Sciences, Faculty of (Tygerberg)	(021) 938 9111	(021) 931 7810
Interactive Telematic Education (Stellenbosch)	(021) 808 3563	(021) 808 3565
Library (=JS Gericke) (Stellenbosch)	(021) 808 4385	(021) 808 4336
Military Science, Faculty of (Saldanha)	(022) 702 3999	(022) 814 3824
School for Public Management and Planning (Bellville Park)	(021) 918 4122	(021) 918 4123
<b>Other units</b>		
Admissions	(021) 808 4546	(021) 808 3822
Bursaries and Loans	(021) 808 4627	(021) 808 2954
Central Administration, Stellenbosch	(021) 808 4515	(021) 808 3822
Centre for Teaching and Learning (Extended Degree Programmes)	(021) 808 3717	(021) 808 3822
Communication and Liaison	(021) 808 4633	(021) 808 3800
Examinations Section	(021) 808 4582	(021) 808 3822
International Office	(021) 808 4628	(021) 808 3799
Research Development	(021) 808 4914	(021) 808 4537
Student Counselling and Development, Centre	(021) 808 3894	(021) 808 4706
Student Fees	(021) 808 4913	(021) 808 3739
Student Housing	(021) 808 2848	(021) 808 2847
Student Records	(021) 808 4574	(021) 808 3822
<b>Faculty Secretaries of other Faculties</b>		
Arts and Social Sciences	(021) 808 4840	(021) 808 3822
Economic and Management Sciences	(021) 808 4837	(021) 808 3822
Education	(021) 808 4831	(021) 808 3822
Engineering	(021) 808 4835	(021) 808 3822
Health Sciences: Admin, Stellenbosch	(021) 808 4842	(021) 808 3822
Health Sciences: Tygerberg Campus	(021) 938 9204	(021) 931 7810
Law	(021) 808 4850	(021) 808 3822
Military Science	(021) 808 4835	(021) 808 3822
Science	(021) 808 4832	(021) 808 3822
Theology	(021) 808 4850	(021) 808 3822

# Preface

## VISION AND MISSION OF THE FACULTY OF AGRISCIENCES

### **Vision**

International excellence with wide acknowledgement of the depth and relevance of our research, the exceptional quality of our education, and the usefulness of our service to agriculture and forestry.

### **Mission**

The mission of the Faculty of Agrisciences is to be the preferred provider of world-class research, education and service to agriculture and forestry in southern Africa. We strive to use our knowledge, expertise and skills to the benefit of South Africa and the region, of its people and its industries, and of our clients in a manner that ensures the sustainable use of the region's natural, physical and social resources and that gains the widest public recognition.

To this end:

- our research forms a seamless continuum, from path-breaking fundamental investigations, through market-driven applied research, to technology development and transfer aimed at practical implementation;
- we ensure, through our modern, high-quality methods of learning and teaching and inspired by our research successes, that our students are the first choice of employers, that they are known as the shapers of opinion, and that they are ready to step into leadership roles whether locally or internationally;
- we provide a one-stop service to industries and clients;
- we work together in strategic alliances;
- every staff member is multi-skilled and of world-class standard.

**Web site:** <http://www.sun.ac.za/agric/>

## PROFILE OF THE GRADUATES OF THE FACULTY OF AGRISCIENCES

Our graduates are scientists who have the necessary knowledge, skills and disposition to function optimally, whether independently or in team context, in a scientific agricultural or agriculturally-related environment. This includes the judicious implementation of the relevant sciences in the value chain to provide a variety of food and fibre products in an economical, environmentally friendly and sustainable manner so as to promote the progress and welfare of humanity.

In order to fulfil these requirements, our graduates display the following professional characteristics:

### **Knowledge**

- Possess the necessary knowledge of the applicable sciences, and understand the interaction between the biological and abiotic factors in the environment and the basic principles of research methodology
- Possess the ability to create new knowledge, generate ideas and act innovatively
- Possess the ability to function efficiently in an interdisciplinary environment
- Understand sustainable development and sustainable resource management
- Make knowledgeable decisions on the basis of proven information
- Follow a systems approach in the analysis of and approach to environmental problems

### **Attitude and disposition**

- Show respect for the environment and those who use it
- Acknowledge own limitations in knowledge and skills

- Have a positive disposition to continuous professional development
- Are involved in and render service to the broader community
- Set a positive example with regard to social responsibilities and obligations
- Accept and strive for the highest standards of knowledge

**Skills**

- Possess the ability to gather knowledge, integrate it, interpret and apply it and to think and act in a problem-solving manner
- Communicate effectively with role players from different environments and backgrounds
- Possess sufficient skills to function as scientists, whether independently or in team context
- Can interpret and utilise relevant subject literature
- Possess the ability to efficiently utilise suitable resources and means in the working environment

# The Faculty of Agrisciences

## INTRODUCTION

The provision of sufficient high-quality food and sufficient plant and animal fibre at affordable prices, as well as the creation of employment and entrepreneurial opportunities, are some of the challenges facing the present-day agricultural and forestry industries. These opportunities and challenges are further influenced by the diversity of our country's topography, soil varieties, variable climate, limited water resources and the stricter requirements that selective consumers are constantly setting for agricultural and forestry produce. South Africa boasts a large variety of animal and plant life that, while agricultural and forestry activities are being carried out, must be protected and conserved to ensure that our descendants will also be able to enjoy our natural resources. These are the challenges facing you, the future agricultural or forestry scientist.

## AGRICULTURE

In South Africa agriculture contributes about 4% to the gross domestic product, it is an important earner of foreign exchange (R20 billion in 2001), it is a large employer (10% of formal job opportunities) and it meets people's basic needs for food and fibre. Agro-tourism is becoming increasingly important as an industry and provides recreational opportunities to many city dwellers. For every R1 million increase in the demand for agricultural produce, 83 new job opportunities are created, compared to only 29 such opportunities in the rest of the economy. It is generally acknowledged that agriculture plays an important role in poverty relief.

Soil is an important production factor in agriculture and forestry. The Republic of South Africa covers 122,3 million hectares, of which approximately 102,8 million ha, about 84%, are used for agriculture and forestry. Of this, about 16 million ha are used for crop production, about 1,5 million ha are planted with trees, and there are 143 000 ha of natural forest. Natural pastures cover approximately 83 million ha, most of which is found in semi-desert areas. Soils with optimal physical and chemical conditions are scarce and localised, although there are various unique soil/climate combinations that make the provision of products for niche markets possible.

South Africa has a shortage of water. About 30% of South Africa receives less than 250 mm of rain a year, about 34% receives between 250 and 500 mm, 25% between 500 and 750 mm, and only 11% of the country has a rainfall of more than 750 mm a year. Rainfall over large parts of the country is uncertain, and periodic droughts occur regularly. Because of these and other factors, South Africa is largely dependent for its water supply on reservoirs and subterranean water sources. Slightly more than 1,2 million ha is under irrigation. Agriculture is currently still the main user of water, about 50%, but there is increasing pressure on agriculture to release more water for industrial and domestic use. Only 10% of agricultural land can be utilised without irrigation. The management of forestry plantations in water catchment areas has to follow strict guidelines. Water and irrigation management therefore requires particular expertise.

South Africa is pre-eminently an agricultural country. Because of our varied climate and topography we can grow almost any crop. We are presently in the fortunate position of being self-sufficient in most primary food and fibre products for the population of the country. Types of food in which the country is at present not self-sufficient are wheat, oilseed, rice, tea and coffee. More than 33% of the total value of horticultural production is exported. Of this, pome fruit makes up the largest volume. Other examples of South African exports are subtropical fruit, maize, sugar, vegetables, wine, cut flowers, flower bulbs, mohair and karakul pelts. 81% of agricultural land is under natural pasture that is used mainly for extensive stock-farming. This is almost 70% of the total land surface of

South Africa. Stock-farming is carried out with a variety of animals, including cattle, pigs, sheep, goats and poultry. Aquaculture is a rapidly growing industry with considerable potential.

Besides the production of fresh produce, other important value-adding activities are post-harvest operations, product manufacture, food processing, storage and preservation. The quality of the product enjoyed by the consumer is dependent on sound management of soil, crops and herds. Careful and responsible pest and disease management is therefore also required.

## **FORESTRY**

South Africa has beautiful forests. Some of the tree species are used for timber that compares favourably with the best in the world. Unfortunately, our forests of indigenous trees are limited, and many years ago it was found necessary to plant tree species from other parts of the world. The demand for timber shows a steady increase. To meet the need for timber, and to ensure adequate timber resources for the future, production from the current 1,3 million ha of afforested area must be expanded by establishing new forests or by increasing the current level of production from existing forests.

When trees reach maturity, they must be harvested. This facet of the forestry industry is very complex, especially where trees are growing on steep mountain slopes. Road systems must be planned in detail and expensive harvesting equipment must be acquired and used efficiently.

The processing of the timber is the next step in the value-adding chain. This can be done either at a sawmill, where it is sawn, seasoned and graded, ready to be used in building or furniture, or at a paper mill, or at some other plant for processing into chips or fibre. Forests do not only meet our timber needs. They also provide outdoor recreational facilities. The need for forests and parks is becoming increasingly important, especially with the current population growth. The majority of forestry areas are accessible to the public. The wider field of conservation ecology addresses this aspect, for example through the conservation of the fauna and flora and the management of the natural environment for its esthetical and scientific importance. Trees also play an important role in rural and urban areas for the production of firewood, bark, medicine and ornaments, thereby enhancing the general quality of life.

Seen against this background, it is obvious that special knowledge, skills and management expertise are required for sustainable agricultural and forestry production. Our wide range of teaching programmes covers, therefore, all aspects of natural resource management, plant and animal production, post-harvest operations and economic management, from the basic science, through to the practical and economic aspects of the respective value chains of agriculture and of forestry.

Graduates in agriculture and forestry can follow a variety of careers in plant or animal production, conservation, processing and marketing. There are, for example, careers in research, teaching, consultation, information dissemination, farm management, environment management and industrial plant management (cellars, food factories and sawmills). Professions and careers such as these are not only practised in agricultural and forestry companies, but also in associated industries, commercial enterprises and government departments. Agrisciences graduates of this University enjoy high regard in the international labour market.

**ACADEMIC OFFERING**

<b>PROGRAMMES</b>	<b>QUALIFICATIONS</b>
Bachelor's programme in Crop Production Systems	BScAgric
Honours programme in Crop Production Systems	BScAgricHons
Master's programme in Crop Production Systems	MScAgric
PhD programme in Crop Production Systems	PhD (Agric)
DSc programme in Crop Production Systems	DScAgric
Bachelor's programme in Food and Wine Production Systems	BSc Food Sc or BScAgric
Honours programme in Food and Wine Production Systems	BSc Food ScHons or BScAgricHons
Master's programme in Food and Wine Production Systems	MSc Food Sc or MScAgric
PhD programme in Food and Wine Production Systems	PhD (Food Sc) or PhD (Agric)
DSc programme in Food and Wine Production Systems	DSc Food Sc or DScAgric
Bachelor's programme in Animal Production Systems	BScAgric
Honours programme in Animal Production Systems	BScAgricHons
Master's programme in Animal Production Systems	MScAgric
MPhil programme in Livestock Industry Management	MPhil
MPhil programme in Assisted Reproduction	MPhil
PhD programme in Animal Production Systems	PhD (Agric)
DSc programme in Animal Production Systems	DScAgric
Bachelor's programme in Agricultural Economics and Management	BScAgric or BAgricAdmin
Honours programme in Agricultural Economics and Management	BScAgricHons or BAgricAdminHons
Master's programme in Agricultural Economics and Management	MScAgric or MAgricAdmin
PhD programme in Agricultural Economics and Management	PhD (Agric)
DSc programme in Agricultural Economics and Management	DScAgric
Bachelor's programme in Forestry and Natural Resource Sciences	BScFor
Honours programme in Forestry and Natural Resource Sciences	BScForHons
Master's programme in Development Forestry	MFor
Master's programme in Forestry and Natural Resource Sciences	MScFor
PhD programme in Forestry and Natural Resource Sciences	PhD (For)
DSc programme in Forestry and Natural Resource Sciences	DScFor
Bachelor's programme in Conservation Ecology	BScConsEcol
Master's programme in Conservation Ecology	MScConsEcol
PhD generic programme for: Conservation Ecology, Wine Biotechnology, specific fields of study in Agricultural Sciences, Forestry Sciences, Food Sciences	PhD
Bachelor's programme in Agricultural Production and Management*	BAgric

\*By virtue of a co-operation agreement between Stellenbosch University and the Western Cape Provincial Government, the Bachelor's programme in Agricultural Production and

Management (BAgric) is presented by the Cape Institute for Agricultural Training: Elsenburg on the Elsenburg campus. All information about this programme is available from the Cape Institute for Agricultural Training: Elsenburg (tel. (021) 808 5451/3).

## **DEPARTMENTS**

The following departments form part of the Faculty:

Agricultural Economics

Agronomy

Animal Sciences

Conservation Ecology and Entomology

Food Science

Forest and Wood Science

Genetics

Horticultural Science

Plant Pathology

Soil Science

Viticulture and Oenology

Institute for Wine Biotechnology\*

\*Forms part of the Department of Viticulture and Oenology

## **MODULES**

The summarised content of the modules presented by these departments is given in alphabetical order on pages 58 - 114.

## **THE AGRISCIENCES STUDENT ASSOCIATION (ASA)**

ASA is an association for students in agricultural or forestry sciences of Stellenbosch University. The association strives to promote the academic and social interests of its members. It achieves this by representing its members on faculty and other academic bodies and committees within the University.

ASA welcomes you to the Faculty of Agrisciences and hopes that you enjoy your stay. We are an association run by its members for its members. Feel free to contact us whenever you need to, even if just to say hello.

### **Contact us at:**

Agrisciences Student Association

Faculty of Agrisciences

Stellenbosch University

Private Bag X1

MATIELAND

7602

SOUTH AFRICA

E-mail: [asa@sun.ac.za](mailto:asa@sun.ac.za)

## **GENERAL RULES FOR UNDERGRADUATE PROGRAMMES**

**BScAgric, BScFor, BScConsEcol, BSc Food Sc and BAgricAdmin**

### **ADMISSION REQUIREMENTS**

For admission to the four-year programmes for the degrees BScAgric, BScConsEcol, BScFor\*, BSc Food Sc or to the three-year programme for the degree BAgricAdmin, students must be in possession of the matriculation certificate or a certificate of exemption from the Joint Matriculation Board, with a 50% (D symbol) average and Mathematics with at least an E (HG) or D symbol (SG) and a Natural Science subject with at least an E symbol (SG). Candidates with an average less than 50% may, on the strength of a written motivation, be asked to undergo special selection. These requirements do not apply to

students who qualify for exemption on the grounds of age or to students from foreign countries who qualify for conditional matriculation exemption.

\*For admission to the Wood Products Science field of study in the undergraduate programme in Forestry and Natural Resource Sciences (BScFor), a student must be in possession of a matriculation certificate or a certificate of exemption from the Joint Matriculation Board, with at least a 50% (D symbol) average, Mathematics HG with at least a C symbol and Physical Science HG with at least a D symbol or SG with at least a C symbol.

Prospective students are strongly advised to take Physical Science and Biology for the Matriculation examinations because the University's Departments of Chemistry and Polymer Science and of Physics assume that students taking first-year modules in Chemistry and Physics possess sufficient knowledge to have obtained at least a Standard Grade pass in Physical Science.

## **ADMISSION REQUIREMENTS**

The general minimum undergraduate admission requirements of the Stellenbosch University (SU) are:

- A National Senior Certificate (NSC) as certified by Umalusi with an achievement of at least 4 in four designated university entrance subjects.
- An achievement of at least 50%, calculated in a ratio of 40:60, for the SU Access Tests and the average (excluding Life Orientation) obtained for the NSC.

In addition to the above admission to programmes leading to BScAgric, BScFor\*, BScConsEcol, BSc Food Sc and BAgriAdmin requires at minimum:

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 4
- Physical Sciences 4 OR
- Physical Sciences 3 and Life Sciences 4

\*For the field of study Wood Products Science:

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 5
- Physical Sciences 5

In addition to the general admission requirements of SU, admission to the programme leading to BAgri (Elsenburg) requires at minimum:

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics or Mathematical Literacy 4
- Physical Sciences 4 OR
- Life Sciences 4 OR
- Agricultural Sciences 4

## **GENERAL PROVISIONS**

Students must make sure of the prerequisite pass (PP), prerequisite (P) and corequisite (C) modules listed for each module. Details are given in the section Subjects, Modules and Module Content of this Part 7 of the Calendar. Students must also make sure of the examination and promotion regulations as well as the requirements for readmission, as set out in Part 1 (General) of the Calendar.

## **EXTENDED DEGREE PROGRAMME (EDP)**

The Extended Degree Programme (EDP) was introduced to assist students with proven potential but without adequate schooling in mastering their degree programmes. An additional year of study is added to a mainstream degree programme to form an EDP. This extra year is utilised to prepare students, by means of additional academic support, for specific mainstream subjects and for university studies in general.

In all fields of study in the Faculty of Agrisciences except the three fields given below, the EDP includes an additional year of study before students start the first year of study of their chosen mainstream degree programme. The curriculum of this additional year is specifically designed to provide additional academic support and to facilitate the transition between school and university. Students must pass all the modules of this year to gain admission to the first year of the mainstream programme.

In three of the fields of study in the Faculty the EDP is constituted by spreading the first year of the mainstream programme over two years. During these two years additional support modules are presented with the first-year curriculum of the mainstream programme. The three fields of study this arrangement applies to are *Agribusiness Management*, *Agricultural Economic Analysis and Management* and *Wood Products Science*. All prescribed modules for these two years must be passed to gain admission to the second year of the mainstream programme.

Any student who is admitted to a mainstream programme may apply for admission to the relevant EDP. Based on school results and/or the results of any assessment or test prescribed by the University, a student may be advised or compelled by the Faculty to follow the EDP route.

Students who obtained between 50% and 57% in their Grade 12 final examination may be required to register for the EDP. Students who do not meet a programme's admission requirements by one symbol in one of the prescribed school subjects may apply for admission to a degree programme and if admission is granted, may be required to follow the EDP route.

All necessary information on the structure and curriculum of the EDP will be supplied to students who want to or are required to register for the EDP. This information may also be obtained from the Faculty Secretary (tel. (021) 808 4833).

## **GENERAL NOTES**

### **General Information**

For further information on admission and registration of students, accommodation, regulations in regard to university examinations, rules dealing with advanced degrees, and/or recognition of degrees, consult Part 1 (General) of the Calendar.

### **Assessment**

There are mainly two systems used for the determination of the final mark for every module, viz.:

- (i) continuous assessment for determination of final marks (The rules are given in Part 1 (General) of the Calendar.); and
- (ii) determination of the class and examination mark weighted in a certain relation to determine the final mark.

The following rules apply to the determination of the class mark. Semester modules must make use of at least three, and in the case of year modules, six assessment opportunities to determine the class mark. Every assessment opportunity should contribute more or less an equal proportion to the class mark. Preliminary test and/or assessment dates are indicated in the study guide of a module. Finalisation of the dates takes place in consultation with the students concerned. In a class group with diverse study programmes, with associated difficult consensus on test or assessment dates, assessment will take place after completion of certain parts of the module.

Tests take place during the normal lecture or practical periods. No scheduled test may take place during the last two weeks of the formal class contact time of a semester (just before the first examination opportunity). Tests are scheduled so that they do not coincide with the middle semester tests of other faculties.

## **Standing Rules for Dean's Concession Examinations (DCEs)**

1. A final-year student who, when all examinations of the current round have been taken and when all final marks are available, (i) is one module in arrears for the degree; (ii) does not qualify for supplementary examination; (iii) has been permitted to write examinations in all modules required for the degree; and (iv) has taken the examinations in all the modules concerned, may be admitted to a Dean's Concession Examination (DCE) as a concession by the Dean, in consultation with the academic department(s) concerned.
2. The DCE shall be taken at a scheduled time during the last week of January or the first week of February.
3. These students shall be identified by the Faculty Secretary, who shall furnish the departments concerned with their names via the Dean's office. The onus shall be on the students concerned to communicate with the Faculty Secretary in good time (not later than 15 January) about possible admission to the DCE. Students who are granted a DCE shall present themselves for the examination, which shall be conducted departmentally.
4. DCEs in modules subject to continuous assessment shall be taken at the same time as referred to in paragraph 2 above, subject to the procedures laid down in paragraph 3 above.
5. Students who have been granted a DCE shall ascertain when and where the DCE in question is to be written and present themselves at such time and place.
6. DCEs shall be granted only with the approval of the Dean. No student shall be granted a DCE, under any circumstances, by any department. It shall not be competent for any teacher to give an undertaking to a student in this matter.
7. The Rules for DCEs in other faculties may differ from the Rules of the Faculty of Agrisciences. Students are required to familiarise themselves with such Rules, because it is taken into consideration together with those of the Faculty of Agrisciences.

## **GENERAL RULES FOR POSTGRADUATE PROGRAMMES**

### **Honours programmes**

Honours programmes follow a specific major of the preceding bachelor's degree and consist in each case of a composite year programme with a number of prescribed and elective modules. To pass, the student must obtain in each module a final mark of at least 50 (out of 100).

### **Master's programmes**

Master's programmes are taken in a particular major of the preceding bachelor's or honours degree.

The MScAgric, MScConsEcol, MScFor, MSc Food Sc, MAgricAdmin or MFor degrees are awarded to students who -

- (a) hold an applicable bachelor's degree of this University or a bachelor's degree approved for this purpose by the Senate, and who - on written application - have been admitted by the Senate to the particular programme with a minimum study period of two years, or hold an applicable honours degree of this University or a similar honours degree approved for this purpose by the Senate, and who - on written application - have been admitted by the Senate to the particular programme with a minimum study period of one year;
- (b) have followed an approved curriculum of advanced study and/or research, which may include a period of study or research at some other place recognised by the Senate;
- (c) have passed the prescribed examination(s);
- (d) have submitted a complete and well-written thesis or assignment which shows that independent scientific and technical investigations have been carried out and that the results have been interpreted satisfactorily;
- (e) included a statement in the thesis or assignment that the thesis or assignment has not been submitted to another university in order to obtain a degree and that it is the candidate's own work; and

(f) have satisfactorily taken an oral examination.

In certain cases supplementary study may be required.

Besides being able to use Afrikaans and English satisfactorily, candidates are advised, in their own interest, to acquire a reading knowledge of German or French (or some other language).

Candidates must also satisfy all other regulations regarding theses or assignments for master's degrees. (See Higher Degrees in Part 1 (General) of the University's Calendar.)

The MPhil programme in Livestock Industry Management and in Assisted Reproduction is set out in the study field Animal Production Systems.

### **Doctoral programmes**

The PhD (Agric), PhD (For), PhD (Food Sc) or PhD degrees are awarded to candidates who -

- (a) hold the degree MScAgric, MScConsEcol, MScFor, MSc Food Sc, MAgricAdmin, MPhil or MFor of this University, or another university's degree approved by the Senate for this purpose;
- (b) after the Senate's approval of the proposed research project, have carried out, to the satisfaction of the University, original research under supervision of a promoter for at least two years after obtaining the said master's degree at Stellenbosch University or at another place approved by the University, and have completed, to the satisfaction of the University, the study of such subjects as were required by the Senate;
- (c) have submitted a complete and well-written dissertation which shows that the candidate has made a particular contribution to the enrichment of knowledge in the chosen field, with proof of independent critical judgement and accompanied by a declaration that the dissertation has not been submitted to another university in order to obtain a degree and that it is the candidate's own work; and
- (d) have taken an oral examination to the satisfaction of the University, provided that, subject to approval by the Senate, exemption from this examination may be granted in special cases.
- (e) In addition, a candidate may be required to write an examination should the examiners find it necessary.

Besides being able to use Afrikaans and English satisfactorily, candidates are advised, in their own interest, to acquire a reading knowledge of German or French (or some other language).

A candidate for the PhD degree must have been enrolled for at least two academic years before the degree can be awarded. When application for admission is made, particulars of qualifications (accompanied by certified copies of certificates if the qualifications were not awarded by Stellenbosch University), the location and extent of the research, and the subject of the dissertation must be supplied to the Senate for approval. Upon approval being granted, the promoter will be appointed.

As to the date of submission of the dissertation, the number of copies to be submitted, as well as other requirements which need to be satisfied before the degree can be awarded, the general rules and regulations as given in the Higher Degrees in Part 1 (General) of the University's Calendar apply.

The DScAgric, DScFor or DSc Food Sc degree is awarded to candidates who have held, for at least five years, the PhD (Agric), PhD (For), PhD (Food Sc) or PhD degree of this University or some other qualification considered suitable in the opinion of the Senate, or to candidates who have held, for at least seven years, the MScAgric, MScConsEcol, MScFor, MAgricAdmin or MSc Food Sc degree of this University or some other qualification considered suitable in the opinion of the Senate, have carried out advanced original research and/or creative work to the satisfaction of the University, have submitted an original and high-quality published work\* or works that convinces the Senate that the candidate has made a real and influential contribution to the enrichment of knowledge in

the field of agricultural or forestry sciences or food science and have taken an oral examination, if required by the examiners, to the satisfaction of the University.

\* The term published work refers to a work that has been published in a scientific journal, a magazine, pamphlet or book freely available to the public, either in libraries or from some retail outlet. The reason why publication is required is to ensure that the work submitted is available for criticism by experts in the subject concerned. Examiners have the discretion to disregard a submitted work if, in their opinion, it was not readily available for criticism because it was hard to come by or because there was insufficient time for criticism since it was submitted for the degree too soon after publication.

Other publications by the candidate with little or no connection with the particular subject in which the main study has been performed, may also be submitted to support the candidature.

A candidate for the DScAgric, DScFor or DSc Food Sc degree must have been enrolled for at least one academic year at this University before the degree can be awarded. The candidate must give the Registrar written notice of at least one year of his intention to present himself as a candidate for the degree and must include in such notification the title(s) and extent of the proposed work(s). If the Senate accepts the notification, a promoter and examiners will be appointed.

A candidate for the DScAgric, DScFor or DSc Food Sc degree must provide before 1 September (for graduation in December) or before 1 December (for graduation in April) four copies of the work(s) which he wants to submit to the University, accompanied by a declaration that it is his own work and that it has not been submitted to another university in order to obtain a degree. Where a considerable part of the work(s) submitted has not been published only in the candidate's name, the candidate must provide satisfactory evidence that shows which part of the work is his own and he must state who conceived it, under whose guidance it took place and who executed, processed and put it in writing. The candidate must also indicate which part of the work, if any, has already been submitted by him, or by a co-author, to this or any other university in order to obtain a degree.

The general rules for doctoral degrees concerning the appointment of examiners, as given under Higher Degrees, and as set out in Part 1 (General) of the University's Calendar, are also applicable to the DScAgric, DScFor and DSc Food Sc degrees.

# Programmes Offered

## **INSTRUCTIONAL PROGRAMMES AND FIELDS OF STUDY**

South Africa constantly needs well-trained experts who can make meaningful contributions to supplying a fast-growing population with food and fibre, to ensuring that food and natural resources remain unpolluted and safe for the consumer, and to managing the environment in a sustainable way in order to ensure its preservation for posterity. The Faculty of Agrisciences plays a central role in this major challenge through its instructional programmes aimed at providing students with the theoretical, technological, practical and generic skills for sustainable food production and food safety. The instructional programmes train students to become experts in one of six industry sectors, namely Crop Production Systems, Animal Production Systems, Food and Wine Production Systems, Agricultural Economics and Management, Conservation Ecology, and Forestry and Natural Resource Sciences.

The student must first select one of six instructional programmes. Each instructional programme may consist of various fields of study from which the student must make a choice. Each field of study consists in turn of a number of specific modules - a module is a predetermined study unit. These fields of study are related, but each on its own forms a specialisation within the training programme as a whole. The combination of major subjects selected for each field of study is determined by the student's chosen field of specialisation. For each of the instructional programmes the modules are grouped in such a way that they contain all the information required to ensure comprehensive training within a particular field of the selected programme.

Basic scientific principles are studied ever more deeply from the first year of the programme, to culminate in the final year of study in the student's two major subjects. This provides the undergraduate student with some specialist training (for a specific career) within the more general training provided by the programme as a whole (for a more general career).

Thanks to the general formative nature of the instructional programme, students who obtain a bachelor's degree are equipped to achieve success in any career relating to agriculture or forestry.

The following scheme sets out the hierarchy of the building blocks from the modules to a degree:

Modules → subjects → field of study → programme (system) → degree

After obtaining the bachelor's degree, the student can proceed with postgraduate study to obtain successively the honours, master's and a doctoral degree in one of the specialisation fields of the instructional programmes.

After obtaining one or more postgraduate qualifications, the graduate is able to enter the labour market as a specialist in his field.

The first year of all study fields (with the exception of the BAgriAdmin degree) is taken in the Faculty of Science and/or Engineering. Different combinations of the modules are required for each study field and/or programme. The specific combinations are given in the different study programmes.

From the second year of study students join their selected study programme in the Faculty of Agrisciences.

In the case of the BAgriAdmin programme, students join the programme in the first year in the Faculty of Agrisciences.

## **CROP PRODUCTION SYSTEMS**

*More information is available on the following web sites:*

<http://www.sun.ac.za/agric/> (Faculty home page)

<http://www.sun.ac.za/agron/> (Department of Agronomy)  
<http://www.sun.ac.za/agric/entomology/> (Department of Conservation Ecology and Entomology)  
<http://www.sun.ac.za/genetics/> (Department of Genetics)  
<http://www.sun.ac.za/horticulture/> (Department of Horticultural Science)  
<http://www.sun.ac.za/plantpath/> (Department of Plant Pathology)  
<http://www.sun.ac.za/agric/soil/> (Department of Soil Science)  
[http://www.sun.ac.za/viti\\_oenol/](http://www.sun.ac.za/viti_oenol/) (Department of Viticulture and Oenology)

### **Bachelor's Programme**

The undergraduate (bachelor's) programme in Crop Production Systems leads to the BScAgric degree. The programme covers training in the production of agricultural crops, pasture crops, vegetable crops, deciduous fruit, citrus and vines. For each crop, various subjects, such as crop production, biochemistry, soil science, agricultural water science, agricultural economics, genetics, entomology, nematology, plant pathology and biometry, are integrated into a meaningful whole. Within this whole, students follow a combination of modules on ecology, development, physiology, production, breeding, nutrition, soil and water management, as well as harmful plant pathogens, insects, nematodes and their control in an environmentally friendly, sustainable and economically acceptable way.

There are three fields of study within the programme, namely Crop Production, Crop Protection and Breeding, and Soil and Water Management. In Crop Production the emphasis falls on the training of crop production managers for, amongst others, agronomy, deciduous fruit, citrus and vines. In Crop Protection and Breeding students are trained to become specialists in crop protection (the control of entomological and nematological pests and plant diseases) and genetic crop improvement. In Soil and Water Management students are trained to become specialists who understand the nature, importance and management of soil and water in crop production.

After successful completion of this programme, the graduate will be able to:

- formulate, analyse, evaluate and solve general terms, concepts, principles, theories and problems relating to relevant topics, singly or in combination, of crop production, crop protection and breeding and soil and water management;
- identify and by critical and creative input solve production and management problems relating to soil or crop matters. Solutions will be scientifically founded and based on theory-driven arguments, enabling decisions to be taken in a responsible manner. In the Crop Production field of study problems of crops (agronomy, horticulture and viticulture) are addressed. In the Crop Protection and Breeding field of study problems dealing with plant health (plant pathological or entomological in nature) or by improved breeding (genetics) are dealt with. In the Soil and Water Management field of study the responsible management of soil and water are addressed;
- effectively liaison, communicate and work together in group association. The programme covers participation with group work, group activities (for example farm planning task in Soil Science and orchard management plan in Horticulture) and evaluation in group association;
- organise and manage, singly or in group association, in a responsible and effective manner;
- learn to independently extract scientific information, to analyse, combine and critically evaluate and to apply same in specialised subjects for example pedology and land evaluation, soilless cultivation of crops, cultivation of deciduous fruit or fynbos, selection of wine cultivars on specific soils and terrains ("terroir"), detection and identification of pest organisms in the vine and fruit industries;
- effectively communicate with peers, supervisors and subordinates by the use of information technology as support for oral or written discussions and presentation of reports and submissions;

- use applicable scientific and statistical methods and evaluations for decision-making in regard to soil, botanical, plant health and plant breeding aspects; and
- understand and appreciate in the chosen field of study the complex and interdisciplinary interactions and have a holistic approach to these and similar fields of study.

The fields of study with both majors are as follows:

Crop Production: Agronomy, Horticulture or Viticulture in combination with Entomology, Plant Pathology, Genetics or Agricultural Economics.

Crop Protection and Breeding: Plant Pathology and Entomology or Genetics.

Soil and Water Management: Soil Science and either Agronomy, Horticulture, Chemistry or Viticulture.

The prescribed modules and elective modules of the various years of study for each field are set out below; the module content is given on pages 58 - 114. For compulsory vacation work in Soil Science and Viticulture and for practical training in Soil Science and Viticulture see pages 115 - 117. The fields of study that include Viticulture as an elective module are currently being revised and, if approved, module changes can be expected from 2010 onwards.

**The undergraduate programme in Crop Production Systems is subdivided into the following fields of study: Crop Production, Crop Protection and Breeding, and Soil and Water Management.**

### **All fields of study**

#### **First Year (124 or 140 credits)**

Biology 124(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Crop Production 152(8)

Mathematics (Bio) 124(16) *or* Mathematics 114(16), 144(16)\*

Physics (Bio) 178(32) *or* Economics 114(12), 144(12) *and* Oenology 142(8)\*\*

*\*Only students doing Water and Soil Management and taking Soil Science and Chemistry as majors must take Mathematics 114 and 144.*

*\*\*Students taking Agricultural Economics must take Economics 114 and 144 and Oenology 142; all other students take Physics (Bio) 178.*

#### **Field of study: Crop Production**

##### **Second Year (144 credits)**

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Crop Protection 244(16)

Crop Production 214(16)

Soil Science 214(16), 244(16)

*and*

Genetics 214(16), 244(16) *or* Agricultural Economics 234(16), 242(8), 262(8)

##### **Third Year (144 credits)**

Biometry 312(8), 342(8)

Soil Science 314(16), 344(16)

*and either*

Agronomy 314(16), 344(16) *or*

Horticulture 314(16), 342(8), 352(8) *or*

Viticulture 314(16), 344(16)

*and two of:*

Agricultural Economics 314(16), 344(16)\* *and/or*

Entomology 314(16), Nematology 344(16)\* *and/or*  
Genetics 314(16), 344(16) *and/or*  
Plant Pathology 314(16), 344(16)

\* *Agricultural Economics 314(16), 344(16) and Entomology 314(16), Nematology 344(16) may not be taken concurrently.*

**Fourth Year (128 credits)**

Agronomy 414(16), 424(16), 444(16), 454(16) *or*  
Horticulture 414(16), 434(16), 444(16), 464(16) *or*  
Viticulture 414(16), 424(16), 444(16), 454(16)

*and*

Agricultural Economics 414(16), 424(16), 444(16), 454(16) *or*  
Entomology 418(32), 454(16), 464(16) *or*  
Genetics 324(16), 354(16), 414(16), 444(16) *or*  
Plant Pathology 414(16), 424(16), 444(16), 454(16)

**Field of study: Crop Protection and Breeding**

**Second Year (144 credits)**

Biochemistry 214(16), 244(16)  
Biometry 212(8), 242(8)  
Crop Protection 244(16)  
Crop Production 214(16)  
Genetics 214(16), 244(16)  
Soil Science 214(16), 244(16)

**Third Year (144 credits)**

Biometry 312(8), 342(8)  
Entomology 314(16)  
Genetics 314(16), 344(16)  
Nematology 344(16)  
Plant Pathology 314(16), 344(16)

*and one of:*

Agronomy 314(16), 344(16) *or*  
Horticulture 314(16), 342(8), 352(8) *or*  
Viticulture 314(16), 344(16)

**Fourth Year (128 credits)**

Plant Pathology 414(16), 424(16), 444(16), 454(16)

*and*

Entomology 418(32), 454(16), 464(16) *or*  
Genetics 324(16), 354(16), 414(16), 444(16)

**Field of study: Water and Soil Management**

**Second Year (144 credits)**

Biochemistry 214(16), 244(16)  
Biometry 212(8), 242(8)  
Chemistry 214(16), 244(16)  
Crop Production 214(16)  
Crop Protection 244(16)  
Soil Science 214(16), 244(16)

**Third Year (128-144 credits)**

Biometry 312(8), 342(8)  
Chemistry 224(16), 254(16)\*  
Plant Pathology 314(16), 344(16)

Soil Science 314(16), 344(16)

and

Agronomy 314(16), 344(16) or

Horticulture 314(16), 342(8), 352(8) or

Viticulture 314(16), 344(16)

\* *Chemistry 254 is only for students who major in Soil Science and Chemistry.*

### **Fourth Year (128 credits)**

Soil Science 414(16), 424(16), 444(16), 454(16)

and

Agronomy 414(16), 424(16), 444(16), 454(16) or

Chemistry 324(16), 334(16), 344(16), 354(16) or

Horticulture 414(16), 434(16), 444(16), 464(16) or

Viticulture 414(16), 424(16), 444(16), 454(16)

### **Postgraduate Programmes**

Postgraduate programmes in Crop Production Systems can be taken after completion of the bachelor's programme. Students can, depending on their previous qualifications, enter a suitable postgraduate programme in one of their majors and obtain one of the following degrees: Bachelor of Science in Agriculture with Honours (BScAgricHons), Master of Science in Agriculture (MScAgric), Doctor of Philosophy in Agriculture [PhD (Agric)] or Doctor of Science in Agriculture (DScAgric).

### **Honours Programme**

#### **Honours programme in Crop Production Systems (BScAgricHons)**

The one-year honours programme in Crop Production Systems leads to the qualification BScAgricHons in either Agronomy, Entomology, Genetics (Plant Breeding), Soil Science, Horticulture, Plant Pathology or Viticulture. (For further study in Agricultural Economics see the relevant honours programme). The programme consists of further specialised study of one of the majors of the BScAgric degree. Supplementary studies may sometimes be required. The modules and study tasks add greater depth of learning, building further on the bachelor's programme, and they have been specifically compiled for each field of study so that specialised training in a specific field of study of Crop Production Systems is ensured. The programme is research- and career-oriented and is based on modern technology and the most recently available research on crop production systems. It links up with research projects carried out in the department concerned.

#### **Agronomy:**

The latest technological developments and scientific progress in agronomy are studied.

Agronomy 711(30): Physiology of annual crops

Agronomy 712(30): Problem identification in agronomical systems and literature review

Agronomy 741(30): Yield improvement in annual crops

Agronomy 742(30): Research planning and technique development in agronomy

*Conditions: Participation and presentations by students are continuously assessed during seminar classes, while a written examination is set for each module in order to obtain a final mark.*

#### **Entomology:**

The programme includes advanced self-study on morphology and systematics, including phylogenetic systematics, biogeography, interactions between insect herbivores and plants, as well as between herbivores and their carnivores; competition; insect conservation; differences between natural and agro-ecosystems and damage assessment; sampling for the monitoring of insect populations; pest management techniques. Emphasis is placed on practical skills. Students may select any three of the five topics listed below.

Entomology 771(40): Morphology and systematics

Entomology 772(40): Ecology

Entomology 773(40): Principles of insect pest management

Entomology 774(40): Biologically intensive insect pest management techniques

Entomology 775(40): Technologically intensive insect pest management techniques

### **Genetics (Plant Breeding):**

There are three divergent fields of application in genetics, viz. human genetics, plant breeding and animal breeding. In this programme, emphasis is placed on plant breeding.

Biometry 711(6): Postgraduate biometry

Genetics 713(10): Genetic data analysis and bio-informatics

Genetics 772(10): Use of computer software in plant breeding

Genetics 773(24): Advanced plant breeding

Genetics 774(40): Plant breeding techniques

Genetics 775(30): Plant breeding literature study

### **Soil Science:**

The programme consists of structured discussion classes, seminars, self-study and the carrying out of the student's own experiment (mini-project) as well as field and laboratory work in Soil Science. Deepening of knowledge takes place in all four speciality fields (presented as separate modules), viz. pedology and soil genesis, soil physics and water management, soil chemistry and fertilisation and soil biology. The task of self-study and execution of an experiment or field/laboratory work within modules are determined in line with the student's academic background and field of interest in consultation with the lecturer concerned.

Soil Science 771(30): Specialised pedology and soil genesis

Soil Science 772(30): Specialised soil physics and water management

Soil Science 773(30): Specialised soil chemistry and fertilisation

Soil Science 774(30): Soil biology

### **Horticulture:**

This self-study programme deals with advanced ecophysiology, plant physiology and postharvest physiology. The content of these study fields is designed to improve the student's knowledge of the interaction between fruit trees and the environment, the intraplant control of the growth and development of fruit trees, and the maintenance of postharvest fruit quality.

Biometry 711(6): Postgraduate biometry

Horticulture 771(30): Research methodology

Horticulture 772(30): Advanced plant physiology

Horticulture 773(14): Laboratory techniques

Horticulture 774(40): Research project

### **Plant Pathology:**

The programme of study consists of the following four modules:

Plant Pathology 771(30): Applied phytopathology

Plant Pathology 772(30): Advanced disease management

Plant Pathology 773(30): Advanced molecular plant pathology

Plant Pathology 774(30): Project management and presentation

### **Viticulture:**

The programme entails formal lectures, as well as seminars, self-study and experimental work in Viticulture. The composition of the modules is based on the student's academic background and field of interest, determined in cooperation with the respective lecturers. The following modules are offered: techniques in viticulture; molecular aspects of key processes in grapevines; principles of *in vitro* cultures of grapevine tissue/organs and applications; advanced grapevine physiology; analysis of spatial patterns. Students are required to perform self-study on the South African wine industry and to perform independent research in Viticulture.

Viticulture 771(40): Training in research methodology

Viticulture 772(35): Advanced techniques in viticulture

Viticulture 773(35): Advanced physiology and molecular aspects of key processes in the grape plant

Viticulture 774(10): Principles of the *in vitro* culture of grapevine tissue/organs and their application

## **Master's Programme**

### **Master's programme in Crop Production Systems (MScAgric)**

The master's programme in Crop Production Systems leads to the MScAgric degree in the fields of Agronomy, Entomology, Genetics (Plant Breeding), Soil Science, Horticulture, Plant Pathology or Viticulture. The programme consists of a one-year MScAgric if the student already holds a suitable honours degree, or else a two-year MScAgric. In the latter case the student must follow the research component of the programme and the prescribed modules for the relevant honours programme (see above). If the student already has a BScAgricHons, the programme consists of only a research component. The programme is as follows:

#### **Agronomy:**

Agronomy 878(120): Master's thesis

Research on a particular aspect of tillage, weed control, crop production, stress physiology, vegetable production or pasture management is undertaken.

#### **Entomology:**

Entomology 878(120): Master's thesis

Topics for the master's degree are determined in consultation between the prospective student and the lecturer concerned. Fields from which topics can be selected include morphology and systematics, insect conservation ecology and integrated pest management of insects.

#### **Genetics (Plant Breeding):**

Genetics 878(120): Master's thesis

Research projects cover different aspects of plant breeding such as: biometrical applications in data analysis; genotype-environment interactions; the application or modification of conventional plant breeding methodology; application of cytogenetic procedures in genetic analysis; biochemical and molecular markers for the location, mapping and tagging of useful genes; genotyping and marker-assisted selection; transfer of genes from wild related species to cultivated cereals employing wide crossings and cytogenetic manipulations or direct gene transfer by means of genetic engineering.

#### **Soil Science:**

Soil Science 878(120): Master's thesis

Topics for the research project are selected from one of the following specialisation fields: Soil genesis and classification; weathering and clay mineral synthesis; plant nutrition and fertilisation; irrigation and soil-plant-water management including salinity control and management; resource (soil, land and water evaluation and management systems such as, amongst others, erosion control); rhizosphere and pedosphere organisms and interactions.

The project may consist of either soil science only or soil science integrated with a crop (plant), climate and/or terrain study. The student is guided towards project planning for problem-solving by research within general guidelines and an overall picture of sustainable resource use through environmentally friendly, economical soil, water and plant management. The student must show that he has the ability to deal analytically and systematically with problems relating to the soil-, plant-, water- and atmosphere-continuum, and to identify possible solutions and formulate guidelines for the environmentally friendly management of natural resources.

**Horticulture:**

Horticulture 878(120): Master's thesis

A research topic may be chosen from the following themes: Growth and development strategies for deciduous fruit, citrus and fynbos plants that limit production and/or quality such as fruit set, fruit size, colour development, tree architecture and light interception, flower initiation, dormancy and stress conditions, for example sun scorch in fruit, post-harvest physiology including controlled atmospheric storage requirements for deciduous fruit, citrus and cut flowers, physiological abnormalities such as gel decline in plums, surface scorch marks on apples, blackening of protea foliage.

**Plant Pathology:**

Plant Pathology 878(120): Master's thesis

Research projects can be selected from one of the following themes: Fungal taxonomy (description and reclassification of known and new fungi by the application of various methods, such as molecular technology); applied molecular plant pathology, including the use of molecular-based techniques for the detection, diagnosis and characterisation of plant pathogenic populations of vines, deciduous fruit, citrus and agronomic crops; pre- and postharvest pathology in deciduous fruit, vines and citrus (status and behaviour of inocula on fruit surfaces, infection processes and plant resistance reactions); stem diseases in vines (etiology, diagnosis, epidemiology and integrated management); use of fungicides (spray technology) and fungal resistance (sensitivity in wild populations and disruption after fungicide exposure, management of fungicide resistance in fruit orchards, vine yards and agronomic crops: integrated management (chemical, biological and alternative compounds) of diseases in deciduous fruit, vines, citrus and agronomic crops. New or existing disease epidemics of economic importance are also researched.

**Viticulture:**

Viticulture 878(120): Master's thesis

Research projects may be chosen from the following themes: The influence of stress on grapevine physiology; terroir studies; grapevine environment interactions; remote sensing; morphological and anatomical studies; plant improvement; the influence of various factors on the time of ripening and quality of table grapes. Newly identified and prioritised projects of importance to the industry are also investigated.

**Doctoral Programmes****PhD programme in Crop Production Systems [PhD (Agric)]**

Agronomy 978(240): Doctoral dissertation

Entomology 978(240): Doctoral dissertation

Genetics 978(240): Doctoral dissertation

Soil Science 978(240): Doctoral dissertation

Horticulture 978(240): Doctoral dissertation

Plant Pathology 978(240): Doctoral dissertation

Viticulture 978(240): Doctoral dissertation

This programme leads to the PhD (Agric) degree in Agronomy, Entomology, Genetics (Plant Breeding), Soil Science, Horticulture, Plant Pathology or Viticulture. A dissertation containing original research is required. The programme focuses on research in various specialisation fields of Crop Production Systems and trains students to become subject specialists in these fields.

A relevant and practically oriented research project must be carried out in one of these fields, leading to innovation or problem solving through high-level research in the discipline and in the industry concerned. This equips the student on the highest academic level with the knowledge and expertise he needs for entering the research industry or some other professional field. They thus become professionals who, either as a team member or individually, can play a meaningful role in national or international research, teaching and

policy making in specialist fields concerned with sustainable and environmentally friendly food production and food safety.

### **DSc programme in Crop Production Systems (DScAgric)**

Agronomy 998(240): DSc research collection  
 Entomology 998(240): DSc research collection  
 Genetics 998(240): DSc research collection  
 Soil Science 998(240): DSc research collection  
 Horticulture 998(240): DSc research collection  
 Plant Pathology 998(240): DSc research collection  
 Viticulture 998(240): DSc research collection

The degree DScAgric is awarded to candidates who have held either the PhD (Agric) degree from this University or some other equivalent (in the opinion of the Senate) qualification for at least five years, or who have held the MScAgric degree of this University or some other adequate (in the opinion of the Senate) qualification for at least seven years, have produced advanced original research and/or creative work in the Agricultural Sciences, and have submitted original and previously published work(s) of a high standard that show(s) that the candidate has made a real and high-quality contribution to the enrichment of the knowledge of an agricultural discipline.

### **FOOD AND WINE PRODUCTION SYSTEMS**

*More information is available on the following web sites:*

<http://www.sun.ac.za/foodsci/> (Department of Food Science)

[http://www.sun.ac.za/viti\\_oenol/](http://www.sun.ac.za/viti_oenol/) (Department of Viticulture and Oenology)

[http://www.sun.ac.za/wine\\_biotechnology/](http://www.sun.ac.za/wine_biotechnology/) (Institute for Wine Biotechnology)

### **Bachelor's Programme**

The undergraduate (bachelor's) programme in Food and Wine Production Systems leads to one of the following qualifications: BScAgric or BSc Food Sc. In this programme students may concentrate on Food Production Systems or on Wine Production Systems.

Food Production Systems covers the integration of knowledge on the manipulation of interactions between food ingredients and the food environment, the development of new products, the investigation of food structures, sensory and nutritional properties, the post-harvest handling and preservation of food in a user-friendly and economically acceptable manner, as well as the commercialisation of traditional food products for prospective entrepreneurs in low-income communities. Students in these fields are prepared for a career as consultant, entrepreneur, manager, product developer, quality assurance and production manager, technical food marketer and specialists in food- and wine-related industries.

Wine Production Systems covers the vine and its organs and integrates this knowledge in the scientific manipulation of the plant for the creation, in harmony with the environment, of sustainable product types which can be used to produce unique wines. Furthermore, it deals with the integration of a thorough understanding of the chemical and biological processes involved in the making of wine and brandy products in order to ensure the sustainability of the natural resources. Students in this field are prepared for a career in the wine industry.

The fields of study of the programme Food and Wine Production Systems are:

Food Science with Chemistry  
 Food Science with Biochemistry  
 Viticulture and Oenology General  
 Oenology Specialised

On successful completion of the programme the graduate will be able to:

- understand the terms, concepts, principles and theories within the fields of oenology, viticulture or food science;

- identify and solve unfamiliar production and management problems within the fields of oenology, viticulture or food science using evidence-based solutions and theory-driven arguments, indicating that responsible decisions can be made using critical and creative thinking;
- interact effectively with others in a group after regular exposure to group work and evaluation of these group activities;
- organise and manage himself and his group activities responsibly and effectively by meeting regular deadlines for projects, reports and tests with success;
- retrieve, analyse, compile and critically evaluate scientific information, learn independently and apply this information to better understand specialist areas within the fields of oenology, viticulture or food science;
- communicate information coherently using visual, mathematical, language and information technology skills as developed through oral and written exams, seminars and exposure to the food and beverage industry during compulsory holiday work;
- apply scientific methodology, procedures, operations and techniques, including the use of experimental controls and relevant statistical methods and evaluation effectively in the fields of oenology, viticulture or food science, showing responsibility towards the environment; and
- comprehend the complex nature and interdisciplinary relationships of the applied fields of oenology, viticulture or food science after the scientific development/preparation of a food or beverage product and, therefore, develop a holistic view of the study field.

The modules of the various years of study for each field are set out below; the module content is given on pages 58 - 114. For compulsory industry training in Food Science, Viticulture and Oenology, see pages 115 - 117. The fields of study that include Viticulture and Oenology as modules are currently being revised and module changes, if approved, can be expected from 2010 onwards.

**The Undergraduate Programme in Food and Wine Production Systems is subdivided in the following fields of study: Food Science with Biochemistry, Food Science with Chemistry, Viticulture and Oenology General and Oenology Specialised.**

### **Field of study: Food Science with Biochemistry**

#### **First Year (132 credits)**

Biology 124(16), 154(16)

*and one of*

Biology 144(16) *or* Food Science 144(16)\*

*and*

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Mathematics (Bio) 124(16)

Physics (Bio) 178(32)

*\*Recommended choice*

#### **Second Year (128 credits)**

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Food Science 214(16), 244(16)

Marketing Management 214(16)

Microbiology 214(16), 244(16)

#### **Third Year (128 credits)**

Biochemistry 314(16), 344(16)

Food Science 314(16), 324(16), 334(16), 344(16), 354(16)

Microbiology 354(16)

**Fourth Year (144 credits)**

Food Factory Machinery 414(16), 444(16)

Food Science 434(16), 454(16), 478(48), 488(32)

**Field of study: Food Science with Chemistry****First Year (132 credits)**

Biology 124(16), 154(16)

*and one of*Biology 144(16) *or* Food Science 144(16)\**and*

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Mathematics (Bio) 124(16)

Physics (Bio) 178(32)

*\*Recommended choice***Second Year (128 credits)**

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Chemistry 214(16), 224(16), 244(16)

Food Science 214(16), 244(16)

**Third Year (128 credits)**

Chemistry 334(16), 344(16)

Food Science 314(16), 324(16), 334(16), 344(16), 354(16)

Microbiology 214(16)

**Fourth Year (144 credits)**

Food Factory Machinery 414(16)

Food Science 434(16), 454(16), 478(48), 488(32)

Microbiology 354(16)

**Field of study: Viticulture and Oenology General****First Year (132 credits)**

Biology 124(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Crop Production 152(8)

Mathematics (Bio) 124(16)

Oenology 142(8)

Physics (Bio) 178(32)

**Second Year (144 credits)**

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Crop Production 214(16)

Crop Protection 244(16)

Microbiology 214(16)

Oenology 244(16)

Soil Science 214(16), 244(16)

**Third Year (144 credits)**

Biometry 312(8), 342(8)

Oenology 314(16), 344(16)

Viticulture 314(16), 344(16)

*and (with consideration of prerequisites) four of the following six modules:*

Entomology 314(16)

Nematology 344(16)

Plant Pathology 314(16), 344(16)

Soil Science 314(16), 344(16)

### **Fourth Year (128 credits)**

Oenology 414(16), 424(16), 444(16), 454(16)

Viticulture 414(16), 424(16), 444(16), 454(16)

### **Field of study: Oenology Specialised**

#### **First Year (132 credits)**

Biology 124(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Crop Production 152(8)

Mathematics (Bio) 124(16)

Oenology 142(8)

Physics (Bio) 178(32)

#### **Second Year (144 credits)**

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Chemistry 214(16), 244(16)

Crop Production 214(16)

Crop Protection 244(16)

Microbiology 214(16)

Oenology 244(16)

#### **Third Year (144 credits)**

Biometry 312(8), 342(8)

Chemistry 334(16), 344(16)

Oenology 314(16), 344(16)

Viticulture 314(16), 344(16)

*and either*

Entomology 314(16) *and* Nematology 344(16) *or*

Plant Pathology 314(16), 344(16)

#### **Fourth Year (128 credits)**

Oenology 414(16), 424(16), 444(16), 454(16)

Viticulture 414(16), 424(16), 444(16), 454(16)

### **Postgraduate Programmes**

Postgraduate programmes in Food and Wine Production Systems follow the bachelor's programme. Students can, depending on their existing qualifications, join an appropriate postgraduate programme in one of their majors to obtain one of the following degrees: Bachelor of Science in Agriculture with Honours, Bachelor of Science in Food Science with Honours, Master of Science in Agriculture, Master of Science in Food Science, Doctor of Philosophy (Agriculture), Doctor of Philosophy (Food Science), Doctor of Science in Agriculture and Doctor of Science in Food Science.

### **Honours Programme**

#### **Honours programme in Food and Wine Production Systems (BScAgricHons, BSc Food ScHons)**

The honours programmes in Food and Wine Production Systems lead to one of the following qualifications: BScAgricHons (Wine Biotechnology), BScAgricHons (Viticulture

and Oenology), or BSc Food ScHons. The honours programme extends over one year and consists of further study of one of the majors for the degree BScAgric or BSc Food Sc; supplementary study is sometimes required. The modules and study assignments add depth to the study and form a continuation of the bachelor's programme. The modules are compiled for each field of study to ensure specialised training in a specific field of study of Food and Wine Production Systems. The programme is research- and career-oriented and is based on modern technology and the most recently available research in the field of Food and Wine Production Systems. It links up with research projects undertaken in the departments concerned.

### **Food Science:**

The study programme consists of advanced study of various aspects of food science, applicable laboratory techniques and sensory science.

Food Science 771(40): Advanced study of food science

Food Science 772(15): Advanced laboratory techniques

Food Science 773(60): Training in research methodology

Food Science 774(5): Sensory science

### **Oenology:**

The programme entails formal lectures, as well as seminars, self-study and experimental work in Oenology. The formal lectures are presented as modules, which include the following: Terroir and its implications for grapevine cultivation; genetic properties and improvement of wine yeasts; advanced alcoholic fermentation; wine evaluation; wine aroma; advanced malolactic fermentation; enzymes in wine preparation; role of phenols in grapes/wine; environmental management. Students are required to perform self-study on the South African wine industry and to perform independent research in oenology.

Oenology 771(40): Training in research methodology

Oenology 772(10): Techniques for advanced oenological analyses

Oenology 773(35): Microbes and their impact on wine quality

Oenology 774(30): Wine chemistry

Oenology 745(5): Environmental management

### **Viticulture:**

The programme entails formal lectures, as well as seminars, self-study and experimental work in Viticulture. The formal lectures are presented as modules. The composition of the modules is based on the students' academic background and field of interest, determined in cooperation with the respective lecturers. The following modules are offered: techniques in viticulture; molecular aspects of key-processes in grapevines; principles of *in vitro* cultures of grapevine tissue/organs and applications; advanced grapevine physiology; analysis of spatial patterns. Students are required to perform self-study on the South African wine industry and to perform independent research in viticulture.

Viticulture 771(40): Training in research methodology

Viticulture 772(35): Advanced techniques in viticulture

Viticulture 773(35): Advanced physiology and molecular aspects of key processes in the grape plant

Viticulture 774(10): Principles of the *in vitro* culture of grapevine tissue/organs and their application

### **Wine Biotechnology:**

The programme comprises formal lectures, as well as seminars, self-study and experimental work in Wine Biotechnology. Admission requirements are a suitable degree (e.g. BSc, BScAgric, BEng) with any applicable discipline as a major. The following topics are covered: Genetic properties and improvement of wine yeasts; grape-based beverages; alcoholic fermentation; chemical compounds of grapes and wine; techniques in wine and grapevine biotechnology; malolactic fermentation and microbial spoilage; enzymes in

preparation of wine; grapevine structure and functions; as well as grapevine improvement with the aid of biotechnology. Students are required to carry out self-study on the South African wine industry as well as independent research in grapevine and wine biotechnology.

Wine Biotechnology 714(5): Chemical components of grapes and wine

Wine Biotechnology 771(40): Research methodology for grapevine and wine biotechnology

Wine Biotechnology 772(25): Techniques in grapevine and wine biotechnology

Wine Biotechnology 773(30): Biotechnology of wine related microbes

Wine Biotechnology 774(20): Vine structure and functioning and grapevine improvement

## **Master's Programme**

### **Master's programme in Food and Wine Production Systems (MScAgric, MSc Food Sc, MSc)**

The master's programmes in Food and Wine Production Systems leads to one of the following qualifications: MScAgric (Oenology), MScAgric (Viticulture), MSc (Wine Biotechnology), MScAgric (Wine Biotechnology) or MSc Food Sc. The programme entails one year of master's studies, or two years of master's studies if the student holds an applicable BScAgric degree. In the latter case the student must follow the research component of the programme and the prescribed modules for the particular honours programme (see above). Where the BScAgricHons or BSc Food ScHons is held, the programme consists only of a research component. The syllabus for the MSc Food Sc, MSc Agric or MSc is as follows:

#### **Food Science:**

Food Science 878(120): Master's thesis

Research on an appropriate subject within one of the following departmental research programmes: Food processing, food fermentation, food environment management, food molecular biology, near-infrared spectroscopy and the systematics of bacteria formation by propionic acid.

#### **Oenology:**

Oenology 878(120): Master's thesis

Research projects can be chosen from the following themes: Wine authentication techniques; factors affecting ethanol production; the use of enzymes for wine; the effect of micro- and macro-oxygenation on wine composition and quality; factors affecting stuck fermentations; biogenic amines; malolactic fermentation; yeast evaluation; products and techniques to improve wine style and quality. Newly identified and prioritised projects of importance to the industry are also investigated.

#### **Viticulture:**

Viticulture 878(120): Master's thesis

Research projects may be chosen from the following themes: the influence of stress on grapevine physiology; terroir studies; grapevine-environment interactions; remote sensing; morphological and anatomical studies; plant improvement; the influence of various factors on the time of ripening and quality of table grapes. Newly identified and prioritised projects of importance to the industry are also investigated.

#### **Wine Biotechnology:**

Wine Biotechnology 878(120): Master's thesis

Research projects can be selected from the following topics: the selection and genetic improvement of wine yeasts and bacteria for the improvement of wine fermentation and processing, and for the improvement of the quality and sensory properties of wine and other grape-based beverages; the metabolic reprogramming of yeasts; the role of transcription

factors and signal transduction in cell differentiation; genetic improvement of wine grape cultivars with regard to disease and stress resistance.

## **Doctoral Programmes**

### **PhD programme in Food and Wine Production Systems [PhD (Agric), PhD (Food Sc), PhD]**

Food Science 978(240): Doctoral dissertation

Oenology 978(240): Doctoral dissertation

Viticulture 978(240): Doctoral dissertation

Wine Biotechnology 978(240): Doctoral dissertation

This programme lead to one of the following qualifications: PhD (Agric) (fields: Oenology, Viticulture or Wine Biotechnology), PhD (Wine Biotechnology) or PhD (Food Sc). A dissertation containing original research in one of these fields is required. The programmes focus strongly on research in various specialist fields of Food and Wine Production Systems and they train students to become subject specialists in the fields of food science, oenology, viticulture, grapevine biotechnology and wine biotechnology.

For each field of study a relevant and practically oriented research project is chosen which puts the student in contact with the industry, leading to problem solving in the industry concerned, and also prepares the student to enter the research or professional market. They thus become professionals who can play, either as a team member or individually, a meaningful role in national or international research, teaching and policy making in specialist fields concerned with sustainable and environmentally friendly food production and food safety.

### **DSc programme in Food and Wine Production Systems (DScAgric, DSc Food Sc)**

Food Science 998(240): DSc research collection

Oenology 998(240): DSc research collection

Viticulture 998(240): DSc research collection

Wine Biotechnology 998(240): DSc research collection

The degree DScAgric or DSc Food Sc is awarded to candidates who have held the PhD, PhD (Agric) or PhD (Food Sc) degree of this University, or some other equivalent (in the opinion of the Senate) qualification for at least five years, or who have held the MSc, MScAgric or MSc Food Sc degree of this University, or some other adequate (in the opinion of the Senate) qualification for at least seven years, and who have produced advanced original research and/or creative work in Food Science or the Agricultural Sciences, have submitted original and previously published scientific paper(s) of a high standard which indicate(s) that the candidate has made a real and high-quality contribution to the enrichment of the knowledge in Food Science or the Agricultural Sciences and, if required by the examiners, has taken an oral examination to the satisfaction of the University.

## **ANIMAL PRODUCTION SYSTEMS**

*More information is available on the following web site:*

[http://www.sun.ac.za/agric/animal\\_science/](http://www.sun.ac.za/agric/animal_science/) (Department of Animal Sciences)

### **Bachelor's Programme**

The undergraduate (bachelor's) programme leads to the BScAgric degree. The programme covers the integration of knowledge of ecology, biochemistry, physiology, nutrition, breeding, production and product quality, as well as the management of animal production systems for increased production and production efficiency in an environmentally friendly and economically efficient manner.

After the successful completion of this programme, the graduate will be capable of:

- knowing and understanding terminology, concepts, theory and principles of animal physiology, animal breeding and nutrition;
- being aware of and understanding that the different disciplines describe different dimensions of a complex animal production system as well as their interaction with one another;
- applying analytical and practical skills in the extensive and intensive animal industry, laboratories, in the field and by computer;
- identifying, analysing and proposing solutions to industry-related problems in an independent manner;
- making responsible decisions using critical and creative thoughts processes;
- functioning in a multidisciplinary environment;
- registering as a candidate Natural Scientist, qualified as an animal scientist, with the South African Council of Natural Scientists;
- demonstrating a positive attitude, not only towards the animal industry, but also towards the broader community by means of continuous service and professional development; and
- studying towards obtaining postgraduate qualifications at numerous national and international bodies.

The Animal Production Systems programme makes provision for the following fields of study (with majors in brackets):

Animal Sciences (Animal Science)

Animal Sciences with Agronomy (Animal Science)

Animal Sciences with Conservation Ecology (Animal Science)

Agricultural Economics with Animal Sciences (Agricultural Economics)

Aquaculture and Conservation Ecology (Aquaculture and Conservation Ecology)

Aquaculture (Aquaculture)

The modules of the various years of study for each field are set out below; the module content is given on pages 58 - 114. For compulsory vacation work and practical training see pages 115 - 117.

**The Undergraduate Programme in Animal Production Systems is subdivided in the following fields of study: Animal Sciences, Animal Sciences with Agronomy, Animal Sciences with Conservation Ecology, Agricultural Economics with Animal Sciences, Aquaculture, and Aquaculture and Conservation Ecology.**

**Field of study: Animal Sciences**

**First Year (132 credits)**

Animal Science 144(16)

Biology 124(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Mathematics (Bio) 124(16)

Physics (Bio) 178(32)

**Second Year (144 credits)**

Animal Science 244(16)

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Genetics 214(16), 244(16)

Microbiology 214(16)

Physiology and Animal Physiology 214(16)

Physiology and Animal Physiology 244(16) *or* Microbiology 244(16)

**Third Year (136 credits)**

Animal Husbandry 334(16)  
Animal Nutrition Science 324(16), 344(16)  
Animal Products Science 352(8)  
Animal Physiology 324(16), 344(16)  
Biometry 312(8), 342(8)  
Genetics 324(16), 354(16)

**Fourth Year (128 credits)**

Animal Breeding Science 424(16), 454(16)  
Animal Husbandry 434(16), 464(16)  
Animal Nutrition Science 414(16), 444(16)  
Animal Products Science 334(16), 462(8)  
Animal Science 442(8)

**Field of study: Animal Sciences with Agronomy****First Year (132 credits)**

Animal Science 144(16) *or* Biology 144(16)  
Biology 124(16), 154(16)  
Chemistry 114(16), 154(16)  
Computer Literacy 171(4)  
Mathematics (Bio) 124(16)  
Physics (Bio) 178(32)

**Second Year (144 credits)**

Animal Science 244(16)  
Biochemistry 214(16), 244(16)  
Biometry 212(8), 242(8)  
Crop Production 214(16)  
Genetics 214(16), 244(16)  
Physiology and Animal Physiology 214(16), 244(16)

**Third Year (136 credits)**

Agronomy 314(16)  
Animal Nutrition Science 324(16), 344(16)  
Animal Physiology 324(16), 344(16)  
Animal Products Science 352(8)  
Biometry 312(8), 342(8)  
Genetics 324(16), 354(16)

**Fourth Year (136 credits)**

Agronomy 424(16), 454(16)  
Animal Breeding Science 424(16), 454(16)  
Animal Nutrition Science 414(16), 444(16)  
Animal Husbandry 464(16)  
Animal Products Science 334(16)  
Animal Science 442(8)

**Field of study: Animal Sciences with Conservation Ecology****First Year (132 credits)**

Biology 124(16), 144(16), 154(16)  
Chemistry 114(16), 154(16)  
Computer Literacy 171(4)  
Mathematics (Bio) 124(16)  
Physics (Bio) 178(32)

**Second Year (144 credits)**

Animal Science 244(16)  
Biochemistry 214(16), 244(16)  
Biometry 212(8), 242(8)  
Genetics 214(16), 244(16)  
Physiology and Animal Physiology 214(16), 244(16)  
Botany and Zoology 214(16)

**Third Year (144 credits)**

Animal Nutrition Science 324(16), 344(16)  
Animal Physiology 324(16), 344(16)  
Biometry 312(8), 342(8)  
Conservation Ecology 314(16), 344(16)  
Genetics 324(16), 354(16)

**Fourth Year (136 or 144 credits)**

Animal Breeding Science 424(16), 454(16)  
Animal Nutrition Science 414(16), 444(16)  
Animal Products Science 334(16)  
Biodiversity and Ecology 344(16)  
*and*  
Conservation Ecology 448(32) *or*  
Animal Husbandry 464(16) *and* Animal Science 442(8)

*and*

Agronomy 424(16) *or*  
Conservation Ecology 414(16)

**Field of study: Agricultural Economics with Animal Sciences**

**First Year (124 credits)**

Animal Science 144(16)  
Biology 124(16), 154(16)  
Chemistry 114(16), 154(16)  
Computer Literacy 171(4)  
Economics 114(12), 144(12)  
Mathematics (Bio) 124(16)

**Second Year (128 credits)**

Agricultural Economics 234(16), 242(8), 262(8)  
Animal Science 244(16)  
Biochemistry 214(16), 244(16)  
Biometry 212(8), 242(8)  
Physiology and Animal Physiology 214(16), 244(16)

**Third Year (120 credits)**

Agricultural Economics 314(16), 344(16)  
Animal Husbandry 334(16)  
Animal Nutrition Science 324(16), 344(16)  
Animal Products Science 352(8)  
Animal Physiology 324(16), 344(16)

**Fourth Year (120 or 128 credits)**

Agricultural Economics 414(16), 424(16), 444(16), 454(16)  
Animal Nutrition Science 414(16), 444(16)

*and two of*

Animal Husbandry 434(16) *and/or* 464(16) *and/or* Animal Products Science 462(8)

**Field of study: Aquaculture****First Year (132 credits)**

Biology 124(16), 144(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Mathematics (Bio) 124(16)

Physics (Bio) 178(32)

**Second Year (128 credits)**

Animal Science 244(16)

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Genetics 214(16), 244(16)

Physiology and Animal Physiology 214(16), 244(16)

**Third Year (128 credits)**

Animal Physiology 324(16), 344(16)

Animal Nutrition Science 344(16)

Aquaculture 314(16), 344(16)

Biometry 312(8), 342(8)

Genetics 324(16), 354(16)

**Fourth Year (128 credits)**

Animal Breeding Science 424(16)

Animal Nutrition Science 444(16)

Aquaculture 414(16), 444(16), 478(32)

Conservation Ecology 424(16)

Food Science 434(16)

**Field of study: Aquaculture and Conservation Ecology****First Year (124 credits)**

Biology 124(16), 144(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)

Economics 114(12), 144(12)

Mathematics (Bio) 124(16)

**Second Year (128 credits)**

Agricultural Economics 262(8)

Biochemistry 214(16), 244(16)

Biometry 212(8), 242(8)

Conservation Ecology 212(8)

Genetics 214(16), 244(16)

Physiology and Animal Physiology 214(16), 244(16)

**Third Year (128 credits)**

Animal Physiology 324(16), 344(16)

Aquaculture 314(16), 344(16)

Biodiversity and Ecology 344(16)

Conservation Ecology 314(16), 344(16)

Food Science 214(16)

**Fourth Year (128 credits)**

Agricultural Economics 444(16)

Aquaculture 414(16), 444(16)

Conservation Ecology 414(16), 424(16)

Genetics 324(16)

and one of

Aquaculture 478(32) or Conservation Ecology 448(32)

### **Postgraduate Programmes**

Postgraduate programmes can be taken after completion of the Bachelor's programme. Students can, depending on their existing qualifications, join a suitable postgraduate programme in one of their major subjects to obtain one of the following qualifications: Bachelor of Science in Agriculture with Honours, Master of Science in Conservation Ecology, Master of Philosophy (Livestock Industry Management), Master of Philosophy (Assisted Reproduction), Master of Science in Agriculture, Doctor of Philosophy in Agriculture or Doctor of Science in Agriculture.

### **Honours Programme**

The honours programme in Animal Production Systems is presented over one year and leads to the qualification BScAgricHons (Aquaculture) or BScAgricHons (Animal Science). For further studies in Agronomy, Conservation Ecology and/or Agricultural Economics see the relevant honours programmes.

After the successful completion of the programme the graduate will be able to:

- analyse, consequent to the bachelor's programme, more complex problem situations and create and/or make suggestions towards increasingly sophisticated stock farming or intensive animal production systems;
- combine integrated knowledge in the fields of specialisation animal breeding, animal nutrition, animal physiology and animal products to enable problem-solving;
- plan, execute, analyse data and report in a scientific manner research projects;
- generate new knowledge using fundamental animal husbandry and scientific principles; and
- obtain further postgraduate qualifications at various national and international institutions.

### **Animal Science:**

The Animal Science programme focuses on specialisation in one of the following study fields: animal nutrition, animal breeding, animal physiology or animal product science. Various modules are presented in each study field.

Animal Science 711(24): Fundamental ruminant nutrition

Animal Science 712(24): Fundamental monogastric nutrition

Animal Science 713(24): Fundamental animal breeding

Animal Science 714(24): General animal physiology

Animal Science 715(24): Reproductive physiology

Animal Science 716(24): Abattoir practices

Animal Science 741(24): Applied large-stock nutrition

Animal Science 742(24): Applied small-stock nutrition

Animal Science 743(24): Applied monogastric nutrition

Animal Science 744(24): Operational system for monogastric animals

Animal Science 745(24): Applied animal breeding

Animal Science 746(24): Statistical procedures in animal breeding

Animal Science 747(24): Digestive physiology

Animal Science 748(24): Assisted reproductive techniques

Animal Science 751(24): Quality characteristics of meat

Animal Science 752(24): Value adding to meat

Animal Science 771(18): Postgraduate seminar

Biometry 711(6): Postgraduate biometry

*Stipulation: Animal Science 771 and Biometry 711 are compulsory. Besides the prescribed modules, the student can choose one of the following groups of Animal Science elective*

modules: (711 and 741 and 742 and 712) OR (712 and 743 and 744 and 711) OR (713 and 745 and 746 and one of 711, 712, 714, 715 or 716) OR (714 and 747 and 715 and 748) OR (716 and 751 and 752 and one of 711, 712, 713, 714 or 715).

### **Aquaculture:**

The honours programme in Aquaculture comprises three compulsory modules and various possible elective combinations with Animal Science and/or Conservation Ecology.

Aquaculture 771(36): Aquaculture management practice

Aquaculture 772(30): Aquaculture research practice

Biometry 711(6): Postgraduate biometry

*Stipulation: The student must select a minimum of an additional 48 credits on NQF level 7 or higher from either Animal Science or Conservation Ecology. The selection is subject to approval by the Chair, Department of Genetics.*

### **Master's Programmes**

#### **Master's programme in Livestock Industry Management [MPhil (Livestock Industry Management)] - Animal Science**

*From 2009 until further notice the programme MPhil (Livestock Industry Management) - Animal Science will not be offered.*

Animal Science 711(24): Fundamental ruminant nutrition

Animal Science 712(24): Fundamental monogastric nutrition

Animal Science 713(24): Fundamental animal breeding

Animal Science 714(24): General animal physiology

Animal Science 715(24): Reproductive physiology

Animal Science 716(24): Abattoir practices

Animal Science 741(24): Applied large-stock nutrition

Animal Science 742(24): Applied small-stock nutrition

Animal Science 743(24): Applied monogastric nutrition

Animal Science 744(24): Operational system for monogastric animals

Animal Science 745(24): Applied animal breeding

Animal Science 746(24): Statistical procedures in animal breeding

Animal Science 747(24): Digestive physiology

Animal Science 748(24): Assisted reproductive techniques

Animal Science 751(24): Quality characteristics of meat

Animal Science 752(24): Value adding to meat

#### **Master's programme in Livestock Industry Management [MPhil (Livestock Industry Management)] - Aquaculture**

Aquaculture 711(24): Aquaculture production and management systems I

Aquaculture 712(24): Aquaculture products

Aquaculture 741(24): Aquaculture production and management systems II

Aquaculture 742(24): Aquaculture ecology

Aquaculture 743(24): Aquaculture nutrition

Animal Science 811(24): Research competency

Livestock Industry Management 877(96): MPhil assignment

*Stipulation: Animal Science 811 and Livestock Industry Management 877 are compulsory. Apart from the compulsory modules the student must follow five more modules from the above, chosen in consultation with the supervisor and approved by the Chair, Department of Animal Sciences.*

The master's programme in Livestock Industry Management leads to the MPhil degree. The minimum admission requirement is a three-year bachelor's degree in the biological sciences. The aim of the programme is to provide students with the necessary more advanced knowledge and understanding of the science and practice of animal production

systems, and to teach them the appropriate methodology for the respective fields of interest. Special emphasis is placed on the development of management skills.

This programme is also presented by interactive telematic education. For further information, contact (021) 808 3934.

### **Master's Programme in Assisted Reproduction [MPhil (Assisted Reproduction)]**

*From 2007 until further notice this programme will not be offered.*

Assisted Reproduction 721(10): Reproductive physiology

Assisted Reproduction 722(10): Body control mechanisms

Assisted Reproduction 723(10): Laboratory and laboratory animal management

Assisted Reproduction 733(10): Spermology

Assisted Reproduction 871(40): *In vivo* embryo production

Assisted Reproduction 872(40): *In vitro* embryo production

Assisted Reproduction 773(60): Postgraduate seminar series

Assisted Reproduction 876(60): MPhil report

*Stipulation: The MPhil report consists of a research project which is to be completed, written up and submitted during the two-year period as a publishable research article.*

The minimum admission requirement is a three-year bachelor's degree with Animal Physiology/Physiology as a major. Supplementary work may be required. The programme's duration is two years.

### **Master's Programme in Animal Production Systems [MScAgric (Animal Science) or MScAgric (Aquaculture)]**

Animal Science 878(120): Master's thesis

Aquaculture 878(120): Master's thesis

The master's programme in Animal Production Systems leads to the qualification MScAgric degree (field: Animal Science or field: Aquaculture). The programme consist of a one-year MScAgric if the student already holds a suitable honours degree, or a two-year MScAgric if the student holds a BScAgric degree. In the latter case the student must follow the research component of the programme and the prescribed modules for the particular honours programme (see above). Where the BScAgricHons degree is already held, the programme consists only of a research component. Research in the following fields is possible: increasing the efficiency of animal product production, improving the quality of animal products in the ruminant, small-animal and poultry industries and intensive and extensive aquaculture systems, nutrition and breeding.

### **Doctoral Programmes**

#### **PhD programme in Animal Production Science [PhD (Agric)]**

Animal Science 978(240): Doctoral dissertation

This programme in Animal Production Systems leads to the qualification PhD (Agric) (field: Animal Sciences). The programme focuses strongly on research and aims to discover new insights and knowledge in the field of Animal Production Systems. This knowledge increases general intellectual and professional skills and promotes the adaptability of the student to carry out advanced research in a specific field of study that links up with other fields of study. Students thus become professionals who can, either as a member of a team or individually, play a meaningful role in national and international research, teaching and policy making in respect of animal production systems.

#### **DSc programme in Animal Production Systems [DScAgric]**

Animal Science 998(240): DSc research collection

The degree DScAgric is awarded to candidates who have held the PhD (Agric) degree of this University, or some other equivalent (in the opinion of the Senate) qualification for at least five years, or who have held the MScAgric degree of this University, or some other

adequate (in the opinion of the Senate) qualification for at least seven years, and who have produced advanced original research and/or creative work in the agricultural sciences, have submitted original and previously published work(s) of a high standard which indicate(s) that the candidate has made a real and high-quality contribution to the enrichment of the knowledge in an agricultural sciences discipline and, if required by the examiners, has taken an oral examination to the satisfaction of the University.

## **AGRICULTURAL ECONOMICS AND MANAGEMENT**

*More information is available on the following web site:*

<http://www.sun.ac.za/agric/agriculture/> (Department of Agricultural Economics)

### **Bachelor's Programme**

The undergraduate (bachelor's) programme in Agricultural Economics and Management leads to one of the following qualifications: BScAgric or BAgricAdmin. The aim of the programme is to develop, for the public and private sectors, skilled agricultural economists and agricultural managers who have a thorough understanding of agricultural economics and agricultural management techniques. In order to satisfy all the agricultural economics and agricultural management requirements of the target markets, the programme consists of three related fields of study with corresponding degree qualifications: Agricultural Economic Analysis (BScAgric), Agricultural Economic Analysis and Management (BScAgric) and Agribusiness Management (BAgricAdmin). Students also have the option to switch, after the first two years of study for BAgricAdmin (Agribusiness Management), to BScAgric (field: Agricultural Economic Analysis and Management).

After successful completion of the programme the graduate will be able to:

- apply analytical and practical skills in the laboratory, field and on the computer;
- know and understand terminology, concepts, theories and principles of the various subjects;
- understand that the various subjects highlight different dimensions of a complex agricultural system and understand how these dimensions fit together;
- apply the integrated view of the agricultural system to analyse it effectively;
- develop an effective agribusiness system for the supply of inputs or handling of outputs of a farming system;
- evaluate and/or improve a farming or agribusiness system in terms of financial-economic, physical-biological and social viability;
- analyse agricultural, environmental and trade policy in order to determine the nature and magnitude of their potential impact upon agriculture;
- utilise contributions from various perspectives for more effective problem analysis, marketing and production system design;
- organise and manage the acquisition of information from literature searches, field surveys, agricultural economic and statistical analysis for effective system analysis and design;
- communicate effectively with collaborators and suppliers of information on all levels, from labourers to executive management;
- have a holistic view of a farming or agribusiness system to realise the integratedness of its dimensions and the potential impact of environmental forces on the local, regional and international level for effective strategic management;
- be more aware of and tolerant for possible opposing viewpoints of different interest groups (input suppliers, product/service buyers, labourers, employees, share holders), illustrating professional and social life skills needed for effective management of the agribusiness; and
- demonstrate entrepreneurial skills by identifying a business opportunity effectively and to exploit it by applying the necessary knowledge and skills effectively.

The prescribed modules of the various years of study for each field are set out below; the module content is given on pages 58 - 114.

For BComm with Agricultural Economics see Part 10 of the University Calendar.

**The Undergraduate Programme in Agricultural Economics and Management is divided into three fields of study: Agribusiness Management as a field of study for the qualification BAgriAdmin, and Agricultural Economic Analysis and Agricultural Economic Analysis and Management as fields of study for the qualification BScAgric.**

**Field of study: Agribusiness Management**

**First Year (122 credits)**

Animal Production Physiology 112(8)

Business Management 113(8), 142(6)

Crop Production 142(8)

Computer Literacy 171(4)

Economics 114(12), 144(12)

Industrial Psychology 112(4)

Soil Science 114(16), 142(8)

Statistical Methods 176(18)

Supply Chain Management 114(12)

Theory of Interest 152(6)

**Second Year (136 credits)**

Agricultural Economics 234(16), 242(8), 262(8)

Financial Accounting 188(24)

*and one of the following groups*

Financial Management 214(16)

Marketing Management 214(16)

Marketing Management 244(16) *or* Investment Management 254(16)

*or*

Financial Management 214(16)

Logistic Management 214(16), 244(16)

*and*

Agronomy 212(8)

Horticulture 222(8)

Viticulture 244(16)

*or*

Animal Production 214(16), 244(16)

**Third Year (128 credits)**

Agricultural Economics 314(16), 324(16), 344(16), 354(16)

*and 48 credits from the following modules as per timetable*

Financial Management 314(12), 324(12), 344(12), 354(12)

Logistic Management 318(24), 348(24)

Marketing Management 314(12), 324(12), 344(12), 354(12)

Strategic Management 344(12)

*and*

Agronomy 324(16) *or* Crop Protection 244(16)

**Field of study: Agricultural Economic Analysis**

**First Year (124 credits)**

Biology 124(16), 144(16), 154(16)

Chemistry 114(16), 154(16)

Computer Literacy 171(4)  
Economics 114(12), 144(12)  
Mathematics (Bio) 124(16)

**Second Year (134 credits)**

Agricultural Economics 234(16), 242(8), 262(8)  
Animal Production Physiology 112(8)  
Business Management 113(8), 142(6)  
Crop Production 142(8)  
Financial Accounting 188(24)  
Soil Science 114(16), 142(8)  
Statistical Methods 176(18)  
Theory of Interest 152(6)

**Third Year (128 credits)**

Agricultural Economics 314(16), 344(16)  
Economics 214(16), 244(16)

*and one of*

Financial Accounting 288(32) *or* Statistics 214(16), 244(16)

*and one of the following groups*

Agronomy 212(8), Horticulture 222(8), Viticulture 244(16)

*or*

Animal Production 214(16), 244(16)

*or*

Aquaculture 314(16), 344(16)

**Fourth Year (144 credits)**

Agricultural Economics 414(16), 424(16), 444(16), 454(16), 478(32)  
Economics 318(24) and 348(24) or 388(24)

**Field of study: Agricultural Economic Analysis and Management**

**First Year (126 credits)**

Animal Production Physiology 112(8)  
Business Management 113(8), 142(6)  
Crop Production 142(8)  
Computer Literacy 171(4)  
Economics 114(12), 144(12)  
Industrial Psychology 112(4)  
Mathematics (Bio) 124(16)  
Soil Science 114(16), 142(8)  
Statistical Methods 176(18)  
Theory of Interest 152(6)

**Second Year (136 credits)**

Agricultural Economics 234(16), 242(8), 262(8)  
Financial Accounting 188(24)

*and one of the following groups*

Financial Management 214(16)

Marketing Management 214(16)

Marketing Management 244(16) *or* Investment Management 254(16)

*or*

Financial Management 214(16)

Logistics Management 214(16), 244(16)

*and*

Agronomy 212(8)  
Horticulture 222(8)  
Viticulture 244(16)

*or*

Animal Production 214(16), 244(16)

### **Third Year (136 credits)**

Agricultural Economics 314(16), 344(16)  
Crop Protection 244(16)  
Economics 214(16), 244(16)  
Financial Accounting 288(32)

*and 24 credits from the following modules*

Financial Management 314(12), 324(12), 344(12), 354(12)  
Logistics Management 318(24), 348(24)  
Marketing Management 314(12), 324(12), 344(12), 354(12)  
Strategic Management 344(12)

### **Fourth Year (144 credits)**

Agricultural Economics 414(16), 424(16), 444(16), 454(16), 478(32)  
Economics 318(24) and 348(24) or 388(24)

### **Postgraduate Programmes**

Postgraduate programmes follow after completion of the bachelor's programme. Students can, depending on their existing qualifications, follow a suitable programme to obtain one of the following postgraduate qualifications: Bachelor of Science in Agriculture with Honours (BScAgricHons) or Bachelor of Agricultural Management with Honours (BAgricAdminHons), Master of Science in Agriculture (MScAgric), Master of Agricultural Management (MAgricAdmin), Doctor of Philosophy in Agriculture [PhD (Agric)] or Doctor of Science in Agriculture (DScAgric).

### **Honours Programme**

#### **Honours programme in Agricultural Economics and Management (BScAgricHons, BAgricAdminHons)**

The honours programme in Agricultural Economics and Management leads to one of the following qualifications: BScAgricHons (Agricultural Economics) or BAgricAdminHons (Agricultural Economics). The programme runs for one year and is designed to equip students with high-level skills in the use of agricultural economics and agricultural management techniques, including the analysis of the limitations and potential of the agricultural sector, so that they become expert agricultural managers and agricultural economists. After the successful completion of the programme the graduate will be able to analyse more complex problem situations and to create more sophisticated farming or agribusiness systems and/or make sophisticated agricultural policy recommendations. These skills are necessary in order to ensure the international competitiveness of South African agriculture and related industries, and also to enable South Africa to play its rightful role in the agricultural sector in Africa. The programme contains all the required components for the high-level training of agricultural economists. Agricultural Economics forms the central component of the programme. The programme combines two core aspects, namely the management of agriculture-related enterprises and agricultural economic analysis.

#### **Agricultural Economics:**

Agricultural Economics 770(12): Farm planning and decision analysis  
Agricultural Economics 771(24): Farm management  
Agricultural Economics 772(24): Actual concerns in agricultural policy

Agricultural Economics 773(24): Agricultural marketing  
Agricultural Economics 774(24): Resource policy and development  
Agricultural Economics 775(24): Agricultural production and resource management  
Agricultural Economics 776(24): International trade and marketing  
Agricultural Economics 777(24): Rural development  
Agricultural Economics 789(24): Analysis of spatial patterns  
Agricultural Economics 779(12): Econometric analysis in the agricultural sector

## **Master's Programme**

### **Master's programme in Agricultural Economics and Management (MScAgric, MAgricAdmin)**

Agricultural Economics 878(120): Master's thesis

The master's programme in Agricultural Economics and Management leads to one of the following qualifications: MScAgric (Agricultural Economics) or MAgricAdmin (Agricultural Economics). The programme focuses strongly on research and is designed to develop in students a high-level ability to undertake independent research in terms of problem solving, multidisciplinary approaches and scientific scholarship. After completion of the programme students are able to carry out independent investigations in selected aspects of the agricultural and related sectors. Students concentrate on a single aspect of one of the two main fields of the programme, namely the management of agriculture-related industries and agricultural-economic analysis. For the degrees MScAgric and MAgricAdmin independent research must be carried out on a suitable topic within the broad framework of agricultural potential assessment, international competitiveness or structural changes in agriculture.

## **Doctoral Programmes**

### **PhD programme in Agricultural Economics and Management [PhD (Agric)]**

Agricultural Economics 978(240): Doctoral dissertation

This programme leads to the PhD (Agric) degree (field: Agricultural Economics). A dissertation containing original research is required. The programme focuses strongly on research and is designed to develop high level skills in the use of Agricultural Economic and Agricultural Management techniques, including the analysis of the limitations and potential of the agricultural sector, in students who wish to become agricultural economists or management experts in the private or public sector. This knowledge is necessary to ensure the international competitiveness of South African agricultural and related industries, and to enable South Africa to play its rightful role in the development of the agricultural sector in Africa.

### **DSc programme in Agricultural Economics and Management (DScAgric)**

Agricultural Economics 998(240): DSc research collection

The degree DScAgric is awarded to candidates who have held the PhD (Agric) degree of this University, or some other equivalent (in the opinion of the Senate) qualification for at least five years, or who have held the MScAgric or MAgricAdmin degree of this University, or some other adequate (in the opinion of the Senate) qualification for at least seven years, and who have produced advanced original research and/or creative work in the Agricultural Sciences, have submitted original and previously published work(s) of a high standard which indicate(s) that the candidate has made a real and high-quality contribution to the enrichment of the knowledge in an agricultural sciences discipline and, if required by the examiners, has taken an oral examination to the satisfaction of the University.

## **FORESTRY AND NATURAL RESOURCE SCIENCES**

*More information is available on the following web site:*

<http://www.sun.ac.za/forestry/> (Department of Forest and Wood Science)

## **Bachelor's Programme**

This undergraduate (bachelor's) programme leads to the Bachelor of Science in Forestry (BScFor) degree. Within the programme there are two fields of study, namely: Forest and Resource Management and Wood Products Science. The first year of study in Forest and Resource Management consists of one Forestry module plus the first year of study in the Biological Sciences programme in the Faculty of Science. For Wood Products Science, from the first year of study modules are taken in the Faculties of Agrisciences, Science and Engineering.

From the second year of study students join the relevant programme in the Faculty of Agrisciences. The second year of study of the field of study Forest and Resource Management consists of a study of the basic applied sciences such as Soil Science and Biometry, and students start to specialise in forestry disciplines. An integrated approach is taken with emphasis on Forest Management, Silviculture, Forest Engineering and Community Forestry.

Upon successful completion of the programme in Forest and Resource Management the graduate will be able to:

- employ and convey the knowledge required to safeguard and utilise, in a sustainable way, natural resource ecosystems, with particular reference to native forests and man-made plantations;
- provide solutions to concrete and abstract problems affecting the management or conservation of forests and plantations, based on solid evidence and theoretical arguments, using creative and critical thinking;
- work effectively in teams of peers to efficiently produce solutions to problems in the spheres of forestry and natural resource sciences;
- organise and manage time effectively, individually and in groups, in order to successfully meet deadlines associated with reports and submissions;
- effectively collect or retrieve and then process and critically analyse data in the specialised forestry domain in order to satisfy the demands of forest management or further the requirements of forest research by presenting results in an utilisable format;
- communicate effectively with peers, superiors and subordinates, using information technology support for oral or written discourse and presentation of reports and submissions;
- apply scientific research methodology and state of the art technology in order to effectively undertake a research project into any facet of the forestry domain;
- demonstrate a holistic view of the complex of forest ecotypes covering the globe and the interdisciplinary interactions between the biotic and abiotic components thereof; and
- apply professional training and social life skills within the context of forest conservation, management and sustainable utilisation for the benefit of mankind.

Forest and Resource Management students participate in practicals of one week each during vacations in each of the first three years of study. In the fourth year students attend a summer school and undertake a tour to the summer rainfall regions. An integral part of this programme consists of the compilation of an extensive management plan or report that must be submitted by all students.

The study field Wood Products Science includes a variety of modules concerned with the properties of wood as a material and a series of engineering-based subjects such as Industrial Ergonomics, Engineering Drawing, Engineering Mathematics, Industrial Management, Engineering Economics and Quality Assurance. Students in Wood Products Science participate in practical periods during vacations from their first to fourth year.

Upon successful completion of the programme in Wood Products Science the graduate will be able to:

- apply and convey the knowledge required to utilise the products emanating from natural resource ecosystems in a sustainable manner and process and reconstitute these into products useful to humanity;

- provide solutions based on solid experimental evidence and theoretical arguments, using creative and critical thinking, to concrete and abstract problems affecting the production in sawmills, boardmills, furniture factories, wood preservation plants, wood construction plants, lamination plants and other wood processing industries;
- work effectively in teams of peers to efficiently produce solutions to problems in the spheres of wood products science and technology;
- organise and manage time effectively, individually and in groups, in order to successfully meet deadlines associated with reports and submissions and manufacturing processes;
- effectively collect or retrieve and then process and critically analyse data in the specialised forest products domain in order to satisfy the demands of processing plant management or further the requirements of forest product research by presenting results in an utilisable format;
- communicate effectively with peers, superiors and subordinates, using information technology support for oral or written discourse and presentation of reports and submissions;
- apply scientific research methodology and state of the art technology in order to effectively undertake a research project into facets of the forest products domain;
- demonstrate a holistic view of the complex of forest products being produced around the world and the interdisciplinary interactions between the international role players in the field of forest products; and
- apply professional training and social life skills within the context of forest products production and utilisation of forest resources for the benefit of mankind.

The prescribed modules and elective modules of the various years of study for each field are set out below; the module content is given on pages 58 - 114. For compulsory practical work, see pages 115 - 117.

**The Undergraduate Programme in Forestry and Natural Resource Sciences is subdivided into the following fields of study: Forest and Resource Management and Wood Products Science.**

### **Field of study: Forest and Resource Management**

#### **First Year (124 credits)**

Biology 124(16), 144(16), 154(16)  
 Chemistry 114(16), 154(16)  
 Forest Science 142(8)  
 Geo-environmental Science 114(16)  
 Mathematics (Bio) 124(16)  
 Computer Literacy 171(4)

#### **Second Year (121 credits)**

Agricultural Economics 262(8)  
 Biometry 212(8), 242(8)  
 Computer Literacy 272(5)  
 Forest Science 212(8), 222(8), 241(4), 242(8), 254(16)  
 Industrial Psychology 244(16)  
 Soil Science 214(16)  
 Wood Products Science 114(16)

#### **Third Year (128 credits) (only for 2008)**

Forest Science 354(16), 364(16)  
 Soil Science 314(16)

*and one of the following groups:\**

**1. Forest Management**

Forest Science 344(16)  
Conservation Ecology 314(16)  
Financial Management 214(16)  
Industrial Psychology 244(16)  
Marketing Management 214(16)

*or*

**2. Forestry Sciences**

Biometry 312(8), 342(8)  
Biotechnology 314(16)  
Entomology 314(16)  
Plant Pathology 314(16)  
Soil Science 344(16)

*or*

**3. Conservation Forestry**

Biodiversity and Ecology 344(16)  
Conservation Ecology 314(16)  
Financial Management 214(16)  
Forest Science 344(16)  
Industrial Psychology 244(16)

*\*In the third year a student has to take the modules of the group taken in the second year.*

**Third Year (128 credits) (from 2009)**

Forest Science 314(16), 324(16), 344(16), 354(16), 364(16)  
Soil Science 314(16)  
Conservation Ecology 314(16), 344(16)

**Fourth Year (128 or 136 or 144 credits) (only for 2009)**

Forest Science 414(16), 424(16), 434(16), 444(16), 458(32)

*and one of the following groups:\**

**1. Forest Management**

Geography and Environmental Studies 324(16)  
Industrial Psychology 314(12)  
Strategic Management 344(12)

*or*

**2. Forestry Sciences**

*two of the following:*

Entomology 454(16)  
Geography and Environmental Studies 324(16)  
Plant Pathology 424(16)

*or*

**3. Conservation Forestry**

Conservation Ecology 414(16), 424(16)

*\*In the fourth year a student has to take those modules of the group taken in the second year.*

**Fourth Year (128 credits) (from 2010)**

Forest Science 414(16), 424(16), 434(16), 422(8), 458(32)  
Industrial Psychology (special) 354(16)  
Project Management 412(12)  
Strategic Management 344(12)

**Field of study: Wood Products Science****First Year (127 credits)**

Applied Mathematics B124(15)  
 Chemistry 114(16), 154(16)  
 Communication 110(0)  
 Computer Literacy 171(4)  
 Engineering Mathematics 115(15), 145(15)  
 Strength of Materials 143(11)  
 Wood Products Science 114(16), 144(16)

**Optional:**

Language Skills (Afrikaans) 143(12); (English) 153(12); (Afrikaans) 163(12)\*  
*\*Language Skills modules are only relevant to students who, as a result of the outcome of the language test, Communication 110, have shown that they need help in either Afrikaans or English; students who performed satisfactorily in both Afrikaans and English are exempt from the Language Skills modules. The Language Skills modules are always voluntary and no student will be forced to enrol for these modules.*

**Second Year (127 credits)**

Engineering Drawing 123(11)  
 Engineering Mathematics 214(15)  
 Forest Science 142(8)  
 Industrial Programming 244(15)  
 Production Management 214(15)  
 Professional Communication 113(12)  
 Wood Products Science 214(16), 254(16), 264(16)

**Optional:**

Language Skills (Afrikaans) 213(10); (English) 223(10); (Afrikaans) 243(10)\*  
*\*Language Skills modules are only relevant to students who, as a result of the outcome of the language test, Communication 110, have shown that they need help in either Afrikaans or English; students who performed satisfactorily in both Afrikaans and English are exempt from the Language Skills modules. The Language Skills modules are always voluntary and no student will be forced to enrol for these modules.*

**Third Year (123 credits)**

Engineering Economics 354(15)  
 Engineering Statistics 314(15)  
 Industrial Management 354(15)  
 Operations Research (Eng) 315(15), 345(15)  
 Wood Products Science 324(16), 334(16); 364(16)

**Fourth Year (125 credits)**

Enterprise Design 444(15)  
 Environmental Engineering 442(8)  
 Industrial Ergonomics 414(15)  
 Quality Assurance 412(8)  
 Quality Management 444(15)  
 Wood Products Science 414(16), 424(16), 444(16), 464(16)

**Postgraduate Programmes**

Postgraduate programmes in Forestry and Natural Resource Sciences may be taken after completion of the bachelor's programme. Students can, depending on their existing qualifications, enter a suitable postgraduate programme in one of their majors to obtain one of the following qualifications: Bachelor of Science in Forestry with Honours (BScForHons), Master of Science in Forestry (MScFor), Master of Forestry (MFor), Doctor of Philosophy

in Forestry [PhD (For)] or Doctor of Science in Forestry (DScFor) in the fields of Forest and Resource Management or Wood Products Science.

## Honours Programme

### Honours programme in Forestry and Natural Resource Sciences (BScForHons)

The honours programme in Forestry and Natural Resource Sciences extends over one year and leads to the qualification BScForHons in Forest Science or Wood Products Science. The modules and study tasks add depth, building further on the bachelor's programme and they have been specifically compiled for each field of study to ensure that students receive specialised training in a specific field of study. The programme is research and career-oriented and is based on modern technology and the most recently available research and it links up with research projects carried out in the Department.

#### Forest and Wood Products Science:

Biometry 711(6): Postgraduate Biometry  
 Forest Science 711(40): Growth and yield science  
 Forest Science 712(40): Forest harvesting  
 Forest Science 713(40): Advanced nursery practice  
 Forest Science 714(40): Advanced tree breeding  
 Forest Science 715(40): Community forestry  
 Forest Science 716(40): Agroforestry  
 Forest Science 741(40): Forest planning  
 Forest Science 742(40): Forest roads and logistics  
 Forest Science 743(40): Sustainable silviculture  
 Forest Science 744(40): Forest eco-physiology  
 Forest Science 771(34): Research project  
 Wood Products Science 711(40): Wood properties I  
 Wood Products Science 712(40): Wood processing  
 Wood Products Science 741(40): Industrial research and practice  
 Wood Products Science 742(40): Wood properties II  
 Wood Products Science 743(40): Wood-based constructions

*Stipulation Forest Science: The modules Biometry 711 (or an equivalent module, subject to the approval of the Chairperson, Department of Forest and Wood Science) and Forest Science 771 are compulsory. The student selects two further modules from the remaining Forest and Wood Products Science modules.*

*Stipulation Wood Products Science: Wood Products Science 741 is compulsory. The student selects two further modules from the remaining Forest and Wood Products Science modules. A Capita Selecta option of one module on NQF level 7, with a credit value of 30 credits or higher from the Faculty of Science or Engineering, subject to the approval of the Chair, Department of Forest and Wood Science, is allowed.*

## Master's Programmes

### Master's programme in Forestry and Natural Resource Sciences (MScFor)

Forest Science 878 (120): Master's thesis  
 Wood Products Science 878 (120): Master's thesis

The master's programme in Forestry and Natural Resource Sciences leads to the qualifications MScFor in the study fields Forest Science or Wood Products Science. The programme consists of a one-year MScFor, if the student already holds a suitable honours degree, or a two-year MScFor in the case where the student holds the BScFor or equivalent degree. In the latter case the student must follow the research component of the programme and the prescribed modules for the particular honours programme (see above). If the student already has a BScForHons degree, the programme consists only of a research component.

**Master's programme in Developmental Forestry (MFor)**

Forest Science 722(15): Inventory and monitoring of renewable green resources

Forest Science 723(15): Sustainable land-use planning

Forest Science 724(15): Forest policy

Forest Science 731(15): Community forestry

Forest Science 732(15): Plantation forest management

Forest Science 733(15): Measurement of growth and prediction of yield

Forest Science 734(15): Harvesting and logistics

Forest Science 752(15): Forest ergonomics

Forest Science 753(15): Natural forest ecosystems

Forest Science 754(15): Silviculture

Forest Science 761(15): Bioenergy systems

Forest Science 762(15): Biomass production systems

Forest Science 763(15): Forest economics

Forest Science 764(15): Energy production from wood and other biomass

Forest Science 878(120): Master's thesis

*Stipulation: Forest Science 878 is compulsory. The student selects a further eight modules from the remaining Forest Science modules or the student must choose one of the following groups of modules: Forest Science 722, 761, 762, 734 and a further four modules of the BioEnergy Hub of the Faculty of Engineering, subject to the approval of the Chairperson, Department of Forest and Wood Science OR Forest Science 724, 732, 733, 734, 752, 753, 754 and 763 OR Forest Science 723, 724, 731, 733, 752, 753, 754 and 763.*

The master's programme in Developmental Forestry leads to the qualification MFor in the study field Forest Science. The three-year BFor degree, as well as other qualifications approved by Senate for this purpose, gives access to this programme. The MFor programme runs for at least two years and consists of an approved curriculum of advanced study and a research component, as prescribed by the supervisor. The MFor degree allows access to a PhD (For) programme.

**Doctoral Programmes****PhD programme in Forestry and Natural Resource Sciences [PhD (For)]**

Forest Science 978(240): Doctoral dissertation

Wood Products Science 978(240): Doctoral dissertation

This programme leads to the qualification PhD (For) in Forest Science or Wood Products Science. A dissertation containing original research is required. The programme focuses on research in various specialist fields of forestry and ensures that students become specialists in these fields.

A relevant and practically oriented research project is undertaken in one of the said fields leading to innovation or the solving of a problem through high-level research in the discipline and in the industry concerned. This educates and prepares students on the highest academic level for entering the research or career market. Students thus become professionals who can, either as a member of a team or individually, play a meaningful role in national and international research, teaching and policy making in specialist fields in an environmentally friendly way.

**DSc programme in Forestry and Natural Resource Sciences (DScFor)**

Forest Science 998(240): DSc research collection

Wood Products Science 998(240): DSc research collection

The degree DScFor is awarded to candidates who have held the PhD (For) degree of this University, or some other equivalent (in the opinion of the Senate) qualification for at least five years, or who have held the MScFor degree of this University, or some other adequate (in the opinion of the Senate) qualification for at least seven years, who have produced advanced original research and/or creative work in the Forestry and Wood Products

Sciences and have submitted original and previously published work(s) of a high standard which indicate(s) that the candidate has made a real and high-quality contribution to the enrichment of the knowledge in a forestry discipline.

## CONSERVATION ECOLOGY

*More information is available on the following web site:*

<http://www.sun.ac.za/consecol/> (Department of Conservation Ecology and Entomology)

### Bachelor's Programme

This undergraduate (bachelor's) programme leads to the qualification BSc in Conservation Ecology. The programme is a collection of modules that will produce a general outcome, allowing a student to choose from a broad range of careers in conservation ecology. The following major outcomes are the most popular careers among students graduating from the programme in Conservation Ecology:

1. Environmental impact assessment (terrestrial and freshwater).
2. Restoration ecology (employment in mining and agriculture, as well as peri-urban organisations for the rehabilitation of soil to its original, natural condition).
3. Conservation biology (suited to jobs in academia, national and provincial parks boards, urban parks and private nature reserves).
4. Game-ranch management.
5. Ecotourism (careers can be followed in various conservation-related fields of ecotourism).
6. Community-based Natural Resource Management (dealing with rural communities and the sustainable use of their natural resources).
7. Environmentally conscious (sustainable) agricultural and forestry production (including organic farm management).

This programme focuses on outcomes 1-5 above.

The interests of students wanting a career in community-based natural resource management (outcome 6) will be best served by the Forestry and Natural Resource Sciences programme, which includes some Conservation Ecology modules, while the environmental agricultural production outcome (outcome 7) is best obtained by taking a programme in either Crop Production, Animal Science or Forest Science, with Conservation Ecology modules as minor subjects. Students interested in a greater emphasis on animal sciences (e.g. management of mixed livestock-game ranches) should take Animal Science programmes with Conservation Ecology as field of study.

Students take part in practicals in each of the first three study years. In the fourth study year, a one-week field trip is attended. Additionally, an integral part of this programme is the production and submission of a management plan or research project by every student in the fourth study year.

The prescribed modules of the various years of study in this programme are set out below; the module content is given on pages 58 - 114.

### Undergraduate Programme in Conservation Ecology

#### Field of study: Conservation Ecology

#### First Year (132 credits)

Biology 124(16), 144(16), 154(16)  
 Chemistry 114(16), 154(16)  
 Computer Literacy 171(4)  
 Geo-environmental Science 114(16), 144(16)  
 Mathematics (Bio) 124(16)

#### Second Year (125 credits)

Biometry 212(8), 242(8)  
 Botany 264(16)

Botany and Zoology 214(16)  
Computer Literacy 272(5)  
Conservation Ecology 212(8), 244(16)  
Microbiology 214(16), 244(16)  
Zoology 254(16)

### **Third Year (124 credits)**

Biodiversity and Ecology 344(16), 354(16)  
Conservation Ecology 314(16), 344(16)  
Genetics 214(16) *and/or* Soil Science 214(16) *and/or* Zoology 315(16)\*  
Industrial Psychology (Spec) 354(12)  
Zoology 334(16)

*\*Choose two of the three modules.*

### **Fourth Year (136 credits)**

Agricultural Economics 262(8)  
Agronomy 424(16)  
Conservation Ecology 414(16), 424(16), 448(32)  
Entomology 464(16)

*and*

Entomology 418(32) *or* Geography and Environmental Studies 324(16) *and* Soil Science 314(16)

### **Postgraduate Programmes**

The postgraduate programme in Conservation Ecology is followed directly after completion of the bachelor's programme. Depending on their existing qualifications, students may enter the postgraduate programme in Conservation Ecology to obtain the qualifications Master of Science in Conservation Ecology (MScConsEcol) and Doctor in Philosophy (PhD) in Conservation Ecology.

### **Master's Programme**

#### **Master's programme in Conservation Ecology (MScConsEcol)**

Conservation Ecology 871(30): Applied conservation ecology  
Conservation Ecology 872(30): Research products and presentation  
Conservation Ecology 878(120): Master's thesis

The master's programme in Conservation Ecology leads to the MScConsEcol degree. The coursework component (60 credits at NQF level 8a) of the curriculum includes ecology, conservation ecology, agriculture and community-based topics. In addition, students, under the guidance of supervisors, are expected to produce two review articles on conservation ecology and to complete four research products (a conference poster, a verbal presentation, a popular article and a scientific manuscript). The research component (minimum time span six months, 120 credits at NQF level 8a) includes independent research on an approved topic in conservation ecology conducted by the student under the supervision of the supervisor. The results must be written up and submitted in the format of a thesis. The thesis must meet the requirements for a master's thesis as prescribed by the Department of Conservation Ecology and Entomology and the University. The thesis will be examined by two examiners, of which at least one must be an external examiner.

### **Doctoral Programme**

#### **PhD programme with specialisation in Conservation Ecology (PhD)**

Conservation Ecology 978(240): Doctoral dissertation

This programme leads to the qualification PhD (field Conservation Ecology). The programme focuses on research in various areas of specialisation of Conservation Ecology and delivers specialists in these fields.

A relevant and practice-oriented research project leading to innovation or to the solution of a problem by high level research in this field of study and in the industry concerned is undertaken. This equips the student at the highest academic level to enter the research or professional market. Professional people who, at national and international levels, individual or as member of a team, will play a meaningful research, teaching and/or policymaking role are delivered.

# Subjects, Modules and Module Content

## ABBREVIATION AND NUMBERING SYSTEM

All subjects are represented by a subject number of 5 digits. Each module of the subject is represented by a three-digit module code, in which the year of study and semester of presentation (unless otherwise stated) are combined. In addition, the credit value, modular subject, teaching load, language specification, modular content and prerequisite pass, prerequisite and corequisite modules for each module are given.

### Example:

<b>55565 AGRONOMY</b>				
<b>314</b>	<b>16</b>	<b>Agronomical production techniques</b>	<b>3L,3P</b>	<b>A</b>

55565 is the subject number; it refers to the subject Agronomy.

314(16) (the 16 will normally be written in brackets) is the module code of the module Agronomy 314(16) with the module subject: Agronomical production techniques.

The module code 314(16) has the following meaning:

First digit: 3 - refers to the year of study in which the module is presented.

Second digit: 1 - is a number to discriminate between modules of the same subject in the same year of study and refers to the semester (unless stated otherwise), according to the following pattern:

1, 2 of 3: modules offered in the first semester;

4, 5 of 6: modules offered in the second semester;

7, 8 of 9: modules offered over two semesters, i.e. a year module.

Third digit: 4 - has no specific meaning, but can be used to discriminate between different modules of the same subject in the same semester of the same year of study.

The number in the second square (otherwise in brackets) (16) - indicates the credit value of the module. Agronomy 314(16) is therefore offered as a module during the first semester of the third year and a student will acquire 16 credits on completion.

The teaching load of each module is indicated in brackets.

The following abbreviations are used:

L - lectures lasting 50 minutes each (e.g. 1L, 2L)

P - practical periods lasting 50 minutes each (e.g. 1P, 2P, 3P)

S - seminar lasting 50 minutes (e.g. 1S)

T - tutorials lasting 50 minutes each (e.g. 1T, 2T)

The teaching load of Agronomy 314(16) amounts to three lectures plus three practicals per week for the duration of the module, i.e. one semester.

In the last square the language specification of each module is indicated. The following specifications are used:

### A Specification

- Prescribed textbooks are in Afrikaans and/or English.

- Class notes drawn up by the lecturer are

(i) fully in Afrikaans, or

(ii) where possible, fully in Afrikaans and fully/partially (e.g. core class notes) also in English.

- Other compulsory reading material (e.g. scholarly journals, books, etc.) is in Afrikaans and/or English.

- Module frameworks and study guides drawn up by the lecturer are in Afrikaans and, where possible, are provided in Afrikaans and English to students whose language of

preference for study is English.

- Transparencies and data-projector contents used by the lecturer in lectures, seminars, tutorials and practicals are in Afrikaans and/or English.
- The oral communication language of the lecturer in lectures, seminars, tutorials and practicals is primarily Afrikaans, but key terms and concepts may be explained briefly in English. Students asking questions in English may be answered in English by the lecturer. Guest lectures by overseas and/or South African lecturers with an inadequate academic language proficiency in Afrikaans may be delivered in English.
- Test and examination question papers are fully in Afrikaans and fully in English on the same question paper.
- Written assignments from lecturers for tutorials, seminars and practicals, when used for assessment purposes, are fully in Afrikaans and fully in English on the same handout.
- Written answers by students to test and examination questions and assignments may be in Afrikaans or English.
- Oral presentations by students in lectures, seminars, tutorials and practicals may be in Afrikaans or English.

### **T Specification**

- Prescribed textbooks are in Afrikaans and/or English.
- Class notes drawn up by the lecturer are
  - (i) fully in Afrikaans and fully in English, or
  - (ii) alternately in Afrikaans and English
- Other compulsory reading material (e.g. scholarly journals, books, etc.) is in Afrikaans and/or English.
- Module frameworks and study guides are
  - (i) fully in Afrikaans and fully in English, or
  - (ii) alternately in Afrikaans and English depending on the language of oral communication of the lecturer in the particular classes.
- Transparencies and data-projector contents used by the lecturers in lectures, seminar classes, tutorials and practicals are in Afrikaans.
- The oral communication language of the lecturer in lectures, seminars, tutorials and practicals is
  - (i) in the same class Afrikaans and English, with the proviso that the use of Afrikaans must be at least 50%, or
  - (ii) alternately Afrikaans and English in different classes of the module or programme, with the proviso that the use of Afrikaans must be at least 50%.

Test and examination question papers are fully in Afrikaans and fully in English on the same question paper.

Written assignments from lecturers for tutorials, seminars and practicals, when used for assessment purposes, are

- (i) fully in Afrikaans and fully in English in the same handout, or
  - (ii) alternately in Afrikaans and English depending on the material not for assessment purposes (class notes, module frameworks, study guides, etc.) where the average use of Afrikaans must be at least 50%.
- Written answers by students to test and examination questions and assignments may be in Afrikaans or English.
  - Oral presentations by students in lectures, seminars, tutorials and practicals in the T specification may be in Afrikaans or English according to their preferred academic language.

### **E Specification**

- Prescribed textbooks are in English.
- Class notes drawn up by the lecturer are fully in English or, where possible, fully in English and fully/partially (e.g. core class notes) also in Afrikaans.
- Other compulsory reading material (e.g. scholarly journals, books etc.) is in English

and/or Afrikaans.

- Module frameworks and study guides drawn up by the lecturer are in English and, where possible, are provided in English and Afrikaans to students whose language of preference for study is Afrikaans.
- Transparencies and data-projector contents used by the lecturer in lectures, seminars, tutorials and practicals are in English.
- The oral communication language of the lecturer in lectures, seminars, tutorials and practicals is primarily English, but key terms and concepts may be explained briefly in Afrikaans. Students asking questions in Afrikaans may be answered in Afrikaans by the lecturer. Afrikaans is not compulsory in the case of overseas lecturers.
- Test and examination question papers are fully in English and fully in Afrikaans on the same question paper.
- Written assignments from lecturers for tutorials, seminars and practicals, when used for assessment purposes, are fully in English and fully in Afrikaans on the same handout.
- Written answers by students to test and examination questions and assignments may be in Afrikaans or English.
- Oral presentations by students in lectures, seminars, tutorials and practicals may be in English or Afrikaans.

### A & E Specification

The A & E Specification entails that separate 'streams' are offered in Afrikaans and English. Consult the characteristics of the A and the E language specifications.

### Requisites

After the description of the content of the module, the prerequisite pass, prerequisite and/or corequisite module(s) are/is given for that module. The following abbreviations are used:

PP - Prerequisite Pass module.

P - Prerequisite module.

C - Corequisite module.

The following definitions apply:

A prerequisite pass module is a module which students must have passed before they are allowed to take the module(s) for which it is a prerequisite pass module.

A prerequisite module is a module in which students must have achieved a class mark of at least 40, or a final mark of at least 40 in the case of a module subject to continuous assessment, before they are allowed to take the module for which it is a prerequisite module.

A corequisite module is a module which students must take in the same academic year as the module for which it is a corequisite, or in an earlier academic year.

Note: No qualification will be awarded unless the candidate has passed all the relevant prerequisite and corequisite modules.

Subjects, as well as their modules, modular content, credit value, pass prerequisites, prerequisites and co-requisites are given below.

### SUBJECTS AND MODULES (ALPHABETICALLY)

<b>15504 AGRICULTURAL ECONOMICS</b>				
(Department of Agricultural Economics)				
<b>234</b>	16	<b>South African agriculture</b>	6L	A
An overview of the structure of the agricultural sector with regard to production and resource use; analysing the roles of agriculture, the institutional framework for agriculture, and the international context. History of agricultural policy; marketing and prices.				
<b>242</b>	8	<b>Agricultural production economics and methods of financial analysis</b>	2L, 1T	A
Production relations; optimising in factor/product, factor/factor, and product/product				

relations; cost relations; income, costs and margins in farming; cost accounting; economic and financial criteria; budgets.

*P Economics 178 or Economics 114, 144*

<b>262</b>	8	<b>The economics of agricultural resources</b>	3L	T
Basic concepts; determinants of the demand, supply and value of natural resources; resources and technology; the influence of location on land use; industry-specific factors.				
<b>314</b>	16	<b>Farm management</b>	4L, 2T	A
Approaches to management; entrepreneurship; strategic and operational decision-making; management functions; management information and systems; capital requirements of a farming operation and credit sources; financing policy. Analysis of problems in respect of estate planning, inheritance and taxation (capital transfer tax and income tax) in agriculture. The communication process, communication channels.				
<i>P Agricultural Economics 242</i>				
<b>324</b>	16	<b>Farm planning and decision-making</b>	4L, 2T	A
Creative problem-solving; framework for analysing farm decision-making; information processing and human judgement; approaches to decision-making under conditions of risk and uncertainty; tools and techniques for farm planning and decision-making; linear programming applications; deficiencies in the linear programming algorithm and the introduction of alternative programming techniques; case studies.				
<i>P Agricultural Economics 242</i>				
<b>344</b>	16	<b>Agricultural and food marketing</b>	3L, 3P	A
Behaviour of food consumers and food quality; food marketing research and information; marketing strategies for agricultural products and food in South Africa; food marketing in the informal sector; behaviour of low-income food consumers.				
<b>354</b>	16	<b>Agricultural policy analysis</b>	3L	A
The farm problem; policy instruments to address the farm problem; applications in South African agriculture; international trade policy.				
<b>414</b>	16	<b>National and international market analysis</b>	3L	A
The determinants of demand and supply as well as elasticities and impact indicators in national and international markets. Empirical estimation in the form of econometric impact models.				
<i>P Statistics 174 or Biometry 274 or Statistics 186 or Statistical Methods 176</i>				
<b>424</b>	16	<b>Institutional analysis of agribusinesses</b>	3L	A
Institutional economics and transactions cost theory form the theoretical core of this module. Strategic trends in agricultural marketing; aspects of marketing management; the industrialisation of agriculture; management of the value chain; cooperative models and structures; vertical integration; organisational and functional dimensions of agricultural marketing; institutional analysis; social capital.				
<b>444</b>	16	<b>Environmental policy</b>	3L	A
Different standards of environmental protection; the use of market instruments vs. command and control policy instruments to limit environment damage; support for environmentally friendly technology; cost benefit analysis; quantification of environmental impacts; international environmental treaties; the theory of environmental auditing.				
<i>P Economics 178 or Economics 114, 144</i>				
<b>454</b>	16	<b>Agricultural policy in the South African context</b>	3L	A
Key issues in South African agriculture: International trade; the political economy of food; land reform; labour policy; the development of value chains in Africa; the linkage effects to the rest of the economy.				

<b>478</b>	32	<b>Agricultural economics research project</b>	1L	A
An assignment that encompasses problem identification, information gathering, analysis and synthesis and that provides students with the opportunity to integrate agricultural economics knowledge in a systems approach. <i>Subject to continuous assessment.</i>				
<b>770</b>	12	<b>Farm planning and decision analysis</b>	3L	T
Planning as a management function; modelling and programming techniques; orientation to problem solving; decision analysis; management of risk and uncertainty; case studies.				
<b>771</b>	24	<b>Farm management</b>	3L	T
The systems approach to problem solving; strategic management, entrepreneurship and other approaches to strategic management processes; environmental scanning and other principles, concepts and tools for futures research; farm system analysis, levels of decision-making, management by objectives and management information systems for decision-making and control.				
<b>772</b>	24	<b>Topical issues in agricultural policy</b>	3L	T
The theoretical structure of agricultural policy analysis; public choice and institutional approaches; the mechanisms of policy implementation; the Policy Analysis Matrix; in depth study of agricultural policy issues in South Africa; the management of policy processes.				
<b>773</b>	24	<b>Agricultural marketing</b>	3L	T
Theory and practice of agricultural marketing analysis, marketing management and marketing strategy formulation on business and industry levels; seminar work (self-study and group discussions) covering specific agricultural marketing opportunities and related topics such as food consumption and agricultural policy.				
<b>774</b>	24	<b>Resource policy and development</b>	3L	T
Project planning, regional development, environmental impact assessments, economic viability studies, use of an electronic resource databases, value adding.				
<b>775</b>	24	<b>Agricultural production and resource management</b>	3L	T
Theory and practice of agricultural production and resource management; analysis of various production systems and relationships; incorporation of risk and uncertainty in decision-making and planning; problems, challenges and issues regarding land, water, capital, technology and human resources.				
<b>776</b>	24	<b>International trade and marketing</b>	3L	T
International trade theory, international marketing, marketing strategies for the export market in general and for South Africa.				
<b>777</b>	24	<b>Rural development</b>	3L	T
Historical overview of rural development conceptual frameworks, the contribution of agriculture to rural development, two sector models, modern growth models; integrated rural development; project analysis, practical experience with rural development projects.				
<b>779</b>	12	<b>Econometric analyses in the agricultural sector</b>	3L	T
The identification and analysis of trends in the agricultural sector using econometric and modelling techniques.				
<b>789</b>	24	<b>Analysis of spatial patterns</b>	3L	T
The recognition and analysis of spatial patterns in the agricultural economy by means of geographic information systems (GIS) and satellite remote sensing.				

<b>55565 AGRONOMY</b>				
(Department of Agronomy)				
<b>212</b>	8	<b>Agronomical crop production</b>	1.5L, 1.5P	A
Economic importance of crops; relationship between soil, climate and production capacity; cultivation practices such as tillage, crop rotation and weed control. <i>P Crop Production 142</i>				
<b>314</b>	16	<b>Agronomical production techniques</b>	3L, 3P	A
Introduction to tillage, fertilisation and crop production; identification and control of weeds; mechanisms of chemical herbicide action. <i>P Crop Production 214</i>				
<b>324</b>	16	<b>Pasture management</b>	3L, 3P	T
Development and ecology of South African veld types; morphology and physiology of pasture plants and their reaction to defoliation; pasture management principles; determination of veld condition; veld management on game farms and management of various veld types.				
<b>344</b>	16	<b>Herbs and decorative plants for intensive plant production systems</b>	3L, 3P	A
Morphology and physiology of herbs and decorative plants and production techniques for intensive plant production systems. <i>P Crop Production 214</i>				
<b>414</b>	16	<b>Greenhouse production techniques</b>	3L, 3P	A
Soilless production techniques (hydroponics) for seedlings and crops using different types of climate control. <i>P Botany 214 or Crop Production 214</i>				
<b>424</b>	16	<b>Ecology and management of natural pastures</b>	3L, 3P	T
Development and ecology of South African veld types; morphology and physiology of pasture plants and their reaction to defoliation; feed quality; pasture management principles; determination of veld condition; veld burning; bush encroachment; veld management on game farms; management of various veld types. <i>Subject to continuous assessment.</i> <i>P Agronomy 314 or Conservation Ecology 314</i>				
<b>444</b>	16	<b>Vegetable crops for intensive production systems</b>	3L, 3P	A
Morphology and physiology of important vegetable crops and production techniques for intensive plant production systems. <i>P Agronomy 414</i>				
<b>454</b>	16	<b>Sustainable production systems for cool weather crops and cultivated pastures</b>	3L, 3P	A
Morphology and physiology of cool weather crops and cultivated pastures. Crop rotations and biological management for sustainable production. Precision farming, quality requirements and utilisation of crops and pastures. <i>P Agronomy 314</i>				
<b>711</b>	30	<b>Physiology of annual crops</b>	3S	T
<i>Adaptations in crop physiology and morphology in response to production conditions.</i>				
<b>712</b>	30	<b>Problem-identification in agronomical systems and literature review</b>	3S	T
Identification and description of agronomical problems, literature review and scientific reporting.				

<b>741</b>	30	<b>Yield improvement in annual crops</b>	3S	T
Domestication of crops; adaptation and ecology of yield; physiological crop improvement; efficient use of resources and inputs.				
<b>742</b>	30	<b>Research planning and technique development in agronomy</b>	3S	T
Studies of agronomical research techniques and the completion of an applicable research project.				

### 56901 ANIMAL BREEDING SCIENCE

(Department of Animal Sciences)

<b>424</b>	16	<b>Production traits improvement</b>	3L, 3P	A
Influence of single and major genes on production traits and their transmission to successive generations; inherited disorders in livestock; breeding and selection for the improvement of economically important production traits; reproduction growth and growth efficiency; milk production; fibre production; egg production; carcass quality; correlated responses in performance traits; interpretation and application of BLUP of breeding values in selection; selection progress and progress determination. <i>Subject to continuous assessment.</i> <i>P Genetics 354</i>				
<b>454</b>	16	<b>Applied breeding plans</b>	3L, 3P	A
Species-specific breeding systems and how they are influenced by the different production systems; animal performance components (direct additive, direct maternal, heterosis) and their estimation and application in breeding systems; breed characterisation in respect of production traits and applied crossbreeding systems; the Livestock Improvement Act; Inter-gis; breeder associations; group breeding schemes; veld bull and veld ram evaluations and the functioning of the National Livestock Improvement Schemes for all livestock species. <i>Subject to continuous assessment.</i> <i>P Genetics 354</i>				

### 54801 ANIMAL HUSBANDRY

(Department of Animal Sciences)

<b>334</b>	16	<b>Poultry management</b>	3L, 3P	A
Biological aspects of poultry management. Housing and ventilation. Management of parent stock, layer hens and broilers. Hatchery management and the hatching of chickens; storage of hatching eggs and disinfecting procedures. Measurement and preservation of egg quality; factors that influence shell quality; pure breeding lines and the development of synthetic breeding lines for the poultry industry. Poultry diseases and biosecurity. <i>C Animal Science 244, Physiology and Animal Physiology 214</i>				
<b>434</b>	16	<b>Management systems for pigs</b>	3L, 3P	A
The biology and morphology of the pig; the feeding management and housing requirements of the pig as influenced by its various growth and development phases; management programmes for pig diseases; manipulation of the sow's reproduction to ensure maximum productivity; the principles involved in the management of a piggery; record keeping systems. <i>Subject to continuous assessment.</i> <i>P Animal Nutrition Science 344</i>				
<b>464</b>	16	<b>Extensive management systems</b>	3L, 3P	A
Sheep and cattle management practices; production systems; mating systems; mating and lambing seasons; identification of animals; fattening; marketing; animal-waste manage-				

ment; flock and herd health.

Practicals: Identification of sheep breeds; assessment and handling of sheep and sheep management practices. Identification of animal diseases and herd health programmes.

Students follow a wool course at the beginning of their third study year and a course in the assessment of animal performance during their fourth year.

*P Animal Nutrition Science 324*

## 56898 ANIMAL NUTRITION SCIENCE

(Department of Animal Sciences)

<b>324</b>	16	<b>Introduction to ruminant nutrition</b>	3L, 3P	A
------------	----	---	--------	---

Chemical composition of feedstuffs; digestive processes and digestibility of feeds and nutrients; metabolism and utilisation of end products of digestion; mineral and vitamin metabolism; protein and energy systems of ruminants; ARC and NRC nutrient standards; feed evaluation.

Practicals: Execution of a digestibility and balance trial with sheep (or other animals), including laboratory analyses and the execution of an in vitro digestive technique.

*C Animal Science 244, Biochemistry 214, 244*

*P Physiology and Animal Physiology 214*

<b>344</b>	16	<b>Introduction to monogastric nutrition</b>	3L, 3P	A
------------	----	--	--------	---

Metabolisable energy and the shortcomings of ME as a criterion; methodology for determining the ME value of raw materials; importance of endogenous energy and the N retention correction; effective energy as alternative criterion; impairment of protein and amino acid in raw materials and the need to use the availability values of amino acid; methodology of determination; nature of the techniques for determining the utilisation coefficients of energy and amino acids for growth and maintenance; calorimetry and carcass analysis; characteristics of the most common raw materials for use in rations; ration formulation.

*C Biochemistry 214, 244, Animal Science 244*

*P Physiology and Animal Physiology 214*

<b>414</b>	16	<b>Advanced ruminant nutrition</b>	3L, 3P	A
------------	----	------------------------------------	--------	---

Applied nutrition of sheep, goats, dairy cattle, beef cattle and game. Metabolic disorders; processing of raw materials and feeds.

Practicals: Ration formulation with the aid of microcomputers. Visits to feedstuff manufacturers and farms.

*Subject to continuous assessment.*

*P Animal Nutrition Science 324*

<b>444</b>	16	<b>Advanced monogastric nutrition</b>	3L, 3P	A
------------	----	---------------------------------------	--------	---

Utilisation coefficients for energy and amino acids and the use of those coefficients in the Gompertz formula; modelling of nutrient needs and calculation of optimum values by means of broiler and egg production models; application of response experiments for determining biologically available nutrient values in raw materials; metabolic disorders in poultry and the control thereof; mycotoxins in raw materials and their effect on growth and production; the use of enzymes in feeds to promote nutrient digestibility.

*P Animal Nutrition Science 344*

## 11851 ANIMAL PHYSIOLOGY

(Department of Animal Sciences)

<b>324</b>	16	<b>Applied physiology in farm animals</b>	3L, 3P	A
Endocrine control and cell communication; pH and electrolyte balance with reference to kidney and lung functions; control of blood pressure and distribution patterns during various physiological circumstances (exercise, cardiovascular shock); applied digestive physiology and intermediate metabolism; temperature control in farm animals. <i>PP Physiology and Animal Physiology 214</i> <i>C Biochemistry 214, 244</i>				
<b>344</b>	16	<b>Advanced animal production physiology</b>	3L, 3P	A
Comparative reproduction physiology; introduction to assisted reproduction techniques; applied immunology and disease resistance; principles and application of pharmaceuticals in animal health. <i>PP Physiology and Animal Physiology 214</i> <i>C Biochemistry 214, 244</i>				

## 11878 ANIMAL PRODUCTION

(Department of Animal Sciences)

<b>214</b>	16	<b>Management technology: Sheep and cattle</b>	3L, 3P	A
Sheep: Supplementary nutrition of grazing sheep and feedlot finishing; internal and external factors affecting wool production; management systems; diseases and herd health programmes. Beef cattle: Nutrition and husbandry of breeding herds produced under grazing and intensive systems; feedlot finishing; rumen dysfunction; processing and preserving feeds; influence of nutrition and other factors on production and profitability. Dairy cattle: Nutrition and husbandry of non-lactating and lactating cows and dairy calves; effect of nutrition and other factors on dairy products and profitability; milk fever. Practical: Feeding practices, feed formulation, visits to farming units and experimental trials, visual evaluation of dairy and beef cattle, discussion of prepared assignments. <i>C Animal Production Physiology 112</i>				
<b>244</b>	16	<b>Management technology: Poultry and pigs</b>	3L, 3P	A
Poultry: Basic principles in poultry production. Description of incubation systems. Commercial egg production. Production of broilers and broiler parents. Economic factors affecting poultry production. Pigs: Planning of a pig production unit. Principles involved in pig housing. Caring of pigs in different stages of life. Nutrition, breeding and selection of pigs. Practicals: Visits to poultry and pig farms. <i>C Animal Production Physiology 112, Animal Production 214</i>				

## 44733 ANIMAL PRODUCTION PHYSIOLOGY

(Department of Animal Sciences)

<b>112</b>	8	<b>Animal production physiology</b>	1.5L, 1.5P	A
Anatomy, histology and physiology of the digestive and reproductive systems. <i>Subject to continuous assessment.</i>				

## 51004 ANIMAL PRODUCTS SCIENCE

(Department of Animal Sciences)

<b>334</b>	16	<b>Meat science</b>	3L, 3P	A
Meat production and meat consumption in perspective; factors that influence carcass composition; slaughter and processing of animals; preslaughter and postslaughter effects on				

meat quality; storage and processing of meat products. Practicals: Visits to abattoirs, production of various meat products. <i>Subject to continuous assessment.</i> <i>C Animal Science 244</i>				
<b>352</b>	8	<b>Dairy science and dairy cattle management</b>	2L, 1.5P	A
Composition and properties of milk and dairy products; factors that influence milk composition; lactation physiology, milk production; housing; management of dry and lactating cows; control of mastitis. Practicals: Determination of milk quality. Operation of the milking machine. Layout of housing. Visits to commercial dairies. Production of soft cheese. <i>P Animal Science 244</i>				
<b>462</b>	8	<b>Wool and fibre science</b>	1.5L, 1.5P	A
The wool follicle, development and influence on wool production; fibre formation. Principles of wool-textile manufacturing. Comparisons between the properties of wool and other natural and synthetic fibres. <i>Subject to continuous assessment.</i> <i>P Animal Science 244</i> <i>C Animal Nutrition Science 414</i>				

## 20826 ANIMAL SCIENCE

(Department of Animal Sciences)

<b>144</b>	16	<b>Animal behaviour and husbandry</b>	3L, 3P	A
General introduction to the care and handling of farm animals. Breeds science. A global overview of the livestock industry. General introduction to animal production systems viz. large stock, small stock, poultry and pigs.				
<b>244</b>	16	<b>Basic principles of animal nutrition and management</b>	3L, 3P	A
Part 1: The chemical composition and digestibility of fodder. The nutrition and nutrient needs of farm animals. Basic composition of rations. Introduction to extensive and intensive feeding. Growth and development of farm animals. Part 2: General principles of the breeding of farm stock viz. large stock, small stock, poultry and pigs. Heredity and race improvement. <i>C Physiology and Animal Physiology 214</i>				
<b>442</b>	8	<b>Practical training</b>	1.5L, 1.5P	A
Methods of gathering scientific literature; seminar preparation and presentation; training in writing and presentation skills. Practical vacation work as prescribed in the "Compulsory practical vacation work" section of this part of the Calendar. Practical vacation work: Report preparation and submission.				
<b>711</b>	24	<b>Fundamental ruminant nutrition</b>	1L	T
Includes rumen dynamics, inter alia the effect of intake and digestibility on retention time and passage rate, as well as degradation rates and the application of relevant models; advanced studies related to protein synthesis and utilisation, energy conversion, microbial efficiency in ruminants and mineral and vitamin metabolism in ruminants.				
<b>741</b>	24	<b>Applied large-stock nutrition</b>	2L	T
Emphasis is placed on the application of advanced dynamic models, such as the latest versions of the Cornell Net Carbohydrate and Protein System and CPM Dairy. The biology underlying the models is also explained.				
<b>742</b>	24	<b>Applied small-stock nutrition</b>	2L	T
Latest developments in nutrition and management practices of small stock.				

<b>712</b>	24	<b>Fundamental monogastric nutrition</b>	1L	T
Fundamental study of nutrients, the utilisation of nutrients, nutritional systems, including energy and amino acid systems, advanced vitamin and mineral metabolism and the use of feed additives and medicines in poultry, pig and pet food diets.				
<b>743</b>	24	<b>Applied monogastric nutrition</b>	2L	T
Diet formulation, the use of predictive growth and simulation models, applied nutritional systems and feed manufacturing techniques.				
<b>744</b>	24	<b>Operational systems for monogastric animals</b>	2L	T
A study of operational systems for the broiler, layer, breeder and hatchery industries, as well as operational systems for pigs, including production, breeding flocks, growth, finishing and preparation for marketing. Different operational systems for freshwater and marine aquaculture enterprises are also discussed.				
<b>713</b>	24	<b>Fundamental animal breeding</b>	1L	T
Methods for the genetic improvement of production traits, e.g. meat, milk, wool, etc. The improvement of reproduction performance and the genetic improvement of adaptation and disease resistance. Quantification of genetic improvement. Selection index theory.				
<b>745</b>	24	<b>Applied animal breeding</b>	2L	T
The animal, its environment and homeostasis. National and international programmes for livestock improvement. Ethical aspects of genetic modification in livestock.				
<b>746</b>	24	<b>Statistical procedures in animal breeding</b>	2L	T
Statistical models in the genetic improvement of livestock. The use of different models and programs in the estimation of (co)variance components and the prediction of breeding values; uni- and multi-trait procedures; estimation and use of performance components in the composition of applied breeding plans.				
<b>714</b>	24	<b>General animal physiology</b>	1L	T
With special reference to endocrine control systems and homeostatic control mechanisms during abnormal physiological conditions.				
<b>747</b>	24	<b>Digestive physiology</b>	2L	T
Comparative study of anatomy/physiology of the digestion system in farm animals; absorption and intermediate metabolism of nutrients.				
<b>715</b>	24	<b>Reproductive physiology</b>	1L	T
Comparative studies of the male and female reproductive systems in farm animals, spermatogenesis, oogenesis, fertilisation, pregnancy and lactation.				
<b>748</b>	24	<b>Assisted reproductive techniques</b>	1L	T
Semen collection methods, semen evaluation and storage, insemination techniques in farm animals: oestrus synchronisation and super ovulation; embryo collection and transfer.				
<b>716</b>	24	<b>Abattoir practices</b>	1L	T
A study of different abattoir practices, abattoir design for the slaughtering of different animal species and ethical aspects pertaining to the slaughter of animals.				
<b>751</b>	24	<b>Quality characteristics of meat</b>	2L	T
Techniques, measurement procedures and models for the prediction of carcass composition and meat quality. Factors influencing the composition and quality traits of meat, e.g. species, age, nutrition, sex, production systems, pre- and post-slaughter treatment. South African legislation regarding meat production and organic meat production topics are also discussed.				
<b>752</b>	24	<b>Value adding to meat</b>	2L	T
Processing procedures, carcass cuts and product development of e.g. sausage, salami, pâtés, etc.				

<b>771</b>	18	<b>Postgraduate seminar</b>	1T	T
Students write a seminar on a relevant topic chosen in consultation with the supervisor.				
<b>811</b>	24	<b>Research competency</b>		T
Design and statistical evaluation of experiments. Scientific reporting of experimental results. Ethics involved in Animal Science.				
<b>20753 APPLIED MATHEMATICS B</b>				
(Department of Mathematical Sciences)				
<b>124</b>	16	<b>Statics</b>	4L, 2T	A & E
Vectors; forces; sum of forces at a point; direction cosines and direction angles; components and component vectors; scalar products; vector products; moment of a force; force systems on rigid bodies; equivalent force systems; couples; line action of the resultant; equilibrium of a rigid body; trusses; friction; centre of mass; centroid; volumes; definite integration.				
<b>46213 AQUACULTURE</b>				
(Department of Genetics [Aquaculture])				
<b>314</b>	16	<b>Introduction to aquaculture</b>	3L, 3P	A
Fish and shellfish in aquaculture. Overview of national and international developments in aquaculture. Applied biology of aquaculture species: Fish, shellfish and crustaceans. Nutritional requirements and management. Water quality and management. Environmental impact and monitoring. <i>Subject to continuous assessment.</i>				
<b>344</b>	16	<b>Aquaculture production and processing</b>	3L, 3P	A
Choice of species and site selection. Aquaculture husbandry system. Intensive and extensive management systems. Fish diseases: health management, identification and prevention. Processing of aquaculture products and product quality and marketing. <i>Subject to continuous assessment.</i> <i>P Aquaculture 314</i>				
<b>414</b>	16	<b>Freshwater aquaculture</b>	3L, 3P	A
Production and management of freshwater aquaculture species: trout, tilapia, catfish, ornamental species, crocodiles, freshwater crawfish and prawns. Management techniques: broodstock, eggs, incubation and hatching, fingerlings and grow-out stages. Production planning, management systems and computer usage. <i>Subject to continuous assessment.</i> <i>P Aquaculture 344</i>				
<b>444</b>	16	<b>Marine aquaculture</b>	3L, 3P	A
Production and management of marine aquaculture species: oysters, mussels, abalone, salmon, seaweed and prawns. Management techniques: brood stock, eggs, incubation and hatching, fingerlings and grow-out stages. Production planning, management systems and computer usage. <i>Subject to continuous assessment.</i> <i>P Aquaculture 414</i>				
<b>478</b>	32	<b>Aquaculture research project</b>	3L, 3P	A
Formulation of an applicable research project proposal, including liaison with the industry and drawing up a budget. Literature study, experimental design, planning and execution, including supervision of facilities and experimental material, usage of apparatus and				

utilisation of calibrators and calibration techniques. Data processing, analysis, interpretation and reporting.				
<i>P Aquaculture 314, 344</i>				
<b>711</b>	24	<b>Aquaculture production and management systems I</b>	2L	T
Fresh water aquaculture. A study of production and management systems for fresh water aquaculture species. Attention is given to the utilisation of computer programs in production planning.				
<b>741</b>	24	<b>Aquaculture production and management systems II</b>	2L	T
Marine aquaculture. A study of production and management systems for marine aquaculture species. Attention is given to the utilisation of computer programs in production planning.				
<b>771</b>	36	<b>Aquaculture management practice</b>	2L	T
Management practice of aquaculture production in relation to production systems, production planning, production management; including intensive and extensive systems, with reference to marine and freshwater species.				
<b>772</b>	30	<b>Aquaculture research practice</b>	2L	T
Preparation and planning of research projects in relation to species, facilities, equipment and apparatus; technique and handling methods; collection, processing and interpretation of data; presentation and information transfer.				
<b>712</b>	24	<b>Aquaculture products</b>		T
Processing technology and management practices in aquaculture. Product quality, food and health standards. Product development.				
<b>742</b>	24	<b>Aquaculture ecology</b>		T
Water ecology and water quality parameters in aquaculture. Water quality management practices. Environmental impact. Recirculation systems and technology.				
<b>743</b>	24	<b>Aquaculture nutrition</b>		T
Feeding behaviour of aquaculture species. Nutrition management practices of aquaculture species. Nutrition and food quality of aquaculture species.				

### **50377 ASSISTED REPRODUCTION**

(Department of Animal Sciences)

<b>721</b>	10	<b>Reproductive physiology</b>	1L	T
The male reproductive system: Primary and secondary sexual organs; spermatogenesis; spermiasis; properties of semen and sperm, survival of sperm; erection and ejaculation, capacitation, hyper activation, acrosome reaction and fertilisation, endocrine control, sperm metabolism, role of accessory reproductive glands. The female reproductive system: Ovaries, oogenesis, ovulation and control of the oestrus cycle; transport of the fertilised oocytes; biology of the oviduct; embryonic properties and embryonic development; implantation, pregnancy, foetal development, birth and lactation; endocrine control.				
<b>722</b>	10	<b>Body control mechanisms</b>	1L	T
Introduction: Anatomical and histological aspects of the reproductive system; basic physiology of the control systems; homeostasis; embryonic development and differentiation; ethical, religious and legal issues of ART.				
<b>723</b>	10	<b>Laboratory and laboratory animal management</b>	1L	T
General aspects: Effect of nutrition on fertility; legal aspects of an embryologist; stock improvement act; statistics for biologists; enterprise management; writing of seminars and research proposals. Laboratory management: Animal management and handling; taking				

and handling of samples; laboratory procedures, sterility, equipment and incubator care.				
<b>733</b>	10	<b>Spermology</b>	1L	T
Semen collection methods; semen evaluation; semen freezing; short and long term storage; semen thawing and survival; inseminations: cervical, transcervical, laparoscopic, surgical; pathology.				
<b>871</b>	40	<b>In vivo embryo production</b>	1P	T
Historical background; oestrus synchronisation; multi-ovulation; insemination versus natural conception; embryo collection and evaluation. Embryo handling, storage and freezing; micromanipulation of the embryo; maternal recognition of pregnancy; pregnancy determination; pathology of reproduction.				
<b>872</b>	40	<b>In vitro embryo production</b>	1P	T
Historical background; development of the ovaries; folliculogenesis and follicular waves; oocyte collection from abattoir material and ultrasonic scanning; follicle and oocyte evaluation; <i>in vivo</i> and <i>in vitro</i> oocyte maturation; cell and coculture; factors influencing maturation and embryonic development; ICSI, GIFT and ZIFT. Fertilisation <i>in vivo versus in vitro</i> ; factors that influence fertilisation; culture of embryos; embryo survival; embryo freezing, thawing and transfer; management of embryo donors and recipients; cloning, transgenics, production of embryonic and adult stem cells, therapeutic use of stem cells in animals and man; pathology.				
<b>773</b>	60	<b>Postgraduate seminar series</b>	1S	T
Students write seminars on subjects chosen in consultation with the supervisor.				
<b>876</b>	60	<b>MPhil report</b>		T
Students write a report on a research project chosen in consultation with the supervisor. The report must be in the form of a scientific article.				
<b>11053 BIOCHEMISTRY</b>				
(Department of Biochemistry)				
<b>214</b>	16	<b>Structure/function relationships</b>	3L, 3P	A
Structure, properties and functions of biomolecules (bio-elements, water, nucleic acids, proteins, enzymes, carbohydrates, lipids, coenzymes). <i>Subject to continuous assessment.</i> <i>NB: Students taking Biochemistry 214 must have passed at least one of the Chemistry modules 114, B134 or 154 (first or second semester) and have obtained a final mark of at least 40 in the remaining chemistry module.</i> <i>P Biology 124</i>				
<b>244</b>	16	<b>Intermediate metabolism</b>	3L, 3P	A
Bio-energetics, metabolism of carbohydrates lipids and nitrogenous compounds, integration of metabolism. <i>Subject to continuous assessment.</i> <i>P Biochemistry 214</i>				
<b>314</b>	16	<b>Specialised biochemistry subjects 1</b>	3L, 3P	A
Advanced protein metabolism: modern preparative and analytical techniques to study the molecular mechanisms of skeletal muscle contraction and control. Molecular cell physiology: regulation of life processes at the molecular level; metabolic regulation; non-equilibrium thermodynamics; energy transformations in live systems; kinetics; metabolic control and regulating analysis; supply-demand analysis. <i>Subject to continuous assessment.</i> <i>PP Biochemistry 214, 244</i>				

<b>344</b>	16	<b>Specialised biochemistry subjects II</b>	3L, 3P	T
<p>Membrane biochemistry: membrane structure; kinetics and thermodynamics of membrane transport; various transport mechanisms and their physiological integration. Signal transduction: intracellular signal transduction pathways; receptors; hormones; cAMP; networks and cross-talk; biochemistry of vision; biochemistry of smell.</p> <p>Immunology: Hereditary and acquired immunity; antibody structure and function; defence mechanisms against disease-causing organisms; inoculation; allergies; immunity deviations; Aids; immunological techniques; immunodiagnostic methods.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Biochemistry 314</i></p>				

### 53953 BIODIVERSITY AND ECOLOGY

(Departments of Botany and Zoology and of Conservation Ecology and Entomology)

<b>344</b>	16	<b>Population and conservation ecology</b>	3L, 3P	E
<p>Use of quantitative methods to answer questions on natural populations and communities; factors that influence population growth, dynamics, structure and management; matrix modelling of populations; metapopulations; factors giving rise to species extinction; landscape ecology; macro ecology; local adaptations and diversity; nature conservation; fragmentation, evaluation of conservation and constant selection of priorities for conservation; application of theory and techniques to conservation research and planning.</p> <p><i>Subject to continuous assessment.</i></p>				

(Presented by the Departments of Botany and Zoology and of Conservation Ecology and Entomology)

<b>354</b>	16	<b>Environmental stress and ecotoxicology</b>	3L, 3P	T
<p>Introduction to structure and functioning of ecosystems. Physical, chemical and biological threats to ecosystems and stress. Chemical pollution and management guidelines. Global consequences of chemical pollution: Climate change, acid rain etc. Nature and role of ecotoxicology. Chemical substances in the environment. Classification of substances, toxins and toxicants. Uptake, distribution and transformation of substance; routes of exposure. Partition coefficients. Bioavailability, absorption, storage and excretion of chemicals. Tolerance, sensitivity of organisms and species sensitivity distributions. Water, soil and marine ecosystems, their services, factors, habitat types, adaptations and trophic relations. Biological threats such as invasive species, parasites, diseases and toxins. Adaptations to chemicals: Acclimation and genetic adaptation and evolutionary consequences. How do we measure toxicity? Can we measure ecotoxicity? Chronic and acute toxicity and dose-response relationships. Toxicity tests and standardisation. Bio-indicators and bio-indicator systems, bio-monitoring and risk assessment. Effects on physiological and molecular levels. Biomarkers and their ecological relevance.</p> <p>(Presented by the Department of Botany and Zoology)</p>				

### 25046 BIOLOGY

(Departments of Biochemistry, Botany and Zoology, Genetics, and Microbiology)

<b>124</b>	16	<b>Cell biology</b>	3L, 3P	A & E
<p>Origin and early history of life; cytology; cell chemistry, biological membranes and cellular respiration; fixing, transfer and expression of genetic information; evolution.</p> <p>(Presented by the Departments of Biochemistry, Botany and Zoology, and Genetics)</p>				
<b>144</b>	16	<b>Biodiversity and ecology</b>	3L, 3P	A & E
<p>Classification of organisms; diversity of micro-organisms, plants and animals; ecological principles and global changes.</p>				

(Presented by the Departments of Botany and Zoology and Microbiology) <i>C Biology 124, Chemistry 114, 154</i>			
<b>154</b>	16	<b>Functional biology</b>	3L, 3P   A & E
Plant anatomy and morphology. Photosynthesis. Water relations and phloem transport. Functional biology of animals. Introduction to biotechnology. (Presented by the Department of Botany and Zoology) <i>C Biology 124, Chemistry 114, 154</i>			
<b>11061 BIOMETRY</b>			
(Department of Genetics [Biometry])			
<b>212</b>	8	<b>Introductory biometry</b>	3L   A & E
Methods of tabulation and graphical representation of data; descriptive measures of locality, variation and association; regression; the elementary principles of randomness, distributions, sampling and estimation; contingency tables and chi-square tests; F-test for heterogeneity of variance. <i>P Mathematics (Bio) 124 or Mathematics 114</i>			
<b>242</b>	8	<b>Applications in biometry</b>	3L   A & E
Treatment and experimental design; efficiency of estimation; analysis of variance; hypothesis tests for means and differences between means: F-test, t-test, Student's LSD; confidence intervals; non-parametric tests. <i>PP Biometry 212</i>			
<b>312</b>	8	<b>Biometrical inference</b>	3L   A & E
Linear and multiple regression; statistical inference; prediction and calibration; testing the assumptions; diagnosis of outliers and influential observations; data transformations; data processing with Excel. <i>P Biometry 242 or 274</i>			
<b>342</b>	8	<b>Linear models in biometry</b>	3L   A & E
Matrix algebra; the general linear model: regression and classification models; goodness of fit tests; analysis of variance; multiple comparisons; covariance analysis; data processing with Excel. <i>P Biometry 312</i>			
<b>711</b>	6	<b>Postgraduate biometry</b>	2P   E
Data processing with SAS Enterprise Guide. Simple descriptive statistics; T tests for single populations, combined t tests and paired t tests for two populations; Analysis of variance: completely random design, random blocks design, latin square design, cross classification designs; repeated measures analysis of variance; Multiple comparison procedures, Non-parametric tests: Mann-Whitney, Wilcoxon, Kruskal-Wallis and Friedman; Linear regression and correlation; Polynomial regression, Multiple regression; selection of independent variables with stepwise regression and all subset regression; Analysis of covariance analysis; Categorical data analyses ( $\chi^2$ tests); Logistic regression. <i>Subject to continuous assessment.</i> <i>P Biometry 212 and 242 or 274 or any other similar module</i>			

**59404 BOTANY**

(Department of Botany and Zoology)

<b>264</b>	16	<b>Plant diversity</b>	3L, 3P	T
------------	----	------------------------	--------	---

Eight main evolutionary developmental lines within the Plant Kingdom: 1. Origin of life; 2. Evolution of photosynthesis; 3. Evolution of plant organelles; 4. Evolution of the multicellular state; 5. Adaptations for life on land; 6. Development of vascular tissue; 7. Evolution of seeds; 8. Evolution of flowers.

The monophyly, general characteristics, origin and relationships, diversity, morphology of main groups, phylogenetic relationships and ecological adaptations of the Algae, Bryophyta; seedless vascular plants and Gymnosperms.

Unique derived characters of angiosperms. The origin and phylogenetic relationships of angiosperms as determined by different classification systems. Angiosperm diversification and classification using morphological, anatomical, biogeographical, chemotaxonomical, palynological and molecular characters. Angiosperm naming based on the International Code of Botanical Nomenclature. Morphological diversity of Angiosperms from the most primitive to the most derived families in a practical series, with specific focus on Fynbos families.

**61476 BOTANY AND ZOOLOGY**

(Department of Botany and Zoology)

<b>214</b>	16	<b>Principles of ecology</b>	3L, 3P	T
------------	----	------------------------------	--------	---

This is a basic ecology module with an emphasis on the ecology of South Africa. Throughout the module we highlight the ecological significance of particular animal or plant traits. We examine the flat tops of acacia trees, the long proboscises of long-tongued flies, the synchronous flowering of many Cape bulb plants and we ask: "Why?" The answers lie in ecology - the study of animals and plants in their environment. The series ends with a discussion of the current understanding of the ecology of a selection of ecosystems from throughout South Africa and the world. The module includes an introduction to the abiotic environment in which plants and animals live.

The module includes a three-day fieldtrip during which students conduct their own research projects. They have the opportunity to develop testable hypothesis, conduct the relevant fieldwork, analyse the results, apply the appropriate statistical tests and write a research paper.

**48550 BUSINESS MANAGEMENT**

(Department of Business Management)

<b>113</b>	8	<b>Business management</b>	2L, 1P	T
------------	---	----------------------------	--------	---

General and strategic management, idea generation and entrepreneurship; marketing and market research, product development; establishment problems; business size and sources of financing; forms of enterprise; commercial law and franchising, buying management; risk and insurance; the management of the enterprise and its environment; contemporary management problems.

<b>142</b>	6	<b>The investment decision</b>	1.5L, 1P	A
------------	---	--------------------------------	----------	---

The investment cycle; role and operation of the JSE stock exchange; investment risks; factors which affect share prices; fundamental and technical analysis of companies.

*Subject to continuous assessment.*

**11479 CHEMISTRY**

(Department of Chemistry and Polymer Science)

<i>NB:</i> Students who wish to continue their studies in Chemistry 3 or higher, should preferably take Chemistry 114 and 154 and Mathematics 114 and 144 in their first year of study.				
<b>114</b>	16	<b>Introductory inorganic and physical chemistry</b>	3L, 3P	A
Revision of atomic structure, atomic orbitals, electron configurations, stoichiometry; chemical binding theories; molecular geometry and structures according to Lewis and VSEPA; chemical equilibriums (qualitative and quantitative treatment); chemical reactions in watery solutions (precipitation, complex formation, acid-base and redox); Solubility problems; pH calculations and buffers; practical exercises; gravimetric analysis, acid/base and redox titrations.				
<b>154</b>	16	<b>Introductory organic chemistry</b>	3L, 3P	A
Introductory study of organic compounds with various functional groups, multifunctional compounds; mechanisms of reactions; stereoisomerism. <i>C Chemistry 114</i>				
<b>214</b>	16	<b>Organic chemistry</b>	3L, 3P	A
Reaction mechanisms; stereochemistry; systematic aliphatic and aromatic chemistry. <i>PP Chemistry 114, 154</i>				
<b>224</b>	16	<b>Analytical chemistry</b>	3L, 3P	T
Introduction to analytical chemistry; errors and uncertainty in analytical data; basic statistical methods; classical volumetric methods (acid-base, redox and complexometric analysis); introduction to instrumental analysis; potentiometry, analytic molecular spectroscopy; UV/visible and infrared spectrophotometrics; introduction to separation science, more particularly chromatography. <i>PP Chemistry 114, 154</i> <i>P Mathematics (Bio) 124 or Mathematics 114, 144</i>				
<b>244</b>	16	<b>Inorganic chemistry</b>	3L, 3P	E
Periodic tendencies; structure and binding in molecules; structure and binding in solid materials; chemistry in solutions; main group elements. Coordination chemistry: introduction, ligand types, nomenclature; isomerism of coordinate compounds; various geometries; forming constants. <i>PP Chemistry 114</i>				
<b>254</b>	16	<b>Physical chemistry</b>	3L, 3P	A
Chemical thermodynamics; thermodynamics of cells; colligative properties; phase diagrams; reaction kinetics; diffraction techniques. <i>P Mathematics 114, 144, Chemistry 224</i>				
<b>324</b>	16	<b>Physical chemistry</b>	3L, 3P	A
<i>Quantum mechanical description of atoms and molecules; vibration spectra and rotation spectra; statistical thermodynamics.</i> <i>PP Mathematics 114, 144</i> <i>P Chemistry 254</i>				
<b>334</b>	16	<b>Inorganic chemistry</b>	3L, 3P	A
Stereochemical non-rigidity; structure and strength correlations in acids and bases; industrial importance; structure and reactivity of transition element complexes; selective complexation; kinetics and mechanism of selected reactions; the role of metal complexes in biological systems; introduction to organometal chemistry; the preparation and characterisation of inorganic compounds (practicals). <i>PP Chemistry 244</i>				

<b>344</b>	16	<b>Organic chemistry</b>	3L, 3P	A
Advanced systematic, acyclic, aromatic and heterocyclic chemistry; stereochemistry; syntheses. <i>PP Chemistry 214</i>				
<b>354</b>	16	<b>Analytical chemistry</b>	3L, 3P	E
Advanced instrumental analysis: molecular spectroscopy: overview of basic principles; <sup>1</sup> H and <sup>13</sup> C-nuclear magnetic resonance spectroscopy and molecular structure; atomic spectroscopy: principles of absorption and emission spectroscopy. Calibration in instrumental analysis; introduction to electrochemical techniques; separation science with emphasis on chromatographic methods <i>P Chemistry 324</i> <i>C Chemistry 344</i>				

**46132 COMMUNICATION**

(Presented by the Language Centre)

<b>110</b>	0	<b>Communication</b>	1P	A & E
Language skills tests are written in the beginning of the first year. Students whose language skills are deficient in Afrikaans or English are encouraged to take and pass the Language Skills modules 143, 153 or 163.				

**50040 COMPUTER LITERACY**

(Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science))

Detailed information at [www.sun.ac.za/rv](http://www.sun.ac.za/rv).

<b>171</b>	4	<b>Computer literacy</b>	1L	T
Utilisation of computers in computer user areas on campus. Introduction to Windows, Internet, Word, Excel and PowerPoint. An optional test can be written during the first term to obtain exemption from the module. Exemption will only be granted to students who obtain a pass mark of 75% and a sub minimum of 65% for each section. A pro-rata discount on student fees will be given to students who qualify for exemption. <i>Subject to continuous assessment.</i>				

<b>272</b>	5	<b>Computer literacy</b>	2L*	T
*35L in total Component 1: (5L) Advanced Word; (10L) Advanced Excel Component 2: (10L) Choice between Introduction to MS Visio and Introduction to MATLAB (Applied Mathematics students are required to take MATLAB, other students in Mathematical Sciences are strongly encouraged to choose MATLAB.) Component 3: (10L) Introduction to Access <i>Subject to continuous assessment.</i> <i>PP Computer Literacy 171</i>				

**55638 CONSERVATION ECOLOGY**

(Department of Conservation Ecology and Entomology)

<b>212</b>	8	<b>Conserving nature</b>	2L, 1P	E
What is biodiversity; a brief history of biodiversity; the importance of biodiversity; how many species are there; global patterns in biodiversity; human impacts and species extinctions; maintaining biodiversity, conventions, sustainable use and approaches to conservation.				

<i>Subject to continuous assessment.</i>				
<b>244</b>	16	<b>Conservation censusing</b>	3L, 3P	E
Monitoring and survey techniques for major plant and animal taxa; plant/animal/habitat relationships; indices of species richness and diversity; indices of community similarity and differences.				
<i>Subject to continuous assessment.</i>				
<b>314</b>	16	<b>Biome ecology</b>	3L, 3P	E
Introduction to biomes; ecology of tropical and afro-montane forests, woodlands, savannas, treeless vegetation types; wetlands; animal diversity/habitat interactions; patterns of endemism; biological invasion and its management.				
<i>Subject to continuous assessment.</i>				
<b>344</b>	16	<b>Introduction to conservation management</b>	3L, 3P	E
History of man and his environment; history and philosophy of conservation; environmental ethics; participation and conflict resolution; cultural conservation; government and community influences on conservation; environmental legislation; conservation management problems; land-use and hydrology; fire ecology and management; ecotourism and recreation; management plans and research.				
<i>Subject to continuous assessment.</i>				
<b>414</b>	16	<b>Nature conservation management</b>	3L, 3P	E
Conservation in utilised landscapes; conservation planning; disturbance ecology; grazing; harvesting; ecological monitoring; restoration ecology; current issues in biodiversity and resource conservation, for example: invasive species, climate change, genetically modified organisms, pollution.				
<i>Subject to continuous assessment.</i>				
<b>424</b>	16	<b>Wildlife management in a changing environment</b>	3L, 3P	E
Decision-making in the face of uncertainty: managing for current climate change; the planning and execution of conservation-based research; wildlife management; sustainable harvesting models and population viability analysis; priority area selection and design; management of alien invasives/WFW/Wetlands; case studies in conservation research.				
<i>Subject to continuous assessment.</i>				
<b>448</b>	16	<b>Conservation plan/research project</b>	6L, 6P	E
Preparation of a comprehensive management plan for an area, community or species, based on fieldwork conducted during the university vacations.				
<i>Assessment: Management Plan (October)</i>				
<i>P Conservation Ecology 314 or 344</i>				
<i>C Conservation Ecology 414</i>				
<b>871</b>	30	<b>Applied conservation ecology</b>	3L	E
Ecology, applied conservation ecology, agricultural and community-based topics will, under the guidance of the various lecturers, be presented to the students. This will take the form of tutorials, journal clubs and informal discussion groups.				
<b>872</b>	30	<b>Research products and presentation</b>	3L	E
Under the supervision of their study leaders, graduate students will be required to produce a review article with respect to their various fields of study. Students will complete a minimum of four research products, for example: a conference poster, a verbal presentation, a popular article and a scientific manuscript.				

<b>14052 CROP PRODUCTION</b>				
(Departments of Agronomy, Horticultural Science, and Viticulture and Oenology)				
<b>142</b>	8	<b>Principles of crop production</b>	1.5L, 1.5P	T
Plant-environment interactions; morphology; classification; reproduction and physiological processes in higher plants				
<b>152</b>	8	<b>Introduction to applied plant science (agriculture)</b>	1.5L, 1.5P	A & E
Classification systems and classification of agricultural crops; structure of plants of agricultural significance; plant growth regulators; ecological principals and introductory agricultural ecology.				
<b>214</b>	16	<b>Introduction to crop production</b>	3L, 3P	A & E
Plant-environment interactions; plant propagation; plant hormones. <i>C Biology 124</i> <i>P Biology 144, 154</i>				
<b>53961 CROP PROTECTION</b>				
(Departments of Conservation Ecology and Entomology and of Plant Pathology)				
<b>244</b>	16	<b>Introduction to crop protection</b>	3L, 3P	A
The recognition and effects of plant pathogenic organisms and arthropods on crops; the principles of epidemiology; integrated pest management and disease control. <i>Subject to continuous assessment.</i>				
<b>12084 ECONOMICS</b>				
(Department of Economics)				
<b>114</b>	12	<b>Economics</b>	3L, 1T	A & E
The economic problem: scarcity, priorities and opportunity cost. Introductory micro-economics: demand and supply and the determination of equilibrium in goods markets, production and cost theory, market structures and the theory of the firm, market failures and the role of the government.				
<b>144</b>	12	<b>Economics</b>	3L, 1T	A & E
Introductory macroeconomics: income and production theory, the foreign sector and monetary economics. National Accounting and macroeconomic data. The South African economy: history and features. <i>C Economics 114</i>				
<b>214</b>	16	<b>Economics</b>	3L, 1T	A
Macroeconomics: the IS-LM model, total demand and supply, inflation, monetary linking mechanisms, stabilisation policy. Microeconomics: goods and factor markets, demand theory, production and cost theory, market structures and the theory of the firm, prosperity theory. <i>PP Economics 178 or Economics 114, 144</i>				
<b>244</b>	16	<b>Economics</b>	3L, 1T	A
South African monetary policy. International trade and finances: The theory of international trade, limitations on free trade, the World Trade Organisation and regional economic integration, the balance of payments, international financial markets, mechanisms of adjustment, policy options, exchange rate determination, the international monetary system and the South African exchange policy. <i>PP Economics 178 or Economics 114, 144</i> <i>C Economics 214</i>				

<b>318</b>	24	<b>Economics</b>	4L, 1S	A
<p>Macroeconomics: Economic growth, economic cycle, monetary and fiscal policy.          Quantitative economy: General data analysis, mathematical and econometric techniques and input/output analyses. Micro-economics: industrial structures, market structures and the theory of the firm, introduction to game theory.  <i>PP Economics 214</i>  <i>P Economics 244</i></p>				
<b>348</b>	24	<b>Economics</b>	4L, 1S	A
<p>This module is aimed at economic policy implementation in a developing country. It covers economic policy criteria, structural characteristics of the South African economy, economic thought and systems, growth and development policy, including aspects such as demand and supply elements of economic growth, sectoral and spatial development, income distribution and social spending, competition policy, economics of the environment, labour policy, education and human capital formation and macro-economic policy implementation.  <i>PP Economics 214</i>  <i>P Economics 244</i>  <i>C Economics 318</i></p>				
<b>388</b>	24	<b>Economics (Applied Economics)</b>	2L, 2T	A
<p>Introductory applied econometrics: statistical concepts, the classic linear regression model, multicollinearity, autocorrelation, heteroscedasticity, semblance dependants, estimation of regression equations. Labour economics and labour econometrics: labour market, demand and supply, demographic trends, trade unions, South African labour market. Management economics: mathematical techniques, demand, cost and production analyses, price determination, introduction to linear programming. South African economic issues.  <i>Subject to continuous assessment.</i>  <i>PP Economics 214</i>  <i>P Economics 244</i>  <i>C Economics 318</i></p>				

## 46825 ENGINEERING DRAWING

(Department of Mechanical Engineering)

<b>123</b>	11	<b>Orthographic drawings</b>	1L, 1P, 3T	A & E
<p>Projection planes; points, lines and planes in space; trace points of lines and trace lines of planes; true lengths and true angles between lines and planes; true angles between planes; new projection planes; shadows; interpenetrations; developments; isometric projections. Works Drawings: 1st and 3rd angle projections; line alphabet; dimensioning; scale; three-view drawing layout; auxiliary views; hidden detail; introduction to sections and cross-hatching. Introduction to 2D-CAD and 3D parametric CAD.</p>				

## 18791 ENGINEERING ECONOMICS

(Department of Industrial Engineering)

<b>354</b>	15	<b>Engineering economics</b>	2L, 3T	A
<p>Introduction to accounting: Financing, tax and growth of a business, income, balance sheet and cash flow statements, financial ratios, working capital cycles, the cost of capital, cost accounting, budgets, introduction to macroeconomics, monetary and fiscal framework, the SA budget.  <i>P Engineering Economics 312 (not applicable to students in Wood Products Science)</i></p>				

<b>38571 ENGINEERING MATHEMATICS</b>				
(Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science))				
<b>115</b>	15	<b>Introductory differential and integral calculus</b>	5L, 2T	A & E
Mathematical induction and the binomial theorem; functions; limits and continuity; derivatives and rules for differentiation; applications of differentiation; the definite and indefinite integral; integration of simple functions.				
<b>145</b>	15	<b>Further differential and integral calculus</b>	5L, 2T	A & E
Transcendental functions; integration techniques; improper integrals; conic sections; polar coordinates; partial derivatives; complex numbers; introduction to matrices and determinants. <i>P Engineering Mathematics 115</i>				
<b>214</b>	15	<b>Differential equations and linear algebra</b>	4L, 2T	A
Ordinary first-order differential equations; linear higher-order differential equations; matrices, determinants, vector spaces, eigenvalues. <i>PP Engineering Mathematics 115 or Engineering Mathematics 145</i> <i>P Engineering Mathematics 145</i>				
<b>59498 ENGINEERING STATISTICS</b>				
(Department of Statistics and Actuarial Science)				
<b>314</b>	15	<b>Engineering statistics</b>	3L, 2.5T	A
Applied probability theory; applications based on discrete and continuous random variables and their probability distributions, such as the normal, gamma, lognormal, Log Pearson type 3 (LP3), Gumbel (EV1) distributions; queuing processes; joint distributions; descriptive statistics and graphical presentations; moments, averages, median and standard deviations; moment generating functions; variation coefficient; skewness coefficient; peaking coefficient; sampling theory; point and interval estimation; hypothesis testing; chi-squared and K-S testing; simple linear and non-linear regression and correlation analyses; introduction to multiple linear regression; introduction to analysis of variance and experimental design. <i>PP Engineering Mathematics 115, 145</i>				
<b>59501 ENTERPRISE DESIGN</b>				
(Department of Industrial Engineering)				
<b>444</b>	15	<b>Enterprise design</b>	2L, 2T	A
Systems engineering, approaches towards enterprise modelling and supply chain management. Concepts like knowledge management, innovation, and different life cycles will be applied through the complete design of an enterprise within formal information, manufacturing and organisational architectures. <i>Final-year admission</i>				
<b>34576 ENTOMOLOGY</b>				
(Department of Conservation Ecology and Entomology)				
<b>314</b>	16	<b>Insect pest management</b>	3L, 3P	A
Origin and types of insect pests; analysis of an insect problem; methods of control: Biological control, lures, sterilants, juvenile hormones, resistant plants, agrotechnical methods,				

legislative measures and chemical control; properties and testing of pesticides; pest management. Biology and control of key pests.				
<b>418</b>	32	<b>Insect diversity</b>	6L, 6P	T
Introduction to the Arthropoda and its classes. Nomenclature of insects. Generalised morphology and anatomy of insects. Growth and metamorphosis of insects. Diversity and classification of the Hexapoda (Protura, Collembola, Diplura and Insecta) with emphasis on ecologically and economically important groups.				
<b>454</b>	16	<b>Applied entomology</b>	3L, 3P	A
Economically important insects: Biology and pest status; damage symptoms; application of integrated pest management (IPM) tactics on selected important crops. Practicals: Visits to appropriate institutions; pest-risk determination of serious pests able to settle in South Africa. <i>Subject to continuous assessment.</i>				
<b>464</b>	16	<b>Insect conservation ecology</b>	3L, 3P	E
Insects as successful organisms; ethics underpinning their conservation; insects and the conservation of ecosystem processes; threats to insects; management for insect diversity conservation; restoration of insect diversity; conventions and social issues in insect diversity conservation.				
<b>771</b>	40	<b>Morphology and systematics</b>	2L, 1S, 2P	T
Morphology and systematics of insects; biogeography of insects.				
<b>772</b>	40	<b>Ecology</b>	2L, 1S, 2P	T
Interactions between insect herbivores and plants, as well as between herbivores and their carnivores; competition; insect conservation; differences between natural and agro-ecological systems.				
<b>773</b>	40	<b>Principles of insect pest management</b>	3L, 3S, 2P	T
Orders and families of insects of importance in insect pest management. Ecological principles in insect pest management. Sampling for monitoring insect pest populations.				
<b>774</b>	40	<b>Biologically intensive insect pest management techniques</b>	3L, 3S, 2P	T
The use of cultural practices, plant resistance and biological control in insect pest management.				
<b>775</b>	40	<b>Technologically intensive insect pest management techniques</b>	4L, 4S, 2P	T
The use of chemical control, the sterile insect technique, semiochemicals and recombinant DNA technology in insect pest management.				
<b>50431 ENVIRONMENTAL ENGINEERING</b>				
(Department of Process Engineering)				
<b>442</b>	8	<b>Engineering and the environment</b>	3L, 2T	A
Ethics; ECSA Code of Conduct for Professional Engineers; energy and the environment; ecological systems and energy flow, ethical elements of environmental management and socio-ecological factors in decision-making, environmental pollution, impact of engineering projects on the environment, environmental impact studies; water and air pollution; pollution standards and regulations, ISO 14000 certification; world-atmospheric changes (damage to ozone layer) and the greenhouse effect and impact on renewable energy sources, nuclear power and nuclear waste. Analysis, measurement and control of soil, water and air pollution caused by engineering systems, water consumption and re-use. (7 weeks) <i>Class mark serves as final mark.</i> <i>P All the modules for the first 2 years of the Wood Products Science programme</i>				

<b>26883 FINANCIAL ACCOUNTING</b>				
(Department of Accounting)				
<b>188</b>	24	<b>Financial accounting</b>	4L	A
Theoretical grounding in generally accepted accounting practice; accounting systems; financial reporting of various kinds of business. NB: The number of lectures on Financial Accounting 188 for those students who did not pass matric accounting is 5L in the first semester.				
<b>288</b>	32	<b>Financial accounting</b>	5L, 1P	A
Continuation of generally accepted accounting practice; financial reporting of various kinds of business. <i>PP Financial Accounting 178 or 188</i>				
<b>51047 FINANCIAL MANAGEMENT</b>				
(Department of Business Management)				
<b>214</b>	16	<b>Introduction to financial management</b>	3L, 1P	A
Structure of the balance, income and cash flow statement; the measurement and judgement of financial performance with reference to profitability, liquidity and solvability analysis; case studies on financial analysis; financial evaluation of businesses; introduction to the investment decision; the financing decision; financial sources; the dividend decision; financial planning and the management of business assets, with special reference to cash, trade debtors and stock control; financial failures; international financial management. <i>Subject to continuous assessment.</i> <i>C Business Management 142</i>				
<b>314</b>	12	<b>Financial planning and control</b>	2L	A
Calculation of weighted average cost of capital and costs of various capital components, financial assessment of businesses; influence of cost and value theory on financial analysis and evaluation; determination of selling prices and cost allocation; the influence of inflation on annual financial statements. <i>C Financial Management 214</i>				
<b>324</b>	12	<b>Short-term insurance</b>	2L	A
Insurance management with particular reference to the application of financial and risk management in the South African context, the financial meaning of the basic principles of short-term insurance, financial management practices and financial year statements of short-term insurers, the determination of the office premium, the meaning of the solvency margin for short-term insurers, classes of short-term insurance, the financial aspects related to the procurement of short-term insurance together with the claim procedure, the financial aspects of re-insurance, the State as insurer, and international aspects of insurance management.				
<b>344</b>	12	<b>Capital investment</b>	2L	A
Application of the following financial selection criteria to large capital projects: back earning period method, method of the equivalent uniform annual costs, method of the net present value and the internal remunerativeness method; the effect of inflation in judging of investment projects and the computation of the costs of capital, priority determination with regard to multiple mutually exclusive projects. <i>C Financial Management 214</i>				
<b>354</b>	12	<b>Amalgamations and take-overs</b>	2L	A
Processes in amalgamations and take-overs, financial and strategic aspects, theories,				

applicability of competitive and other legislation, empirical data, LBOs, MBOs, defence strategies, common projects and alliances, disinvestment; management manual; case studies.

*C Financial Management 214*

## 21180 FOOD FACTORY MACHINERY

(Department of Mechanical Engineering)

<b>414</b>	16	<b>Food factory machinery</b>	3L, 2P, 2T	A
------------	----	-------------------------------	------------	---

Engineering approach to problem-solving; thermodynamic properties of water and an ideal gas; retention of mass, momentum and energy, entropy; thermodynamic processes in closed and open systems; generation, use and reticulation of steam; pumping and piping systems; fans and extraction systems; steady conduction, convection and radiation; air moisture mixtures and air conditioning processes.

*PP Food Science 244*

<b>444</b>	16	<b>Food factory machinery</b>	3L, 2P, 2T	A
------------	----	-------------------------------	------------	---

Flow behaviour and properties of Newtonian and non-Newtonian flows; the cooling cycle and cooling components and equipment; storage of food products by means of refrigeration and freezing; heat transfer including the determination of heat transfer coefficients, boiling and condensation; transient heat transfer during heating, freezing and thawing; mass transfer; thermal processing of food products; evaporation and concentration; drying theory and equipment; mixing; process control.

*P Food Factory Machinery 414*

## 21210 FOOD SCIENCE

(Department of Food Science)

<b>144</b>	16	<b>Introduction to food science</b>	3L, 3P	A
------------	----	-------------------------------------	--------	---

An overview of food science as a discipline and a career choice. Introduction to the principles and practice of food science and technology. Interrelationships between the chemical, physical, biological, nutritional and general quality properties of food products as affected by formulation, processing and packaging. Current issues in food science and ethics in the food industry. Compulsory factory visits.

<b>214</b>	16	<b>Commercial food processing and preservation I</b>	3L, 3P	A
------------	----	--	--------	---

Commercial food processing: principles and methods; microbial growth, spoilage and control of spoilage. Technological principles of heating, irradiation, cold storage, freezing, dehydration and application of pressure; the effect of processing techniques on the nutrient retention and sensory acceptability. Commercial food preservation through chemical control; technological and working principles of preservatives; classification of additives, statutory implications of preservatives. Compulsory factory visits.

<b>244</b>	16	<b>Commercial food processing and preservation II</b>	3L, 3P	A
------------	----	---	--------	---

Commercial food processing and preservation: The dairy industry, chemical, physical and microbiological characteristics of milk, processing techniques and their effect on product quality, manufacture and preservation of the main dairy products. Environmental management in the food industry. Compulsory factory visits.

*P Food Science 214*

<b>314</b>	16	<b>Animal food products</b>	3L, 3P	A
------------	----	-----------------------------	--------	---

Meat, fish and poultry structure and composition. Chemical and biochemical reaction processes. Preservation and product spoilage. Processing of emulsion products. Overview of the meat, poultry, and fishing industries with special reference to the main products, production problems, quality factors and legislative and regulatory control. Compulsory

factory visits. <i>Subject to continuous assessment.</i> <i>PP Food Science 244</i>				
<b>324</b>	16	<b>Nutrition for the food scientist</b>	3L, 3P	A
Nutrients and implications for food product development, processing and preservation. Carbohydrates, proteins, fats, vitamins and minerals pertaining to human nutrition. Detrimental food reactions and functional foods. Critical analysis of commercial food products concerning nutritional aspects, legislation and labelling. <i>PP Food Science 244</i>				
<b>334</b>	16	<b>Reading and writing skills for food science students</b>	3L, 3P	E
The purpose of this module is to develop both first- and second-language speakers' academic reading and writing skills applicable to the Food Science curriculum. 1. Academic reading skills: This module will cover a variety of reading material. Most of the reading material is from the Food Science curriculum, to learn specific reading skills; pieces from other sources will broaden the students' horizons. The aim of this module is to enable students to read interactively and to read critically and selectively with a specific purpose in mind (e.g. the construction of tasks, data collection and class presentation). 2. Academic writing skills: The students are exposed to the "process approach" to academic writing: students learn to plan, design, edit, proofread and revise. Purposes of this module include: the ability to present data, to present arguments and to develop accurate reference techniques. 3. Format of the module: This semester module is presented to the Food Science students as a series of seminars and workshops. Students will attend fifty-minute seminars and one three-hour workshop per week. The goal of the workshop sessions is to see that students get the opportunity to apply the knowledge and experience they obtained in the seminars in a particular situation with prescribed reading and writing assignments. Fellow students' writing skills will be discussed and the lecturer-student consultation will be conducted during the session. <i>Subject to continuous assessment.</i> <i>PP Food Science 214</i>				
<b>344</b>	16	<b>Food of plant origin</b>	3L, 3P	A
Cereal, milling and baking science. Chemical composition of cereals. Milling processes and determination of chemical and rheological quality. Physical, chemical and functional characteristics of ingredients and principles of processing of wheat products. Manufacturing of baked products, pasta products and breakfast cereals. Manufacturing of products from other cereals such as barley, oats, rice, maize and sorghum. Compulsory factory visits. <i>PP Food Science 244</i>				
<b>354</b>	16	<b>Sensory analysis</b>	3L, 3P	A
Introduction to sensory science; consumer sensory analysis, statistical analysis of data; correlation of data obtained through physical measurement and sensory analysis. Compulsory visits to industry. <i>PP Food Science 244</i> <i>P Biometry 242</i>				
<b>434</b>	16	<b>Quality management systems</b>	3L, 3P	A
Principles and advantages of quality and food safety management systems. Definitions, guidelines, requirements and interpretation of the ISO 9001:2000 standard. Effective internal auditing of a quality management system. Overview of ISO 14000, Eurep-Gap, BRC and organic cultivation practices. Fundamental principles and implementation of statistical food				

processing control. Food safety, hygiene and the impact of food processing on food safety. Codex Alimentarius, the Department of Health's regulations relating to HACCP and pre-requisite programmes. Definitions, guidelines, requirements and interpretation of the ISO 22000:2005 standard. Construction of a process flow diagram. Twelve stages en seven principles of HACCP. Identification of food risks, physical, chemical and biological food hazards en CCPs. Completion of the HACCP plan and HACCP control chart. <i>No examination, class mark serves as final mark.</i> <i>Subject to continuous assessment.</i>			
<b>454</b>	16	<b>Food packaging</b>	3L, 3P   A
Introduction to food packaging and packaging materials. The functions of packaging, the respective packaging materials and selection of suitable packaging materials for specific food applications. The possible interaction between food products and packaging materials. Packaging innovations such as modified atmosphere, active and intelligent packaging. Food packaging design principles. Application of legislation regarding labelling of packaging of food products. Compulsory factory visits. <i>PP Chemistry 114</i>			
<b>478</b>	48	<b>Trial design and product development</b>	3L, 3P   A
Process of product development, legislation, marketing and labelling of food products. Identification of product niche markets and product criteria, market evaluation and trends. Formulation development. Evaluation of sensory characteristics, cost and nutritional content. Proximal analyses. Food safety. Group and individual product development. Product development includes market research, product development, evaluation, use of measuring instruments, measuring techniques, data processing, analyses, interpretation and reporting. Problem diagnosis. Project management programme. Compulsory industry training and report. <i>No examination, class mark serves as final mark.</i> <i>PP Food Science 344, 354</i>			
<b>488</b>	32	<b>Analysis of food products</b>	3L, 3P   A
Introduction to food analysis and food chemistry, sampling for quality control, proximal food analyses, vitamin, colorant and olfactant analysis, analysis of undesirable compounds, application of enzymes and food legislation. Seminar presentations. Compulsory factory visits. <i>Subject to continuous assessment.</i> <i>PP Food Science 344</i>			
<b>771</b>	15	<b>Advanced studies in Food Science</b>	2L   T
Write and presentation of seminars on aspects from one of the following research areas: Food environmental management, food microbiology, food fermentation, food biotechnology, food processing, meat and fish processing and near infrared spectroscopy.			
<b>772</b>	40	<b>Advanced laboratory techniques</b>	2L, 2P   T
Laboratory safety, experimental work, specialised laboratory techniques in one of the following research fields: Food environmental management, food microbiology, food fermentation, food biotechnology, food processing, meat and fish processing and near infrared spectroscopy. Motivation of principles and description of techniques.			
<b>773</b>	60	<b>Training in research methodology</b>	4P   T
Execution of research proposal, data synthesis, scientific writing, evaluation and statistical analysis, discussion and conclusion, recommendation, presentation and defence.			
<b>774</b>	5	<b>Sensory science</b>	2P   T
Sensory analysis in research: Analytical panels and consumer panels, advanced statistical analysis of data.			

<b>11290 FOREST SCIENCE</b>				
(Department of Forest and Wood Science)				
<b>142</b>	8	<b>Introduction</b>	1.5L, 1.5P	E
Introduction to forest science, global forest resources, the forest industry locally and internationally, and plantation systems; silvicultural systems and agroforestry; introduction to, and terminology of, forest engineering; forest management, forest economics and forest policy. One week of practical work in September is to be satisfactorily completed as part of this module. <i>Subject to continuous assessment.</i>				
<b>212</b>	8	<b>Introduction to natural forest ecosystems</b>	2L, 2P	E
The importance of natural forests including functions, products for livelihoods and industry and the management of woodlands for sustainability; classification of forests based on structure and function; characterisation of natural forests based on structure and layering; species composition and diversity, succession concepts and theory, silvicultural systems and sustainable management of natural forests, the ecological and socio-economic sustainability methods of natural tropical forests including criteria and indicators for sustainable forest management, certification and management for non-timber forest products. <i>Subject to continuous assessment.</i>				
<b>222</b>	8	<b>Forest informatics</b>	2L, 2P	E
Data, information and knowledge; information in forestry; forest information systems; concepts in information management; the spatial dimension in forestry; applications of geographic information systems and remote sensing in forest data capture and modelling. <i>Subject to continuous assessment.</i>				
<b>241</b>	4	<b>Forest botany</b>	1L, 1P	E
Taxonomy; commercially important taxa of forest tree species; tree morphology terminology; description of the diagnostic characteristics of commercially important forest tree species that are useful to identify trees with the aid of keys; silvicultural characteristics; wood and pulp properties of most important commercial species of the genera Pinus, Eucalyptus and Acacia, as well as selected tropical and temperate hardwood and softwood species. <i>Subject to continuous assessment.</i>				
<b>242</b>	8	<b>Community forestry</b>	2L, 2P	E
Background to community forestry; knowledge, skills and attitudes for successful community foresters; interaction with communities; participation, facilitation and participation methods; the new forestry professional; participatory analysis, planning, monitoring and evaluation (PAME); land ownership and common property resource management; socio-economic aspects of natural resources; conflict management in natural resource management; non-timber forest products; recreation and community ecotourism; case studies of contemporary issues in community forestry; introduction to urban forestry.				
<b>254</b>	16	<b>Forest mensuration and inventory</b>	3L, 3P	E
Determination of diameter, height, volume, form and density of trees, stands of timber and forest products. Production of volume and taper equations; Sampling techniques and their application in forest inventory. <i>P Mathematics (Bio) 124</i>				
<b>314</b>	16	<b>Silviculture I</b>	3L, 3P	E
Seed treatment; nursery practice; plant quality; mycorrhizal fungi; tree breeding and propagation systems; site preparation; plantation establishment and regeneration;				

vegetation management; environmental factors that influence tree growth in plantations; species-site compatibility; the eco-physiological basis for forest production.				
<b>324</b>	16	<b>Forest finance, economics and marketing</b>	3L, 3P	E
Forestry finance; financial analysis of forestry projects; valuation of land and plantations; basic principles of forestry product marketing; international forestry marketing; timber and non-timber forestry products; forestry business environment. <i>Subject to continuous assessment.</i>				
<b>344</b>	16	<b>Agroforestry</b>	3L, 3P	E
Contemporary issues in community forestry; local and international case studies of community forestry; evaluation of community forestry interventions. Definitions and terms in agroforestry (AF); appropriate silviculture systems; ecophysiological interactions in agroforestry; choice of species and use of indigenous trees; tree nurseries for agroforestry; agroforestry planning and problem analysis; land use planning; counselling design and counselling development; agroforestry in areas with dry or temperate climates; permaculture; interaction between agroforestry and urban forestry; non-timber forest products from natural and established forests; recreation and ecotourism; post production handling and marketing of AF products; socio-economic analysis of AF technology.				
<b>354</b>	16	<b>Forest growth and yield science</b>	3L, 3P	E
Site evaluation; development of site index equations; growing stock and stand density; yield models; prediction of current yield; prediction of future yield. <i>Subject to continuous assessment.</i>				
<b>364</b>	16	<b>Timber harvesting</b>	3L,3P	E
Specialisation in timber harvesting techniques; harvesting equipment and systems; evaluation and selection of systems; introduction to operational analysis and logistics; harvest planning (operational and tactical); impact of harvesting on the environment; utilisation of biomass; introduction to work and time study; introduction to forest ergonomics and forest work science; health and safety in forest operations. One week of practical work in April to be satisfactorily completed as part of this module. <i>Subject to continuous assessment.</i>				
<b>414</b>	16	<b>Silviculture II</b>	3L, 3P	E
Effects of silvicultural practices (coppice management, pruning, thinning and fertilization) and environmental factors on stand growth, timber and pulp quality; nutrition and nutrient cycles in plantations; management of fire, climatic, biological and other risks to promote environmental, socio-political and economic sustainability; monitoring systems and certification with emphasis on plantation forestry. A field school and study tour during the final year is a compulsory part of this module. <i>Subject to continuous assessment.</i>				
<b>422</b>	8	<b>Forest and environmental policy and law</b>	2L, 2P	E
<i>(This module is being taught from 2010.)</i> South African forest policy terminology and semantics; policy cycle; policy objectives; forest history in South Africa; status of forests in South Africa (plantation, woodlands, natural forests); global environmental changes and political process; international treaties; national and international land resource and environmental policy and policy development; certification and sustainable development; interaction between land use and development policy; environmental law and regulations; environmental policy analysis; international forest policy and processes. <i>Subject to continuous assessment.</i>				

<b>424</b>	16	<b>Forestry planning</b>	3L, 3P	E
<p><i>(This module is being taught only until 2009.)</i></p> <p>Principles of business planning; the institutional and economic environment of the forestry industry; organisation of the industry; planning techniques; classification and subdivision of land; annual planning of operations; scheduling of logging operations. Capital, investment and interest; computation of interest; financial analysis; inflation and real price change; land valuation; valuation of plantations; optimal financial rotations; support programmes and leasing schemes.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Forest Science 214</i></p>				
<b>424</b>	16	<b>Forest management and planning</b>	3L, 3P	E
<p><i>(This module is being taught from 2010.)</i></p> <p>Principles of business management; peculiarities in forest production systems; the institutional and economic environment of the forestry industry; organisation of the industry; decision-making and decision support in forest management; planning techniques; classification and subdivision of land; annual planning of operations; scheduling of logging operations.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Forest Science 254</i></p>				
<b>434</b>	16	<b>Forest roads and transport</b>	3L, 3P	E
<p>Introduction to secondary timber transport. Terminology and legislation. Vehicle selection. Transport systems. Tactical replacement of equipment and vehicles. Interactions between timber harvesting, the road and secondary timber transport. Introduction to access development. Introduction to surveying, road material and materials testing. Levels of planning. Forest road network planning and sequence of access development, influencing factors and road placement techniques. Road construction techniques. Road maintenance and drainage. The impacts of roads on the environment and forest certification. Road network management systems.</p> <p><i>Subject to continuous assessment.</i></p>				
<b>444</b>	16	<b>Reconnaissance of the environment (industrial forestry)</b>	3L, 3P	E
<p><i>(This module is being taught only until 2009.)</i></p> <p>A study of the total industry of a chosen or allocated management unit in the forest industry. It includes the collection of data on the following aspects: climate, soil, topography, growing stock, age classes, volumes, areas, tree species, products, markets, infrastructure, equipment, protection, ownership, organisation and staff. A visit of approximately three weeks to the management unit is essential.</p> <p><i>No examination; class mark serves as final mark.</i></p> <p><i>P Forest Science 414, 424, 434</i></p>				
<b>458</b>	32	<b>Management plan</b>	3L, 3P	E
<p><i>(This module is being taught only until 2009.)</i></p> <p>Data as described in Forest Science 444 are analysed, processed and used for yield forecasting, yield regulation, and planning of financial, silvicultural, harvesting, roads and staff matters. This is used for the compilation of a comprehensive Management Plan which must be handed in.</p> <p><i>No examination is written; class mark serves as final mark.</i></p> <p><i>C Forest Science 444</i></p>				

<b>458</b>	32	<b>Management plan</b>	3L, 3P	E
<i>(This module is being taught from 2010.)</i>				
A study of the total industry or a of chosen or allocated management unit in the forest industry. It includes the collection of data on the following aspects: climate, soil, topography, growing stock, age classes, volumes, areas, tree species, products, markets, infrastructure, equipment, protection, ownership, organisation and staff. A visit of approximately three weeks to the management unit is essential.				
Data collected on the management unit are analysed, processed and used for yield forecasting, yield regulation and planning of financial, silvicultural, harvesting, roads and staff matters. This is used for the compilation of a comprehensive management plan upon which the module is assessed.				
<i>No examination is written; class mark serves as final mark.</i>				
<i>C Forest Science 414, 424, 434</i>				
<b>711</b>	40	<b>Growth and yield science</b>	2L, 2T, 1P	E
Studies in spacing and thinning of timber crops; results from the CCT and Nelder experiments in South Africa. Spacing indices and interrelationships. Growth and yield modelling. Advanced forest mensuration and inventory, including optimisation.				
<b>712</b>	40	<b>Forest harvesting</b>	2L, 2T, 1P	E
The study and application of precision forestry techniques, which include the strategic planning and optimisation of harvesting systems and methods, modelling of harvesting systems, advanced work science and work organisation (time-study) and project management.				
<b>713</b>	40	<b>Advanced nursery practice</b>	2L, 2T, 1P	E
Seed collection, seed storage and treatment, growth media, mycorrhizal inoculation, vegetative propagation and clonal hedge management, plant nutrition, water quality, disease management, transplant quality and field survival.				
<b>714</b>	40	<b>Advanced tree breeding</b>	2L, 2T, 1P	E
Studies in the application of genetic principles for tree improvement purposes; breeding techniques, including seed orchard technology and cloning; design, analysis and interpretation of provenance and progeny tests; genetic gain.				
<b>715</b>	40	<b>Community forestry</b>	2L, 2T, 1P	E
Community-based natural resource management (CBNRM), sustainable livelihood framework models, research methodologies in social forestry and community development, social issues in forest resource certification, non-timber forest products (NTFPs), international case studies in community forestry.				
<i>Subject to continuous assessment.</i>				
<b>716</b>	40	<b>Agroforestry</b>	2L, 2T, 1P	E
Agroforestry systems, practices and technologies; diagnosis and design in agroforestry; resource use in agroforestry including competition, complementarity for water, nutrient and light, agroforestry research and development approaches, including on-farm research for technology development and dissemination.				
<i>Subject to continuous assessment.</i>				
<b>722</b>	15	<b>Inventory and monitoring of renewable green resources</b>	3L, 3T	E
Principles of inventory with renewable green resources; geo-statistics; assessing land use; landscape metrics; land resources monitoring and assessment using remote sensing and GIS; spatial data analysis and modelling.				
<i>Subject to continuous assessment.</i>				

<b>723</b>	15	<b>Sustainable land use planning</b>	3L, 3T	E
Functions of land resources; threats; sustainability and sustainable land use; land use planning techniques; integrated land use planning concepts; land use planning and rural development; key factors in integrated land use planning. <i>Subject to continuous assessment.</i>				
<b>724</b>	15	<b>Forest policy</b>	3L, 3T	E
Evaluation of a community forestry programme; human-forest interface; planning of community forestry projects; stake holder analysis in community forestry project planning; political processes affecting land resources and environmental policy development; environmental law and regulations and environmental policy analysis; devolution in natural resource management; integrated land use planning. <i>Subject to continuous assessment.</i>				
<b>731</b>	15	<b>Community forestry</b>	3L, 3T	E
Agroforestry systems; tree-crop-soil interactions in agroforestry; community based natural resource management, applied participatory rural appraisal methodology; non-timber forest products; research methodologies for social and natural sciences. <i>Subject to continuous assessment.</i>				
<b>732</b>	15	<b>Plantation forest management</b>	3L, 3T	E
Management as cybernetic cycle; foundations and principles; advanced goal planning and objective setting, analytical hierarchy process; advanced forest inventory concepts; advanced planning techniques; multi-criteria spatial decision support, simulation; integrated resource planning in forest plantations. <i>Subject to continuous assessment.</i>				
<b>733</b>	15	<b>Measurement of growth and prediction of yields</b>	3L, 3T	E
Aspects of advanced forest mensuration, forest inventory, growth and yield estimation, regulation and modelling; simulation of thinning responses and optimisation of stand density control. <i>Subject to continuous assessment.</i>				
<b>734</b>	15	<b>Harvesting and logistics</b>	3L, 3T	E
Advanced concept integration of timber harvesting, access development and logistics; precision forestry techniques; logging mechanics. <i>Subject to continuous assessment.</i>				
<b>741</b>	40	<b>Advanced forestry planning</b>	2L, 2T, 1P	E
Advanced forest inventory concepts (multiphase/multistage sampling including remotely sensed data; permanent forest inventory (CFI)); general planning concepts and decision-making techniques (operations research: decision models, simulation, scenario technique, scoring, AHP and linear/non-linear programming using EXCEL as example, planning under uncertainty); forest planning systems (age-class system, CFC, risk management).				
<b>742</b>	40	<b>Forest roads and logistics</b>	2L, 2T, 1P	E
The study of advanced forest logistics and transport management, which includes the strategic planning and optimisation of forest road access development, advanced road construction and maintenance techniques. Emphasis will be placed on the application of GIS and remote sensing techniques.				
<b>743</b>	40	<b>Sustainable silviculture</b>	2L, 2T, 1P	E
Harvesting and environmental impacts management, slash management and site preparation; forest disturbance and regeneration, competition management, nutrient and carbon cycling; fire and fuel modelling and management.				

<b>744</b>	40	<b>Forest eco-physiology</b>	2L, 2T, 1P	E
Synthesis of growth resource availability: radiation, soil water and nutrient dynamics, stand eco-physiological response mechanisms to silvicultural operations, physiological growth modelling, carbon sequestration; effect of silvicultural operations on wood and fibre quality.				
<b>752</b>	15	<b>Forest ergonomics</b>	3L, 3T	E
Advanced concept integration of ergonomics and forest work science pertaining to timber and biomass harvesting and transport; project management. <i>Subject to continuous assessment.</i>				
<b>753</b>	15	<b>Natural forest ecosystems</b>	3L, 3T	E
Structure and function of forest ecosystems; silvicultural systems; site-species interactions; management and sustainability of forest ecosystems; mycorrhizal fungi; natural regeneration; nutrient cycling in forest ecosystems. <i>Subject to continuous assessment.</i>				
<b>754</b>	15	<b>Silviculture</b>	3L, 3T	E
Genetic tree improvement; hybridisation; propagation techniques, site-species interactions; mycorrhizal fungi; stand regeneration; basic forest eco-physiology. Site, vegetation, and nutrient management; pruning; thinning; risk management. <i>Subject to continuous assessment.</i>				
<b>761</b>	15	<b>Bioenergy systems</b>	3L, 3T	E
Bio-energy systems: Production; harvesting and supply; biomass conversion; energy production; marketing of bio-energy; economics and political framework. Bio-energy services: Greenhouse gas balances of bio-energy systems; trading options for bio-energy; rural development; small grower systems; small business creation; wood-based bio-energy systems. <i>Subject to continuous assessment.</i>				
<b>762</b>	15	<b>Biomass production systems</b>	3L, 3T	E
Sources of biomass; global biomass production; biomass in southern Africa; potential and limitations; principles in biomass production systems; agriculture, forestry and agroforestry systems. <i>Subject to continuous assessment.</i>				
<b>763</b>	15	<b>Forest economics</b>	3L, 3T	E
South African commercial forestry in an international context; forestry supply and demand; economic growth and development in the forestry industry; economic forces impacting on plantation and tropical hardwood forestry; forestry strategies and globalisation; value of natural resources; forestry, poverty and tenure. <i>Subject to continuous assessment.</i>				
<b>764</b>	15	<b>Agroforestry</b>	3L, 3T	E
Conversion of wood into energy, processing methods, determination of calorific values and other properties, comparison of different biofuels, environmental aspects, emissions. <i>Subject to continuous assessment.</i>				
<b>771</b>	34	<b>Research project</b>	2L, 2T, 1P	E
An exercise in research under guidance, including motivation, experimental design, allocation of treatments, data capture, data analysis, formulation of results and conclusions. Final product is essentially a mini-thesis.				

<b>13285 GENETICS</b>				
(Department of Genetics)				
<b>214</b>	16	<b>Introductory genetics</b>	3L, 3P	T
<i>Part I: Principles of Heredity</i> Molecular basis of genetic diversity and heredity; the cell cycle; mitosis and meiosis; chromosomes, genes and heredity; Mendelian genetics; linkage and crossing over of genes on a chromosome; linkage analysis and gene mapping; sexual reproduction and sex determining chromosomes; mutations that affect chromosome number and structure and their phenotypic effects.				
<i>Part II: Population genetics</i> Introduction to population genetics; population diversity and genotype and allele frequencies; Hardy-Weinberg principle; forces of evolution - natural selection, mutation, drift and inbreeding; evolutionary genetics; conservation genetics; quantitative genetics and heredity.				
<i>P Biology 124 or 144 or 154</i>				
<b>244</b>	16	<b>Introductory molecular biology</b>	3L, 3P	A
The biology of the molecule of life. The structure of double-stranded DNA; the processes of replication and recombination of DNA; the deciphering and nature of the genetic code; the processes of transcription and translation; protein structure and function; the regulation of gene expression in prokaryotes and eukaryotes; DNA mutations; DNA repair and transposable elements; the construction and analysis of DNA clones; applications and ethics of recombinant DNA technology; introduction to bio-informatics.				
<i>P Genetics 214</i>				
<b>314</b>	16	<b>Cytogenetics</b>	3L, 3P	A
The module focuses on the organisation, structure and functionality of chromosomes and covers the following: Chromosome structure during the different phases of the cell cycle; DNA organisation within chromosomes; repeated DNA sequences with clear genomic functions (telomeres, centromeres, nucleolus organising regions); repeated DNA sequences without clear genomic function (dispersed and tandem repeats); the organisation of coding chromosomal regions; multiple copy genes (rRNA and tRNA genes); protein coding gene families (globin, immunoglobulin and histone gene families); deviant chromosome types (ring, telocentric, dicentric, acentric, iso- and pseudo-isochromosomes, etc.); DNA methylation, gene expression and epigenetic effects; chromosome deviations that result from non-syntenic recombination of large repeat sequences or short tandem repeats; chromosome pairing, chiasma formation and crossing over during meiosis; spindle formation and chromosome separation; variations in chromosome morphology (translocations, deletions, duplications and inversions) and its effect on meiotic pairing structures and gametes produced (with examples, especially in humans); non-disjunction and chromosome lagging as causes of chromosome aberrations; variations in chromosome number (aneuploidy, polyploidy and mosaics); genetic regulation of the cell cycle and cancer; extranuclear inheritance; genetics of development and behaviour; gene therapy.				
<i>Subject to continuous assessment.</i> <i>PP Genetics 244</i>				
<b>324</b>	16	<b>Population genetics</b>	3L, 3P	A
The genetic structure and dynamics of populations; frequencies of genes and genotypes; genetic polymorphisms; random mating and the Hardy Weinberg principle; factors that determine genetic change and genetic equilibrium: mutation, migration, selection and population size; linkage disequilibrium; heterozygosity in subdivided populations; genetic relationships between populations, implications for genetic identification (DNA typing);				

genetic data analysis. <i>Subject to continuous assessment.</i> <i>P Genetics 244</i>				
<b>344</b>	16	<b>Advanced molecular genetics</b>	3L, 3P	A
<i>Studying genomes: Characteristics of genomes; techniques for the study of genomes (practical classes); genetic and physical mapping of genomes (including DNA markers and applications in mapping of genes involved with genetic diseases); diagnostic applications in human genetics, marker-assisted selection in plant and animal breeding. DNA fingerprinting and forensic science; genome projects, i.e. human genome project: characterisation of genomes (identification of genes, determination of gene function, comparison of genomes); creation and applications of transgenic animals, animal models for human genetic diseases. How the genome functions: Role of DNA binding proteins, initiation of transcription; synthesis and processing of RNA and the proteome; regulation of genome activity.</i> <i>Subject to continuous assessment.</i> <i>PP Genetics 244</i>				
<b>354</b>	16	<b>Quantitative genetics</b>	3L, 3P	A
Genetic development of animals and crops. Quantitative traits and continuous variation; resemblance between relatives; estimation of heritability and breeding value; selection methods and genetic improvement; correlated traits; multiple traits selection; molecular assisted selection. <i>Subject to continuous assessment.</i> <i>PP Genetics 324</i> <i>P Biometry 274 or Biometry 212, 242 or Biology 272</i>				
<b>414</b>	16	<b>Plant breeding techniques</b>	3L, 3P	A
Plant breeding objectives; reproduction in plants; cell and tissue culture; breeding strategies for self-and cross-pollinating crops; the utilisation of hybrid vigour; mutation breeding; breeding for insect and disease resistance; variations in chromosome number and its exploitation in breeding programmes; plant breeder's rights. <i>Subject to continuous assessment.</i> <i>PP Genetics 344</i>				
<b>444</b>	16	<b>Quantitative traits and selection methods</b>	3L, 3P	A
Components of phenotypic and genetic variance in self-pollinating crops, cross-populations and cross-pollinating crops; the role of linkage and recombination; experimental design and data analysis; methods of selection and predictions of genetic progress; index selection; genotype/environment interaction; gene mapping of quantitative traits by means of marker genes; marker-assisted selection. <i>Subject to continuous assessment.</i> <i>P Genetics 414</i>				
<b>713</b>	10	<b>Genetic data analysis and bioinformatics</b>	2L, 3P, 1T	T
Genetic data analysis: Examples of discrete traits; genetic and statistical sampling; estimating allele frequencies; testing heterogeneity over samples; detecting and estimating linkage; examples of quantitative traits; modelling quantitative traits. Bioinformatics: Nucleotide databases; protein databases; retrieval, analyses, comparison and annotation of nucleotide sequences; protein sequence and structure analyses; identifying protein domains and orthologous groups; basic -omics applications (genomics, transcriptomics, proteomics, metabolomics); systems biology; gene ontology. <i>Subject to continuous assessment.</i>				

772	10	<b>Use of computer software in plant breeding</b>	3P	T
<p>The module is based on the use of the Agrobase GII programme and covers the following:  <i>Data capturing and management:</i> Managing and editing treatment or variety lists, traits, locality names. Data transformation, sorting and filtering.  <i>Experiment management:</i> Managing germplasm and planning crosses. Planning and managing nurseries. Planning and managing experiments. Deriving planting plans, printing labels and preparing reports.  <i>Data analysis:</i> ANOVA, NNA, GLM, AMMI, and diallel. Evaluation of genotypic performance.  <i>Subject to continuous assessment.</i>  <i>P Genetics 324 or equivalent</i></p>				
773	24	<b>Advanced plant breeding</b>	3P, 1S	T
<p>Randomisation and analysis of experimental designs in field selection trials. Comparisons among genotypes that are being evaluated: dealing with genotype-environment interaction, stability, adaptability, Eberhart-Russell regression and rank tests. AMMI (Additive Main effects and Multiplicative Interaction) analysis of genotypes across localities. Derivation of selection indices.  <i>Subject to continuous assessment.</i>  <i>P Genetics 324 or equivalent</i></p>				
774	40	<b>Plant breeding techniques</b>	4P, 1S	T
<p>Acquisition of practical skills regarding a selection of techniques that relates to, or is directly applicable to the student's main field of interest. Techniques are chosen from the following: cytogenetic procedures (chromosome counts, meiosis and <i>in situ</i> hybridisation); aneuploid analyses and mapping; wide crosses and introgression; embryo rescue; production of haploids using androgenesis or pollination with an incompatible species; chromosome doubling to produce doubled haploids or polyploids; seedling disease evaluations and recording of disease ratings; use of host-pathogen interactions (rusts) to identify genes and pathotypes; use of polymerase chain reaction based markers in marker-assisted selection; backcrossing; planning, design, planting, maintenance and harvesting of field trials; use of male sterility in breeding; use of chemical and physical mutagens in breeding; testing of breeding lines for commercial processing ability; etc.  <i>Subject to continuous assessment.</i>  <i>P Genetics 414 or equivalent</i></p>				
775	30	<b>Plant breeding literature study</b>	1S	T
<p>Preparation and presentation of scientific data for publication purposes. Oral presentations aided by "PowerPoint". Reading, discussion and seminar assignments of the latest, relevant (according to the student's main field of interest) plant breeding literature.  <i>Subject to continuous assessment.</i></p>				

## 56502 GEOGRAPHY AND ENVIRONMENTAL STUDIES

(Department of Geology, Geography and Environmental Studies)

324	16	<b>Introduction to geographical information systems</b>	3L, 3P	E
<p>Definition and technical overview of GIS; principles of spatial data structures; South African co-ordinate systems and projection systems; input, capturing, manipulation, analysis and presentation of geodata; integration and exchange of South African national data sets (e.g. census data, topographic data, research); practical GIS application: South African case studies (e.g. decision support for socio-economic and physical environment problems).  <i>Subject to continuous assessment.</i></p>				

<b>64165 GEO-ENVIRONMENTAL SCIENCE</b>				
(Department of Geology, Geography and Environmental Studies)				
<b>114</b>	16	<b>Introduction to earth system science</b>	3L, 3P	T
<p>Introduction to earth system science; star forming processes; the solar system and earth; internal operation of earth; mineral and rock forming processes; the origin of magma and igneous rocks; external structure of the earth; continent forming processes; plate tectonic processes; sedimentary rocks and geological record; the geological time scale; metamorphic rocks and mountain building; humans and plate tectonic processes - earthquakes and volcanoes; the hydrosphere; surface water processes; ground water processes; theory about the origin and evolution of life; global scale environmental systems: Structure and interaction processes in the atmosphere, lithosphere and biosphere; ecosystems and the human niche in the environment; mineral and energy reserves; global change and environmental problems (i.e. the greenhouse effect, hole in the ozone and loss of biodiversity).</p> <p><i>A 50% sub-minimum for practical work is required for admission to the examination.</i></p>				
<b>144</b>	16	<b>Mapping of human- environment systems</b>	3L, 3P	T
<p>Collection and mapping of spatial information (surveying, remote sensing, aerial photography); mapping and expression of physical and cultural landscapes (aerial photos and ortho-photos); cartographic principles and concepts (map scales, coordinate systems, map projections); map construction and illustration techniques (e.g. layout, graphical principles, production techniques, data classification and map symbols); training in geographical information systems (GIS) with the focus on the visualisation of spatial information.</p> <p><i>Subject to continuous assessment.</i></p>				
<b>39632 HORTICULTURE</b>				
(Department of Horticultural Science)				
<b>222</b>	8	<b>Fruit production</b>	1.5L, 1.5P	A
<p>Overview of the fruit industry with emphasis on the technology of fruit production, including vegetative reproduction, rootstocks, delayed foliation, cross pollination, fruit thinning, ripeness maturity standards, principles of pruning and training.</p> <p><i>No examination, class mark serves as final mark.</i></p> <p><i>P Crop Production 142</i></p>				
<b>314</b>	16	<b>Deciduous fruit production</b>	3L, 3P	A
<p>Biology and technology of deciduous fruit production (pome fruit, stone fruit and table grapes). Bearing habits, rootstocks, nursery tree quality, vegetative development, shoot and root growth, growth reactions to bending and pruning of shoots. Eco-, para- and endo-dormancy. Carbohydrate and nitrogen reserves. Reproductive development, flower formation, fruit set, regulation of yield, fruit growth, fruit colour development, fruit ripening.</p> <p><i>P Crop Production 214</i></p>				
<b>342</b>	8	<b>Citrus production</b>	1.5L, 1.5P	A
<p>Biology and technology of citrus production. Rootstocks, nursery tree quality, vegetative development, shoot and root growth. Reproductive development, fruit growth, external and internal fruit quality.</p> <p><i>P Crop Production 214</i></p>				
<b>352</b>	8	<b>Cut flower and foliage production</b>	1.5L, 1.5P	A
<p>Biology and technology of the production of cut flowers and foliage. Production prerequisites for selected flower types like roses, carnations, chrysanthemums and fynbos. Control of flower initiation, scheduling of flowering time, colour development and other quality characteristics.</p> <p><i>P Crop Production 214</i></p>				

<b>414</b>	16	<b>Ecophysiology of fruit and flower crops</b>	3L, 3P	A
<p>Advanced principles of stomatal conductance, transpiration, photosynthesis and respiration. Micro-climatological influences on gas exchange. Effects of excess energy - temperature and light. The use of chlorophyll fluorescence as stress indicator. Upscaling of gas exchange and carbon balance of crops. Water relations of cells, tissues and whole plant. Stress physiology and advantageous aspects of stress. Climate change and agriculture. Theory and application of ecophysiological measurement techniques. The writing and presentation of a seminar.</p> <p><i>PP Horticulture 314</i> <i>P Biochemistry 244; Soil Science 344</i></p>				
<b>434</b>	16	<b>Applied plant physiology and tree architecture</b>	3L, 3P	A
<p><i>Lectures:</i> underlying physiology of growth, development and production practices of horticultural crops. Correlative phenomena and the role of plant hormones supported by an overview of relevant cell, tissue and organ anatomy as well as basic genetic principles. Overview of environmental perception and acclimation/adaptation. Dormancy as morphogenetic and survival mechanism. Physiology of growth cessation, hardening, induction and progression of dormancy, rest breaking and branching. Tree architecture and training systems, principles and techniques of tree manipulation and the role of rootstocks. Integration of the above with knowledge on production practices gained in preceding modules.</p> <p><i>Practicals:</i> <i>inter alia</i> lectures by industry specialists on relevant pre-harvest topics as well as visits to fruit production areas to illustrate and support the module content.</p> <p><i>P Horticulture 314</i></p>				
<b>444</b>	16	<b>Postharvest physiology and technology</b>	3L, 3P	A
<p><i>Postharvest physiology of fresh plant products:</i> structure and composition of the product, role of respiration and ethylene metabolism, fruit ripening and senescence, physiological defects or disorders, food safety.</p> <p><i>Postharvest technology:</i> water relations and psychrometrics, quality and maturity parameters, harvest and packing, cooling and storage technology such as controlled atmosphere, transport of fresh plant products.</p> <p>Plant products that are discussed to illustrate principles include deciduous fruit (pome, stone and table grapes) as well as some tropical and subtropical crops, cut flowers and vegetables.</p> <p><i>Practicals:</i> A research project as well as a series of lectures by industry specialists on topics such as postharvest problems, profitability of certain deciduous fruit types, market trends, and alternative crops like fynbos. Visits to the municipal market, pack houses and cold stores, fresh produce distribution centres and the Cape Town port for handling of export products.</p> <p><i>C Biochemistry 244</i></p>				
<b>464</b>	16	<b>Tree nutrition</b>	3L, 3P	A
<p>Phloem transport and carbohydrate partitioning. Root anatomy, mineral application, uptake and partitioning in deciduous fruit and proteas. Crop-based nutritional requirements and application strategies; management of vegetative and reproductive balances and the role of rootstocks. Factors affecting mineral uptake.</p> <p><i>Practicals:</i> <i>i.e.</i> an orchard report. Cultivation of alternative crops.</p> <p><i>PP Horticulture 314</i> <i>P Soil Science 244</i></p>				
<b>771</b>	30	<b>Research methodology</b>	1L	T
<p>Literature searches, critical reading of scientific papers, philosophy and ethics of research, scientific writing skills, statistical methods applicable to Horticulture.</p>				
<b>772</b>	30	<b>Advanced plant physiology</b>	1L	T
<p>Study selected course material, relevant to the production of horticultural crops and to the deepening of basic physiological knowledge. Subjects covered include; anatomy,</p>				

biophysics, basic genetics, primary and secondary metabolism, growth and development, and plant-environment interaction.				
<b>773</b>	14	<b>Laboratory techniques</b>	0.5P	T
The working of instrumentation used in Horticultural research, e.g. ecophysiological apparatus, HPLC, GC and spectrophotometer. Analytical methods commonly used in horticultural research, e.g. carbohydrate analysis, plant pigment determination, plant hormone determination.				
<b>774</b>	40	<b>Research project</b>	2L	E
Literature review on selected research topic, drawing up a research plan, performing treatments, collection, processing and interpretation of data, writing a research report. Regular feedback on the above via oral presentations.				

### 44792 INDUSTRIAL ERGONOMICS

(Department of Industrial Engineering)

<b>414</b>	15	<b>Industrial ergonomics</b>	3L, 1.5T	A
------------	----	------------------------------	----------	---

Operation analysis; work standards; reduction of setup times; training practices; remuneration; anthropometry; workstation and tool design; man/machine interfaces; work physiology and biomechanics; the work environment, cognitive work; shift work; aspects of occupational health and safety.

### 53937 INDUSTRIAL MANAGEMENT

(Department of Industrial Engineering)

<b>354</b>	15	<b>Industrial management</b>	2L, 2T	A
------------	----	------------------------------	--------	---

Industry dynamics and the value chain, BPR (Business Process Re-engineering); SCM (Supply Chain Management) and logistics management, information technology and e-commerce within the framework of a formal ERP (Enterprise Resource Planning) system.  
*P Production Management 244*

### 47422 INDUSTRIAL PROGRAMMING

(Department of Industrial Engineering)

<b>244</b>	15	<b>Industrial programming</b>	2L, 3T	A
------------	----	-------------------------------	--------	---

Use of spreadsheets: Data manipulation, numerical methods, graphs, basic financial calculations, planning and analysis of scenarios and optimising; Visual Basic for Applications for spreadsheet use. Basic computer communication. Theory and application of forecasting with emphasis on spreadsheet applications.

*Subject to continuous assessment.*

*P Engineering Mathematics 214*

### 10553 INDUSTRIAL PSYCHOLOGY

(Department of Industrial Psychology)

<b>112</b>	4	<b>Introduction to human resource management</b>	1L	A
------------	---	--	----	---

Role and benefit of Industrial Psychology in organisations, human resource planning and recruitment, selection of staff, training and development, performance management, remuneration management, work values and attitudes, motivation within the context of work, leadership, groups and work teams, organisation development and change, the labour relation, trade unions, employers and the State, labour relations in the work place.

<b>244</b>	16	<b>Human resource management</b>	3L, 1P	A
------------	----	----------------------------------	--------	---

Nature of human resource management, organisational position of the human resource management department, human resource management aims and human resource manage-

ment policy, scientific human resource planning, post analysis, recruitment, selection, induction, training and development, achievement assessment, basic enumeration, post evaluation, encouragement enumeration, indirect enumeration, labour turn over, work absence, human resource management information systems, safety and health, capital investment in human material, flexi-time, quality of working life and social responsibility, challenges and issues on human resource management terrain, the responsibility, the human resource management audit, role of human resource management in the labour situation in SA - a futuristic look.

<b>314</b>	12	<b>Labour relations</b>	2L, 0.5S	A
Introduction and overview of field of study, history of the development of labour relations, influences of the environment on labour relations, trade unions, employers, the State, relations in the work place (grievances, discipline and dismissal). Introduction to labour legislation: Act on Labour Relations, Act on Basic Service Conditions. <i>P Industrial Psychology 244</i>				

### **44776 INDUSTRIAL PSYCHOLOGY (SPECIAL)**

(Department of Industrial Psychology)

<b>354</b>	12	<b>Industrial psychology (special)</b>	3L	A
Human resources management; human resource planning; recruitment, selection, induction, training and development; performance assessment; remuneration management; labour relations: field of study; organised labour; role of employers; labour law. Organisation psychology: introduction and overview, organisational design, the individual group and teamwork, motivation, leadership, organisational efficiency.				

### **55344 INVESTMENT MANAGEMENT**

(Department of Business Management)

<b>254</b>	16	<b>Introduction to investment theory</b>	3L, 1P	A
Portfolio theory and management, relationship between risk and yield, effective market hypothesis, valuation and risk characteristics of fixed interest bearing effects, judging of share investments, properties of derived instruments, strategies for use of derived instruments, valuation of options and term contracts, measurement and evaluation of portfolio yields. <i>P Statistics 186 or Statistical Methods 176; Business Management 142</i>				

### **59439 LANGUAGE SKILLS (AFRIKAANS)**

(Language Centre)

<b>143</b>	12	<b>Language skills (Afrikaans)</b>	4L, 2T	A
The learning and mastering of basic reading and writing skills in Afrikaans.				
<b>163</b>	12	<b>Language skills (Afrikaans)</b>	4L, 2T	A
The learning and mastering of further reading and writing skills in Afrikaans. Aspects of verbal and non-verbal communication. Written communication.				
<b>213</b>	10	<b>Language skills (Afrikaans)</b>	4L, 1T	A
The further learning and mastering of basic reading and writing skills in Afrikaans. Aspects of verbal and non-verbal communication. Written communication.				
<b>243</b>	10	<b>Language skills (Afrikaans)</b>	4L, 1T	A
The further learning and mastering of basic reading and writing skills in Afrikaans. Aspects of verbal and non-verbal communication. Written communication.				

<b>59730 LANGUAGE SKILLS (ENGLISH)</b>				
(Language Centre)				
<b>153</b>	12	<b>Communication skills in English (intermediary)</b>	4L, 2T	A
The learning and mastering of basic reading, listening and writing skills in English.				
<b>223</b>	10	<b>Language skills (English)</b>	4L, 1T	A
The further learning and mastering of basic reading, listening and writing skills in English. Aspects of verbal and non-verbal communication. Written communication.				
<b>53198 LIVESTOCK INDUSTRY MANAGEMENT</b>				
(Department of Animal Sciences)				
<b>877</b>	96	<b>MPhil assignment</b>		T
<i>Students write a comprehensive report pertaining to a study chosen in consultation with the supervisor.</i>				
<b>50407 LOGISTICS MANAGEMENT</b>				
(Department of Logistics)				
<b>214</b>	16	<b>Logistics management</b>	3L, 1P	A
Introduction to logistics management: the role of logistics in the firm, the elements of logistics, integrated logistics management, channels of distribution, customer service, strategic aspects of logistics management, organisation for effective logistics, international logistics, new trends. <i>PP Business Management 113</i>				
<b>244</b>	16	<b>Logistics management</b>	3L, 1P	A
Business logistics: Private (own) logistics, the outsourcing decision, professional logistics, transport management and operations, arrangement of the supply chain. <i>PP Business Management 113, Logistics Management 214</i>				
<b>318</b>	24	<b>Logistics management</b>	4L	A
Logistics planning and organisation: Strategic aspects of logistics planning. Procurement and production scheduling, managing incoming traffic, materials flow and handling, warehouse management, packaging, order processing. Transport management and operations, intermodal transport, local and international distribution, import and export practice and documentation. <i>PP Logistics Management 244, Economics 178 or Economics 114, 144</i>				
<b>348</b>	24	<b>Logistics management</b>	4L	A
Logistics control: Logistics cost management. Coordination of supply chains. Monitoring and control of logistics performance. Measures of evaluation; the measurement of efficiency, effectiveness and financial productivity. Customer requirements versus achievable logistics performance. Review of logistics goals and objectives. <i>PP Logistics Management 244, Economics 178 or Economics 114, 144</i>				
<b>23795 MARKETING MANAGEMENT</b>				
(Department of Business Management)				
<b>214</b>	16	<b>Marketing management</b>	3L, 1P	A
Modern marketing dynamics in businesses and the community; marketing and the value creation process; consumer satisfaction through quality and service; strategic marketing				

planning; analysis of the marketing environment; marketing information and research; analysis of consumer markets and other types of markets; measuring and estimating of the demand; market segmentation and target market choice; product decisions; price decisions; channel decisions and place strategy; communication decisions; direct marketing and sale promotion decisions.

*C Financial Accounting 288 or Financial Management 214 or Biometry 212\**

*\*Only for Food Science students*

<b>244</b>	16	<b>Advertising and promotion management</b>	3L, 1P	A
Advertising and the marketing process; the consumer community; portfolio planning and research; operation of advertising; advertising planning and strategy; advertising media; media planning and purchases; printed media; creative advertising; integration of the elements of marketing communication. <i>P Marketing Management 214</i>				
<b>314</b>	12	<b>Retail management</b>	2L	A
Retail strategy and the retail mix; establishment decisions; merchandise decisions; price decisions; communication decisions; consumer services and information; technology and systems; permission agreements. <i>P Marketing Management 214</i>				
<b>324</b>	12	<b>Service management</b>	2L	A
Unique characteristics of services; nature and process of service delivery, differences between product and service evaluation, creation, communication and delivery of services; service quality and measurement thereof; organising and implementing service marketing. <i>P Marketing Management 214</i>				
<b>344</b>	12	<b>Marketing research</b>	2L	A
Circumscription of the marketing problem; research design; exploratory research design for secondary data and quantitative research; surveys and observations in descriptive research design; measurement and scale development; questionnaire design; sampling methods; field work and data preparation; hypothesis testing; analysis of variance and co-variance; correlation and regression. <i>P Statistical Methods 176 or Statistics 186; Marketing Management 214, 244</i>				
<b>354</b>	12	<b>Strategic marketing</b>	2L	A
Role and application of marketing in various instances and conditions; business and marketing strategy; competitive marketing strategies; international marketing strategies; the marketing system; consumer markets and buying behaviour; institutional markets and consumer behaviour; marketing information systems and marketing research; marketing planning processes; marketing control. <i>P Marketing Management 214, 244</i>				

## **21539 MATHEMATICS**

(Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science))

<b>114</b>	16	<b>Calculus and Linear Algebra</b>	5L, 2T	A & E
Induction and the binomial theorem. Functions, limits and continuity; derivatives and rules of differentiation; applications of differentiation; the definite and indefinite integral; integration of elementary functions.				
<b>144</b>	16	<b>Calculus and Linear Algebra</b>	5L, 2T	A & E
Complex numbers; transcendental functions; techniques of integration; improper integrals; conic sections; partial derivatives; introduction to matrices and determinants. <i>P Mathematics 114</i>				

<b>21547 MATHEMATICS (BIO)</b>				
(Department of Mathematical Sciences (Mathematics, Applied Mathematics and Computer Science))				
<b>124</b>	16	<b>Mathematics for biological sciences</b>	4L, 2T	A & E
Functions and their inverses: polynomial functions, rational functions, power functions, exponential functions, trigonometric functions, and solving of trigonometric equations. Composition of functions; limits; definition of the derivative of a function; continuity. Differential rules and differential formulas; higher-order derivatives; implicit differentiation. Applications of differentiations: growth and decay curve sketching, optimisation problems, differentials; indefinite integrals; integration techniques: substitution, factorising into partial fractions, factorial integration. The definite integral as the limit of a sum. The fundamental theorem for differentiation and integration. Definite integrals as areas. Solving and using simple differential equations.				
<b>16284 MICROBIOLOGY</b>				
(Department of Microbiology)				
<b>214</b>	16	<b>Introductory microbiology</b>	3L, 3P	T
History, microscopy; classification; structure and function; nutrition requirements and growth factors; food uptake; generation of energy; culture media; growth curves; yields and effects of nutritional limitations; continuous cultures; physical and chemical control; environmental factors; antimicrobial therapy; eukaryotic cell structure and function. Microbes in the dairy and meat industry; beer, wine and bread; microbes as food source. <i>PP Biology 124 or 144</i> <i>P Chemistry 114, 154</i>				
<b>244</b>	16	<b>Microbial diversity and ecology</b>	3L, 3P	T
Prokaryotes; kingdoms of life and classification; Archaea cell structure and functions; gram-positive bacteria; gram-negative bacteria; actinomycetes, "cyano-bacteria". Fungal groupings, cell structure and function, structure of viruses and virus taxonomy, bacteriophages, human viruses. Microbiology of air, water and soil environments, various metabolic types of micro-organisms, role of micro-organisms in mineralization and biochemical cycles, as well as energy flow through the food web, animals and plants dependent on micro-organisms, including symbiotic relationships, microbe-plant relationships and microbe-insect relationships, interactions between micro-organisms. <i>PP Biology 124 or 144</i>				
<b>354</b>	16	<b>Industrial microbiology</b>	3L, 3P	T
Food fermentations; traditional microbial processes; beer, wine, bread, cheese, yoghurt, salami and so on. Specialised food fermentations, e.g. biological preservatives, preparation and role of micro-organisms. Quality control: HACCP, ISO 9000, etc. The occurrence of pathogens and food-spoilage bacteria and their control. Industrial production of non-food products: selected examples of industrial production of enzymes, antibiotics and pharmaceutical products; effect of substrate on production levels. <i>PP Microbiology 214</i>				
<b>43850 NEMATOLOGY</b>				
(Department of Conservation Ecology and Entomology)				
<b>344</b>	16	<b>Plant nematology</b>	3L, 3P	A
An introduction to Nematology, which includes plant and insect parasitic nematodes. Morphological characteristics of diagnostic value, reproduction and biology in general. Agricultural control of plant parasitic nematodes and the control of insects by using insect				

parasitic nematodes. Identification and biology of specific plant parasitic and insect nematode genera of economic importance. Extraction techniques and identification of life specimens by means of light microscopy.

### 33103 OENOLOGY

(Department of Viticulture and Oenology)

<b>142</b>	8	<b>Introduction to oenology</b>	1.5L, 1.5P	T
An introduction to the composition of grapes, must and wine, as well as micro-organisms in winemaking. The fundamentals of alcoholic fermentation, winery equipment and production methods. An introduction to wine styles and wine evaluation.				
<b>244</b>	16	<b>Introduction to oenology</b>	3L, 3P	A
An overview of the South African grapevine and wine industries; grape production for different uses, such as grapes for drying, table grapes, wine grapes; introductory morphology, ecology; composition of must, grapes and wine; micro-organisms in winemaking. Alcoholic fermentation. An overview of the principles and techniques in the making of the various types of wine and brandy. Wine evaluation. <i>C Crop Production 214, Crop Protection 244</i>				
<b>314</b>	16	<b>Principles and techniques of winemaking I</b>	3L, 3P	A
The harvesting and handling of grapes, must and skins before, during and after fermentation; criteria for determining harvest readiness; requirements for and techniques of grape-receiving systems; transport systems; separators, presses and clarification systems; must balancing; fermentation aspects; temperature control; colour extraction techniques; wine evaluation; making of experimental wines; cellar visits; techniques for wine analysis. <i>P Oenology 244, Chemistry 114 (or B134), 154</i> <i>C Viticulture 314</i>				
<b>344</b>	16	<b>Principles and techniques of winemaking II</b>	3L, 3P	A
Finning and clarification of wine, filtration and bottling of wine. The making of concentrates. Enzymes in winemaking. Wine blending. Wine evaluation. Evaluation of experimental wines. <i>P Oenology 314</i>				
<b>414</b>	16	<b>Wine stabilisation, quality control, environmental management</b>	3L, 3P	A
Principles and techniques of wine stabilisation; phenols in grapes and wine; protein, tartrate, oxidative, colour and metal stability; cooling; wood chemistry; quality control systems; product specifications; environmental management systems; wine evaluation; fining trials; stability tests; sensory identification of faults; product development; compulsory vacation work in cellars. <i>P Oenology 314, 344</i> <i>P Biochemistry 214, 244</i>				
<b>424</b>	16	<b>Applied wine microbiology</b>	3L, 3P	A
Applied aspects of yeasts, moulds and bacteria during winemaking; malolactic fermentation; microbial spoilage of wines; preservatives; tests for microbiological stability; identification of faults. <i>P Oenology 314, 344</i> <i>P Biochemistry 214, 244</i>				
<b>444</b>	16	<b>Applied fermentation chemistry and wine analysis</b>	3L, 3P	A
Chemical composition of grapes, juice and wine and the importance thereof for the fermentation process and wine quality; yeast biochemistry and the formation of fermentation products.				

in particular aroma and flavour compounds. Techniques for wine analysis; physical and chemical analysis of juice and wine. Work assignments and reporting. <i>P Oenology 314, 344</i>				
<b>454</b>	16	<b>Wines and brandies, regulations</b>	3L, 3P	A
Principles and techniques of brandy-making and maturation; top wine countries of the world; legislation and regulations affecting wine, brandy, industrial health and safety, the environment; the wine of origin system; evaluation of foreign wines; small-scale brandy distillation; basic marketing and global competition. <i>P Oenology 314, 344</i>				
<b>771</b>	40	<b>Training in research methodology</b>	3P, 1S	T
Project planning, communication and writing skills; oral presentation of research project proposal; carrying out experimental research; data processing, written reporting on and oral presentation of research results; writing and presenting a seminar.				
<b>772</b>	10	<b>Techniques for advanced oenological analyses</b>	1L, 1P	T
General laboratory safety and etiquette, biological calculations and project planning. Advanced techniques for wine analyses, such as HPLC, infrared spectroscopy, GC-MS. Wine evaluation by means of formal wine tastings, basic statistical techniques for the processing and interpretation of tasting data. There also is a focus on different types of wine evaluation systems.				
<b>773</b>	35	<b>Microbes and their impact on wine quality</b>	3L	T
Isolation, identification and classification of wine-associated yeasts and bacteria. Fermentation biochemistry and kinetics; metabolic end products; nitrogen and sulphur metabolism during fermentation; fermentation problems; ethanol tolerance; fermentation bouquet and other volatile esters. Lactic acid bacteria and malolactic fermentation; metabolic end products and the impact on wine aroma. Role of enzymes in vinification. Techniques and targets for the genetic improvement of wine yeasts; legal, ethical and consumer aspects relating to the use of genetically manipulated wine yeasts.				
<b>774</b>	30	<b>Wine chemistry</b>	3L	T
Origin of grape and wine aroma, different cultivars, phenol composition of grapes and wine, chemical reactions during the winemaking process and maturation. Influence of optimal ripeness, viticultural and winemaking techniques and wood maturation on the composition of grapes and/or wine. Overview of the most important techniques to isolate and characterise phenolic compounds.				
<b>745</b>	5	<b>Environmental management</b>	1L	T
The principles of environmental management systems and their development. Good management practices for the implementation of environmental management systems. Monitoring programmes for waste water in wine cellars and distilleries.				
<b>59528 OPERATIONS RESEARCH (ENG)</b>				
(Department of Industrial Engineering)				
<b>315</b>	15	<b>Operations research (Deterministic models)</b>	2L, 3T	A
The systems approach to problem-solving; analysis and formulation of problems leading to linear and integer programming models, network and non-linear programming models; algorithms for solving such models; tasks which includes exercises with computer packages. <i>P Engineering Mathematics 214</i>				
<b>345</b>	15	<b>Operations research (Stochastic models)</b>	2L, 3T	A
Analysis and formulation of problems leading to deterministic and stochastic dynamic programming models; Markov chains and waiting-line models; techniques for solving such				

models; decisions under uncertainty; Bayes' theorem; multicriteria decision-making.  
*P Engineering Statistics 314 or Statistics for Scientists 314*

### 13005 PHYSICS (BIO)

(Department of Physics)

<b>178</b>	32	<b>Physics for biological science</b>	3L, 3P	A & E*
------------	----	---------------------------------------	--------	--------

Mechanics; thermodynamics; waves and oscillations; optics; electricity and magnetism; atomic physics; radioactivity.

\*The language specification, viz. A & E, is subject to timetable limitations.

### 50393 PHYSIOLOGY AND ANIMAL PHYSIOLOGY

(Department of Physiological Sciences)

<b>214</b>	16	<b>Physiological principles and systems</b>	3L, 3P	T
------------	----	---	--------	---

Textbook-based overview of the following physiological principles and systems: homeostasis, cell membranes, general biological control systems, nervous, muscle, respiratory, hormonal, digestive (basic single stomach) systems, and also typical diseases applicable to these systems.

*PP Biology 124, 154 or Biology (Medical) 111 or Physiology 114, 144*

*C Biochemistry 214*

<b>244</b>	16	<b>Systems in physiology</b>	3L, 3P	T
------------	----	------------------------------	--------	---

Textbook-based overview of the following physiological systems of the body: blood and body fluids, special senses, acid/base balance, cardiovascular renal, immune and reproductive systems.

*P Physiology and Animal Physiology 214*

*C Biochemistry 244*

### 32891 PLANT PATHOLOGY

(Department of Plant Pathology)

<b>314</b>	16	<b>Principles of integrated disease control</b>	3L, 3P	T
------------	----	---	--------	---

Epidemiology and disease forecasting; the role of quarantine, disease certification, cultivation practices, plant resistance, fungicides and biological control in integrated disease control programmes; formulation, method and application of fungicides; the management of fungicide resistance in fungal populations.

*P Crop Protection 244*

<b>344</b>	16	<b>Disease development and diagnosis and disease control systems</b>	3L, 3P	T
------------	----	--	--------	---

The biology, life-cycle, diagnosis and control of diseases of citrus, fruit, vine, agronomic and horticultural crops; the importance of fungal infections and mycotoxins in food production.

*Subject to continuous assessment.*

*P Crop Protection 244, Plant Pathology 314*

<b>414</b>	16	<b>Systematics and biology of plant pathogenic fungi and fungal-like eukaryotes</b>	3L, 3P	T
------------	----	---	--------	---

Morphology, taxonomy and biology of fungi and other fungal-like eukaryotic plant pathogens. Fungal physiology. Selected plant pathogenic genera in the kingdoms Chromista (oomycota), Protozoa (slime moulds) and Eumycota (Ascomycota, Basidiomycota, Chytridiomycota, Zygomycota and Glomeromycota). Description of fungal-like eukaryotic plant pathogens.

<b>424</b>	16	<b>Microbial ecology of plant surfaces and the soil</b>	2L, 1S, 3P	T
An introduction to microbial ecology including microbial diversity, structure and development of microbial communities, interactions among microbial populations, adaptations to environmental conditions and quantitative ecology. The interrelationships between microorganisms (beneficial as well as plant pathogenic) associated with plant tissues (leaves, fruits, flowers, seeds and roots), and their living and nonliving environments. Soil as an ecosystem for microbes (fungi, bacteria and actinomycetes) and other biota (micro-, meso- and macrofauna), and the role of these organisms in the soil food web and soil health. Literature searches and the presentation of seminars. <i>Subject to continuous assessment.</i> <i>P Crop Protection 244, Plant Pathology 314</i>				
<b>444</b>	16	<b>Infection routes and host/pathogen interaction</b>	3L, 3P	T
The behaviour of plant pathogenic fungi on plant surfaces; infection sites; penetration processes; forces applied by plant pathogenic fungi during the penetration process and defence systems put up by the plant. <i>P Crop Protection 244, Plant Pathology 314, 344</i>				
<b>454</b>	16	<b>Plant pathogenic prokaryotes and viruses</b>	3L	T
Taxonomy, biology and epidemiology of plant pathogenic bacteria and mollicutes (phytoplasmas and spiroplasmas). Characteristics and epidemiology of plant pathogenic viruses. <i>P Crop Protection 244, Plant Pathology 314, 344</i>				
<b>771</b>	30	<b>Applied phytomycology</b>	1T	T
This course contains various topics in the field of phytomycology, such as the latest developments in fungal systematics and taxonomy, fungal diversity, genetics and genomics, and the role of virulence genes and secondary metabolites in plant diseases. In addition, the course will teach the student how to gain access to information databases on the internet, to use and search international fungal collections, and how important phytosanitary regulations and protocols are for food security and market access of export agricultural produce.				
<b>772</b>	30	<b>Advanced disease management</b>	1T	T
The importance of epidemiology in control and management of plant diseases through the integration of cultivation practices, physical, biological and chemical strategies.				
<b>773</b>	30	<b>Advanced molecular plant pathology</b>	1T	T
Molecular techniques used in plant pathology for characterising and detecting plant pathogens (bacteria, fungi, oomycetes and viruses), as well as the methods used for gene discovery and functional gene analyses in fungal and oomycete plant pathogens. More specifically, the principles and concepts of molecular techniques will be discussed that pertain to: (1) the detection and diagnosis of plant pathogens, including various polymerase chain reaction (PCR) techniques, other DNA-based technologies and enzyme-linked immunosorbent assays (ELISA), (2) the use of sequence data for the identification of plant pathogenic species, (3) molecular markers used for studying the diversity present in plant pathogenic populations, (4) the molecular profiling of root and soil microbial communities, (5) gene discovery techniques and (6) methods used for analysing the function of specific genes in fungi and oomycetes.				
<b>774</b>	30	<b>Project management and presentation</b>	1T	T
Course work will include lessons in project identification, planning and execution, writing of research proposals and reports, presentation of research findings, scientific collaboration and ethics in science. Exercises in project planning and execution will be conducted under supervision. A literature study and scientific findings will be presented as scientific manuscripts and as an oral presentation.				

<b>23256 PRODUCTION MANAGEMENT</b>				
(Department of Industrial Engineering)				
<b>244</b>	15	<b>Production and operations management</b>	2L, 3T	A
Operations management, product/service design and process selection, JIT, aggregate planning, inventory control, MRP, operations scheduling and synchronous manufacturing.				
<b>59447 PROFESSIONAL COMMUNICATION</b>				
(Language Centre)				
<b>113</b>	12	<b>Professional communication</b>	3L, 2T	A & E
Writing of reports and other written communication, oral presentations, use of resources, interpersonal communication, web-based communication, meeting procedures, use of information sources, telephone communication.				
<b>51993 PROJECT MANAGEMENT</b>				
(Department of Process Engineering)				
<b>412</b>	12	<b>Project management</b>	3L, 1T	A
Project Management framework: integration, scope, time, cost, human resources, communication, risk, safety and procurement. Project Management processes: initiating, planning, execution, control and commissioning. [Presented by the Department of Process Engineering (50%) and Department of Industrial Engineering (50%)] Home department: Process Engineering <i>Subject to continuous assessment.</i>				
<b>46167 QUALITY ASSURANCE</b>				
(Department of Industrial Engineering)				
<b>412</b>	8	<b>Quality assurance</b>	3L, 2T	A
Definition of quality; quality assurance methods and techniques; statistical process control; sampling plans. <i>Subject to continuous assessment.</i>				
<b>59471 QUALITY MANAGEMENT</b>				
(Department of Industrial Engineering)				
<b>444</b>	15	<b>Quality management</b>	2L, 3T	A
Definition of reliability and maintainability; reliability management; methods and techniques for reliability modelling; allocation; prediction and maintainability assurance; fault tree analysis; failure mode analysis; quality management; history and background; ISO 9000; total quality management; leadership, 6-sigma; cost considerations; quality audits; experimental design with Statistica. <i>P Engineering Statistics 314 or Statistics for Scientists 314</i>				
<b>14176 SOIL SCIENCE</b>				
(Department of Soil Science)				
<b>114</b>	16	<b>Principles of soil science</b>	3L, 1.5P	T
An elementary overview on the origin and distribution of soils. Discussion of the most important physical, chemical and morphological characteristics of soil. Soil water. Soil organic matter. Soil organisms. Chemical and mineralogical characteristics of soil. Soil pH. Classification and development of South African soils. Land and soil suitability. <i>Subject to continuous assessment.</i>				

<b>142</b>	8	<b>Applications of soil science</b>	1.5L, 1.5P	T
Principles of plant nutrition and fertilisation; ground water and irrigation; salinity and drainage; soil management. <i>Subject to continuous assessment.</i> <i>P Soil Science 114</i>				
<b>214</b>	16	<b>Introduction to soil science</b>	3L, 3P	T
Soil as a three-dimensional unit; soil formation factors: Climate, parent material, relief, organisms and time; weathering processes and products; physical properties of soil: Texture, structure, colour, air/water/temperature relationships; chemical properties of soil: soil colloids, clay minerals, cation adsorption and exchange, soil reaction; formation and properties of soil organic material; elementary interpretation and evaluation of physical, chemical and morphological soil characteristics for resource use. <i>P Chemistry 154</i>				
<b>244</b>	16	<b>Plant nutrition and fertilisation</b>	3L, 3P	T
Composition and nutrition of plants; individual plant nutrient elements; equilibria in the soil; fertilisers: their characteristics and uses; determination of fertiliser requirements and fertiliser application in practice; interaction with rhizosphere and pedosphere organisms. <i>P Soil Science 214, Chemistry 114 (or Chemistry B 134), Chemistry 154</i>				
<b>314</b>	16	<b>Genesis, morphology, classification and uses of soil</b>	3L, 3P	T
Development and classification of South African soils; terrain classification; soil and land mapping; methodology of soil and land suitability evaluation with special reference to crop suitability; soil use planning; soil erosion and its control. <i>P Soil Science 214, Chemistry 114 (or Chemistry B 134) and Chemistry 154</i>				
<b>344</b>	16	<b>Soil and water management</b>	3L, 3P	T
Soil as storage medium for plant water; atmospheric energy balance: evaporation, transpiration and plant water requirements; soil water uptake and water loss in the soil-plant-atmosphere continuum; hydrological cycle and water resources in South Africa; methods of irrigation and irrigation scheduling; irrigation with saline water and salt balance in the soil; irrigation backflow; elimination and management of physical, morphological and chemical limitations of soil; principles of drainage; soil surface management. <i>P Soil Science 214, 244, 314, Mathematics (Bio) 124</i>				
<b>414</b>	16	<b>Advanced soil physics</b>	3L, 3P	T
General physical properties: texture, particle size distribution and specific surface area. Structure and aggregation. Soil aeration. Soil temperature. Soil compaction and strength. Characteristics of water in porous media. Soil water content and potential. Soil water flow in saturated and unsaturated soil. Movement of dissolved salts and other inorganic compounds in soil. Miscible transfer. (Laboratory and practical fieldwork). <i>Subject to continuous assessment.</i> <i>PP Soil Science 214, 244</i> <i>P Soil Science 314, 344, Chemistry 214, 224, 244</i>				
<b>424</b>	16	<b>Advanced soil chemistry</b>	3L, 3P	T
The colloidal fraction of soil: structure of the diffuse double layer, cation adsorption and exchange, anion adsorption. Soil reaction: acidity and alkalinity, influences and control. Oxidation and reduction in soil. Organic material. Salinity. (Laboratory and practical fieldwork). <i>Subject to continuous assessment.</i> <i>PP Soil Science 214, 244</i> <i>P Soil Science 314, 344, Chemistry 214, 224, 244</i>				

<b>444</b>	16	<b>Advanced pedology</b>	3L, 3P	T
<p>Weathering of minerals and rocks: important crystalline layer silicate clay minerals and amorphous weathering products in soils; techniques of mineral identification; advanced soil genesis; development and nature of the South African soil landscape; age of soils; international soil classification systems. (Laboratory and practical fieldwork.)</p> <p><i>Subject to continuous assessment.</i></p> <p>PP Soil Science 214, 244</p> <p>P Soil Science 314, 344, Chemistry 214, 224, 244</p>				
<b>454</b>	16	<b>Advanced resource management</b>	3L, 3P	T
<p>Practically orientated chemical, physical and pedological field and laboratory investigations, with a theoretical foundation; technical report and recommendations; evaluation of the literature; writing and presentation of articles and seminars on subjects related to soil science.</p> <p><i>Subject to continuous assessment.</i></p> <p>C Soil Science 414, 424, 444</p>				
<b>771</b>	30	<b>Specialised pedology and soil genesis</b>	1L, 3P, 1S	T
<p>Specialised study of the following topics: macro and micromorphology of soils; soil geography; paleopedology; soil genesis, classification and cartography; use of geostatistics and pedometrics in soil data processing; soil and land evaluation and use of pedological techniques in land evaluation. A written review article on a specified topic and an oral presentation will be presented to the department. Practicals will include field practicals and case studies in soil classification and interpretation for land evaluation; carrying out a soil survey, and the production of a soil map report.</p> <p><i>Subject to continuous assessment.</i></p>				
<b>772</b>	30	<b>Specialised soil physics and water management</b>	1L, 3P, 1S	T
<p>The module involves specialised knowledge of basic soil physical principles and their integration for solving complex problems. Lectures and practicals include: modelling for the prediction of water movement through soils with different texture classes is studied together with the way in which this is influenced by other soil physical properties; specialised water management and irrigation scheduling practices, such as controlled deficit irrigation, partial root zone drying and pulse irrigation; specialised land preparation designed to tackle unique practical problems. An extended literature review and a research project form an integral part of the module.</p> <p><i>Subject to continuous assessment.</i></p>				
<b>773</b>	30	<b>Specialised soil chemistry and fertilisation</b>	1L, 3P, 1S	T
<p>Critical assessment of topics in the following specialised fields: spectroscopic techniques in surface chemistry and mineralogy; soil quality and carbon sequestration; geochemistry of trace elements in soils; modelling of pollutant migration; chemistry and mineralogy of acid sulphate soils; soils and human health; modern fertilizer technology and sustainability. A written review paper and a research project will be presented to the Department. The research project will deal <i>either</i> with the assessment of soil sorption capacity for agronomically important nutrients and selected environmental pollutants, <i>or</i> with a fertilizer trial involving plant growth response in pots to selected soil amendments. In each case the experimental design and appropriate statistical analysis of data will form part of the project.</p> <p><i>Subject to continuous assessment.</i></p>				
<b>774</b>	30	<b>Soil biology</b>	1L, 3P, 1S	T
<p>Carbon cycle and biological processes in soil. Soil ecology. Biodiversity in soil. Components of soil ecosystem and their interactions. Chemolithotrophic bacteria. Autotrophic</p>				

micro-organisms. Heterotrophic micro-organisms. Human and plant pathogens in soils. Effects of temperature, organic matter supply, pH and redox conditions on ecology of soil micro-organisms. Invertebrates and mammals in soils and their effect on soil properties. Managing the soil ecosystem.

## 19658 STATISTICS

(Department of Statistics and Actuarial Science)

<b>214</b>	16	<b>Applied statistics</b>	3L, 2T	A
------------	----	---------------------------	--------	---

*Sampling techniques:* Simple random; Stratified; Systematic; Cluster; Probability proportional to size.

*Descriptive Statistics:* Various data types; Frequency distributions; Contingency tables; Graphical representation of data (histograms, polygons, bar charts, pie charts); Descriptive measures of location and spread (mean, median, mode, variance, standard deviation, coefficient of variation, percentiles); Approximate measures for grouped data; Box plots; Measure of association (coefficient of correlation); Determining the regression line.

*Probability theory:* Basic probability concepts (sample spaces, events, addition rules, multiplication rules, conditional probabilities, contingency tables); Bayes' theorem; Counting rules.

*Discrete random variables and probability distributions:* Expected value, variance and standard deviation of a discrete random variable; Correlation between discrete random variables; Joint, marginal and conditional distributions; Distribution of the sum of variables; Binomial and Poisson distributions.

*Continuous random variables and probability distributions:* Expected value, variance and standard deviation of a continuous random variable; Uniform, normal and exponential distributions.

*Sampling distributions:* The central limit theorem; Sampling distributions of the mean and a proportion; Sampling distributions of the difference between two means and the difference between two proportions.

*Inferential Statistics:* Interval estimation and hypothesis testing for the mean, a proportion and the variance; Interval estimation and hypothesis testing for the difference between two means, the difference between two proportions and the ratio of two variances; Concept of and calculation of p-values in above cases; Determining sample sizes; Calculation of power and the effect of sample size on power.

*Remark*

Application of statistical techniques using Microsoft® Excel is emphasised throughout.

*Subject to continuous assessment.*

*PP Statistical Methods 176 with a final mark of at least 60% or Statistics 186*

*C Mathematics (Bio) 124*

<b>244</b>	16	<b>Statistical inference</b>	3L, 2T	A
------------	----	------------------------------	--------	---

*Analysis of variance:* Completely randomised one-way, factorial and block designs.

*Nonparametric techniques:* Wilcoxon's rank sum test; Sign test; Wilcoxon's signed rank sum test; Kruskal-Wallis' test; Friedman's test.

*Categorical data analysis:* Hypothesis testing for the difference between two or more proportions; Tests of independence; Goodness-of-fit test.

*Simple linear regression analysis:* The simple linear regression model; Method of least squares estimation; Inference about the model parameters and the correlation coefficient; Residual analysis; Prediction intervals and confidence intervals.

*Multiple regression analysis:* The multiple linear regression model; Residual analysis; Inference about the parameters of the model; Regression models with indicator variables and interaction terms; Polynomial regression; Transformations; Collinearity; Variable selection.

*Time series analysis:* Components of a time series; Smoothing; Several methods of trend fitting and forecasting; Index numbers.

*Quality control:* Control charts; Process capability.

*Remark*

Application of statistical techniques using Microsoft® Excel and one additional statistical software package are emphasised throughout.

*Subject to continuous assessment.*

*P Statistics 214 and Mathematics (Bio) 124*

## 19690 STATISTICAL METHODS

(Department of Statistics and Actuarial Science)

<b>176</b>	18	<b>Statistical methods with computer implementation</b>	*	A
------------	----	---	---	---

\*First semester: 4L, 2T; Second semester: 2L, 2T

*Sampling techniques:* Simple random; Stratified; Systematic; Cluster; Probability proportional to size.

*Descriptive Statistics:* Various data types; Stem-and-leaf display; Frequency distributions; Graphical representation of data (histogram, polygons, bar and pie charts); Descriptive measures of location and spread (mean, median, mode, variance, standard deviation, percentiles); Approximate measures for grouped data; Box plots; Measure of association (coefficient of correlation).

*Probability theory:* Basic probability concepts (sample spaces, events, addition and multiplication rules, conditional probabilities, probability trees, contingency tables); Bayes' theorem; Counting rules.

*Discrete random variables and probability distributions:* Expected value, variance, and standard deviation of a discrete random variable; Covariance between discrete random variables; Expected value and variance of a portfolio; Binomial and Poisson distributions.

*Continuous random variables and probability distributions:* Normal and exponential distributions.

*Sampling distributions:* The central limit theorem; Sampling distribution of the mean and a proportion.

*Inferential Statistics:* Interval estimation and hypothesis testing for the mean and a proportion; Interval estimation and hypothesis testing for the difference between two means; Sample size calculation based on interval estimation.

*Analysis of variance:* One-way and two-way designs.

*Regression analysis:* The simple linear regression model; Inference about model parameters and the coefficient of correlation; Multiple linear regression.

*Time series analysis:* The components of a time series; Smoothing; Least squares trend fitting and forecasting.

*Remarks*

1. Microsoft® Excel will be used throughout the module for the application of the different statistical techniques.

2. Students who passed Statistical Methods 176(18) will be allowed to continue with Statistics 214(16), provided that they obtained a final mark of at least 60%.

*Subject to continuous assessment.*

## 59587 STRATEGIC MANAGEMENT

(Department of Business Management)

<b>344</b>	12	<b>Strategic management</b>	2L	A
------------	----	-----------------------------	----	---

Strategic management challenges in complex environmental situations; business aims and strategic management; historical and modern strategic management paradigms; the internet

and strategic management; biocorporative systems and enterprise strategies; design, evaluation and redesign of business models; robust enterprise abilities (including forming of alliances) and strategic adaptability; strategic management aids; strategic knowledge, innovation and value chain management; strategic performance measurement.

*C Business Management 113\**

*\*Not applicable for students in Wood Products Science.*

### 19712 STRENGTH OF MATERIALS

(Department of Civil Engineering)

<b>143</b>	11	<b>Introduction: Mechanics of deformable bodies</b>	3L, 2T	A & E
------------	----	---	--------	-------

Introduction to mechanics, internal forces and stresses, deformations and strain, material response: material law, axially loaded elements, torsion of elements with circular cross section, symmetrical bending of beams, thin-walled pressure vessels.

*C Engineering Mathematics 115*

### 59080 SUPPLY CHAIN MANAGEMENT

(Department of Logistics)

<b>114</b>	12	<b>Supply chain management</b>	3L, 1P	A
------------	----	--------------------------------	--------	---

The scope of product supply chains, aspects of utility and value creation, aspects of materials management, including resource and inventory acquisition, aspects of production and operations management, aspects of physical distribution management, conforming to customer requirements with respect to product supply and delivery.

### 38784 THEORY OF INTEREST

(Department of Statistics and Actuarial Science)

<b>152</b>	6	<b>Theory of interest</b>	2L, 1T	A, T
------------	---	---------------------------	--------	------

Simple and compound interest. Force of interest. Future value, present value and discount. Accumulation and discounting of amounts of money. Various types of annuities and applications.

### 33081 VITICULTURE

(Department of Viticulture and Oenology)

<b>244</b>	16	<b>Grape production</b>	3L, 3P	A
------------	----	-------------------------	--------	---

Introduction to the anatomy and morphology; directions in production; cultivation practices for wine grape vineyards: principles of location and cultivar choice; vine spacing; training and trellising systems; winter pruning; canopy management; growth regulators; weed control.

<b>314</b>	16	<b>Cultivar science, phenology and physiology</b>	3L, 3P	A
------------	----	---	--------	---

Origin, morphology, description (identification) and cultivation properties of wine grape cultivars. Description (identification) of specific rootstock cultivars. Phenology, physiology of dormancy. Physiology of reproductive growth: hormonal aspects, berry growth and ripening (physiology and chemistry), optimal ripeness.

<b>344</b>	16	<b>Plant material improvement, propagation and table grape science</b>	3L, 3P	A
------------	----	--	--------	---

Improvement of grapevine material (importance, methods, schemes), success of improved material. Grapevine propagation: collection, storage (material), multification, grafting techniques, nursery layout and facilities, physiology and anatomy of graft union healing, top-grafting methods. Cultivation of table grapes and grapes for drying: industries in SA, cultivars, cultivation practices, spring and summer treatments, pre-harvest physiology.

*P Viticulture 314*

<b>414</b>	16	<b>Vineyard management</b>	3L, 3P	A
Viticultural management: irrigation, fertilisation and weed control. Stress physiology (effects on the whole plant as well as on fruit development). International perspective on grapevine cultivation. <i>P Viticulture 314, 344</i>				
<b>424</b>	16	<b>Table grapes and grapevine abnormalities</b>	3L, 3P	A
Cultivation of table grapes and grapes for drying: harvesting and packaging, drying, storage, quality factors, marketing. Abnormalities associated with abiotic and biotic factors and the identification of these under field conditions; anatomical, physiological and morphological abnormalities associated with specific virus diseases. <i>P Viticulture 314, 344</i>				
<b>444</b>	16	<b>Vineyard cultivation practices</b>	3L, 3P	A
Pruning, trellising systems (impact on quality and economics), planting of vineyards, shaping of young vines, light and canopy management (physiology, principles and practices). Management of vineyard variations ("precision viticulture"). Alternative vineyard practices. <i>P Viticulture 314, 344</i>				
<b>454</b>	16	<b>Vineyard establishment and selection of locations for wine grape cultivation</b>	3L, 3P	A
Selection of location; scion and rootstock selections; soil potential and soil improvement; vineyard layout and establishment; growth and function of roots; plant spacing (utilisation of above- and below-ground environment). <i>P Viticulture 314, 344</i>				
<b>771</b>	40	<b>Training in research methodology</b>	3P, 1S	T
Project planning, communication and writing skills; oral presentation of research project proposal; conducting experimental research; data processing; written reporting on and oral presentation of research results; writing and presenting a seminar.				
<b>772</b>	35	<b>Advanced techniques in viticulture</b>	1L, 3P	T
Methods for the identification and characterisation of terroirs and its impact on vineyard cultivation ( <i>students who focus on wine grapes or wine</i> ); or Harvesting, packaging and storage of table and raisin grapes ( <i>students who focus on table grapes and raisin grapes</i> ). Techniques for the measurement and evaluation of vineyard behaviour. The use of GIS and remote sensing in agriculture and the relevance of modelling for the analysis of spatial patterns in agriculture, with specific reference to vineyard cultivation.				
<b>773</b>	35	<b>Advanced physiology and molecular aspects of key processes in the grape plant</b>	3L, 1P	T
Physiological processes of particular importance for yield and grape quality. Photosynthesis, respiration and environmental influences, secondary metabolism, leaf function, root function, berry function, water and nutrient uptake and distribution methods and patterns, growth relationships, allocation and compartmentalisation of nutrients, grape quality, physiological aspects of grapevine manipulation. Molecular biology of sugar and acid metabolism, anthocyanins, water transport and aquaporins.				
<b>774</b>	10	<b>Principles of the <i>in vitro</i> culture of grapevine tissue/organs and their application</b>	1L	T
Introduction. Establishment of <i>in vitro</i> cultures; factors involved in and types of regeneration and reproduction; anatomical/morphological growth reactions of shoot apices <i>in vitro</i> and the effects of cytokinins; physiological properties of <i>in vitro</i> cultures; phases involved in the successful <i>in vitro</i> production of plants. Use of <i>in vitro</i> culturing for plant improvement in grapevines. Facilities and apparatus; culture media. Successive steps from				

*in vitro* culturing to the multiplication and distribution of material to the SA vine and wine industry.

### 50997 WINE BIOTECHNOLOGY

(Department of Viticulture and Oenology [Institute for Wine Biotechnology])

771	40	<b>Research methodology for grapevine and wine biotechnology</b>	3P, 1S	T
Project planning, communication and writing skills; oral presentation of research project proposal; carrying out experimental research; data processing; written reporting on and oral presentation of research results; writing and presenting a seminar.				
772	25	<b>Techniques in grapevine and wine biotechnology</b>	1P	T
General laboratory safety and etiquette, biological calculations; project planning; general molecular biology techniques; polymerase chain reaction (PCR); agarose gel electrophoresis; cloning of DNA fragments; transforming bacterial, yeast and plant cells; DNA sequencing; plant tissue culture; hybridisation techniques; protein isolation and analysis; introduction to bioinformatics, genomics, transcriptomics and proteomics. Small-scale winemaking and analyses of wine, including sensory evaluation.				
773	30	<b>Biotechnology of wine-related microbes</b>	1L	T
Isolation, identification and classification of wine-associated yeasts and bacteria. Fermentation biochemistry and kinetics; metabolic end products; nitrogen and sulphur metabolism during fermentation; fermentation problems; ethanol tolerance; fermentation bouquet and other volatile esters. Biotechnology of lactic acid bacteria; malolactic fermentation and microbial spoilage of wines. Techniques and targets for the genetic improvement of wine yeasts; legal, ethical and consumer aspects relating to the use of genetically manipulated wine yeasts. Role of enzymes in vinification.				
774	20	<b>Vine structure and functioning and grapevine improvement</b>	1L	T
General viticultural concepts, including the vegetative structure and function; reproductive structure and development as well as integration into the establishment and management of vine balance in the viticultural system. Biotechnological aspects of vine plant diseases; molecular-genetic aspects of plant-pathogen interactions; use of recombinant DNA technology to genetically improve plants; techniques and targets for the genetic improvement of plants.				
714	5	<b>Chemical components of grapes and wine</b>	1L	T
Water and sugars; polysaccharides; alcohols; acids; phenols; aldehydes and ketones; acetals; esters; lactones; terpenes; nitrogenous components; hydrogen sulphide and sulphur components; hydrocarbons and derivatives; macromolecules and growth factors; dissolved gases and minerals.				
<b>57584 WOOD PRODUCTS SCIENCE</b>				
(Department of Forest and Wood Science)				
114	16	<b>Wood processing</b>	3L, 3P	E
An introduction to all aspects of Wood Products Science, composition of wood, decay, preservation, processing, sawmill layout, wood defects, grading, wood products, pulp and paper. Visits to various wood processing industries. <i>Subject to continuous assessment.</i>				
144	16	<b>Wood anatomy and identification</b>	3L, 3P	E
Introduction to tree growth; macroscopic and microscopic anatomy and identification of types of woods; descriptions of cell wall ultrastructure, wood variability and wood quality.				

<b>214</b>	16	<b>Wood chemistry and preservation</b>	3L, 3P	E
Introduction to the chemistry relating to wood and wood products. Chemical composition (lignin, cellulose, hemicelluloses, extractives) and chemical utilisation of wood. Chemical modification of wood. Biological degradation of lignocellulosics. Wood preservatives and pressure impregnation procedures. Environmental aspects of preservatives and products. <i>C Chemistry 114, 154</i>				
<b>254</b>	16	<b>Mechanics of wood products</b>	3L, 3P	E
Analysis of beams, columns, axially loaded elements and shafts. Elastic behaviour and deformation of materials. Design and scaling. Timber as a structural material: Influence of moisture, long-term load, chemical pressure treatment, load sharing. Strength grading of timber. The SABS timber design code. <i>P Strength of Materials 143</i>				
<b>264</b>	16	<b>Wood physics and drying</b>	3L, 3P	E
The physics of water in and around wood, moisture content, the concept of humidity, equilibrium and density, sorption, shrinkage and swelling of wood. Electrical, thermal and acoustical properties of wood. The why and how of wood drying, description of various methods, kiln types and schedules, drying defects. <i>Subject to continuous assessment.</i>				
<b>324</b>	16	<b>Wood adhesives and coatings</b>	3L, 3P	E
Structure, types and characteristics of adhesives, structure types and functional mechanisms of wood finishes; adhesion.				
<b>334</b>	16	<b>Principles of wood cutting and tooling</b>	3L, 3P	E
Wood cutting fundamentals, chip formation, cutting conditions, cutting edge maintenance, sawing, planing and moulding, veneer cutting, chipping, turning.				
<b>364</b>	16	<b>Wood products manufacturing I</b>	3L, 3P	E
Basic wood products manufacturing including primary and secondary manufacturing. Focus on production of solid wood (industrial or furniture wood) in sawmills and further processing in secondary industries; introduction to computer-based equipment.				
<b>414</b>	16	<b>Composite products</b>	3L, 3P	E
The manufacturing of particleboard, veneer, plywood, fibreboard, wood cement and wood plastic composites, laminated wood and paper. Processing methods, physical and chemical properties of the products and analysis methods.				
<b>424</b>	16	<b>Design and construction of wooden products</b>	3L, 3P	E
Introduction to the history of furniture design, theory of furniture design, ergonomics of furniture, construction of furniture, construction of joinery products (e.g. windows, doors, stair cases, etc.), technical documentation used in the wood working industry.				
<b>444</b>	16	<b>Wood products manufacturing II</b>	3L, 3P	E
Introduction to manufacturing technologies producing secondary wood products such as furniture, joinery products and structures in the built environment. Includes material preparation, material machining, CNC technologies, case studies of manufacturers, manufacturing methodologies (nested manufacturing, just-in-time, theory of constraints, etc.). <i>P Wood Products Science 424</i>				
<b>464</b>	16	<b>Industrial wood finishing</b>	3L, 3P	E
Composition and properties of various coatings and finishes used in the wood products industry. Surface preparation, coating application technologies (spraying, dipping, roller coating, etc.), curing technologies of finishes, testing of coatings and dry films, environmental aspects of finishing.				

<b>711</b>	40	<b>Wood properties I</b>	2L, 2S	E
Deepening study of the biological and chemical properties which are of importance during the processing to and use of wood-based products. Including amongst others, macro- and ultrastructure, biodegradation, chemical reactivity and accessibility, chemical products. <i>Subject to continuous assessment.</i>				
<b>712</b>	40	<b>Wood processing</b>	2L, 2S	E
Further studies of the processes, economics and management of primary and secondary wood processing industries seen holistically. <i>Subject to continuous assessment.</i>				
<b>741</b>	40	<b>Industrial research and practice</b>	2L, 2S	E
Identification and solving of an industrial problem or development of a product. Learning activities include amongst others the execution of trials, data capture and processing, testing, complete report back.				
<b>742</b>	40	<b>Wood Properties II</b>	2L, 2S	E
Deepening study of the physical and mechanical properties which are of importance for the processing of wood-based products. Including amongst others: wood/water relationship, thermal, electrical and acoustical behaviour and conversion for various energy forms. <i>Subject to continuous assessment.</i>				
<b>743</b>	40	<b>Wood-based constructions</b>	2L, 2S	E
Focus on the design, manufacture and properties of wood-based constructions. Including amongst others: the influence that processes such as drying, chemical treatment and surface treatments have on the material. Joints and adhesives. Durability and performance tests. <i>Subject to continuous assessment.</i>				
<b>59412 ZOOLOGY</b>				
(Department of Botany and Zoology)				
<b>254</b>	16	<b>Animal diversity</b>	3L, 3P	T
Basic patterns of development and structure in invertebrates; an introduction to the processes of development; characteristic features of Protozoa, Coelenterata, Acoelomata and Coelomata; the broad pattern of the evolutionary relationships between them; evolutionary history of the major invertebrate groups; an introduction to invertebrate diversity and identification; the correlation between structure (morphology) and function in invertebrates; the biology of selected parasites. Basic developmental and structural patterns in vertebrates; characteristic features of vertebrates and their body plans; the broad pattern of the evolutionary relationships of vertebrates; mechanisms that govern the ontogeny of vertebrates and the evolutionary implications of developmental mechanisms; evolutionary history of the major organ systems of vertebrates; functional anatomy of support and locomotion; feeding modes and metabolic considerations in vertebrates; survey of reproductive modes and strategies, and sex determination in vertebrates.				
<b>315</b>	16	<b>Behavioural ecology</b>	3L, 3P	E
In this course we will cover a variety of topics relating to the principles of behavioural ecology. The course will expose students to the following, as well as related, topics: Evolutionary arms races: the co-evolution of predator-prey and brood parasite-host interactions; and an evaluation of the debate as to whether these interactions represent evolutionary equilibrium or continuing arms races. Sexual selection and mating systems: different kinds of mating systems, male-male competition and female choice; genetic versus non-genetic benefits of female choice; the debate between Fisherian versus "good genes" mechanisms of female choice; mate choice				

in humans.

Evolution of sociality: social insects provide extensive opportunities for investigating the origin and development of social behaviour, since there is a continuum from solitary all the way through to highly eusocial hymenopterans. The evolution of sociality incorporates the origin and development of social behaviour; recognition systems; regulation of dominance hierarchies through physical and chemical signals.

Reproductive regulation: social systems are characterised by a definite reproductive division of labour with dominant individuals being responsible for colony reproduction.

Using this as the point of departure, focus will be on reproductive skew theory, reproductive cooperation and conflict and how these conflicts are resolved via queen and/or worker policing.

This module may include either a two-week field course run during the latter part of January or a field trip of a shorter duration run in the mid-semester break.

*Subject to continuous assessment.*

<b>334</b>	16	<b>Environmental biology of vertebrates</b>	3L, 3P	A
<p>Physical characteristics of the environment (water, land, and water-land transition); environmental implications for biological design; vertebrates in their environments; physiological responses and adaptation; bioenergetics and metabolism; temperature and its effects, thermal biology and thermal adaptation; animal water balance, osmoregulation and excretion; reproductive biology, hormonal control and evolution of viviparity; scaling in physiology and ecology; physiography of southern Africa; biogeography of southern Africa; terrestrial habitats and adaptive zones; phenotypic plasticity and ecological morphology; survival strategies in terrestrial environments amongst others activity patterns, foraging strategies, migration, group-living, anti-predator strategies. This module includes practical sessions/ topical workshops and a research project. Data for the research project will be collected during a compulsory three day field excursion (scheduled for a weekend in March).</p> <p><i>Subject to continuous assessment.</i></p>				

# Compulsory Practical Vacation Work

## AGRICULTURAL SCIENCES STUDENTS

All students taking the BScAgric degree programme with one or more majors in Animal Science, Oenology, Soil Science or Viticulture must, before completion of the fourth year of study of the programme, undertake practical work to the satisfaction of the University for at least two months during their summer and/or winter vacation at an approved agricultural institution. The institution where practical work is to be done must be chosen in consultation with the department in which the student follows the major(s). The practical work has to be approved by the chairperson(s) of the department(s) concerned before vacation work is undertaken. The student must write a satisfactory report on his practical vacation work and, except in the case of Viticulture, submit it to the chairperson of the department concerned before the end of August of his final year of study. In the case of Viticulture, individual vacation work reports must be submitted on the dates as specified by the Department of Viticulture and Oenology. Partial or full exemption from the above-mentioned rules may be granted at the discretion of the department concerned if the circumstances justify such exemption.

Students with Animal Science as a major who plan to submit a report on their vacation work to the Department of Animal Sciences must spend a minimum of four weeks of their two-month vacation working on the experimental farms of the University. Such vacation work must be done during the vacations of the second year of study. No remuneration is available for this work.

## Industry training in Food Science and in Viticulture and Oenology

### *Food Science*

All students taking programmes to obtain the BSc Food Sc must, for at least eight weeks of their summer and/or winter vacations, carry out practical work to the satisfaction of the University in approved food installations or food research institutions and submit an acceptable report before the end of March to the Department of Food Science before the degree can be awarded.

### *Viticulture and Oenology*

All students taking the BScAgric programme with Viticulture and Oenology as majors must carry out compulsory practical work in both major subjects in accordance with the requirements listed above.

Practical work in Viticulture entails mainly practical work in table and wine grape vineyards at the end of the second year, the end of the third year as well as during the fourth year. The practical work requires at least three weeks during the summer in each of table and wine grape vineyards and at least two weeks of pruning during the winter in table or wine grape vineyards. These work programmes are cleared in consultation with lecturers in the Department of Viticulture and Oenology and must be completed satisfactorily in order to qualify for the degree BScAgric. On completion of each of these practical work programmes, a report must be submitted to the Department.

Practical work in Oenology is undertaken in wine cellars in consultation with the department concerned for at least five weeks. To enable students to perform practical work during the harvest season, final-year students are allowed to join the start of the fourth academic year four weeks late.

**Please note: The University is not liable for any injury that may be sustained during industry training or for any claims that may result from such injuries.**

## **Practical training in Soil Science, Performance-testing of sheep and wool classing**

### *Soil Science*

In order to gain the necessary practical experience, all students taking any module of Soil Science at the third and fourth year are obliged to undertake one or more organised excursions and/or practical assignments during short vacations and/or weekends during the relevant semester. Such organised excursions and/or assignments should take place for a period of time determined by the Department of Soil Science, and they should be under the guidance of one or more lecturers of the Department of Soil Science in collaboration with lecturers of, inter alia, the Departments of Agronomy, Horticultural Science, Viticulture and Oenology, or Forest and Wood Science. Travel and accommodation costs must be borne by the students themselves.

### *Performance-testing of sheep and wool classing*

A course on wool classification is presented during the week before the start of the academic year. This course must be attended by all third-year students taking Animal Science as a major. Training in performance-testing is given at the same time, must be attended by all final-year students taking Animal Science as a major.

## **FORESTRY STUDENTS**

### **Study tours**

All students taking the BScFor (except the study field Wood Products Science) degree programme must undertake, during the winter or summer vacation preceding the fourth year of study, a study tour of approximately three weeks to the forest regions of South Africa. A complete report, as prescribed by the tour leader, must be handed in to the tour leader by the start of the following quarter.

### **Practical work**

First-year students who take the BScFor programme (except students in the study field Wood Products Science) must carry out compulsory vacation work for one week in the September vacation. Students, who have passed their first year at another university and join the second year of study at Stellenbosch University, must supplement the practical work of the first year. All students taking the BScFor programme, except students in the study field Wood Products Science, must carry out the prescribed compulsory vacation work for one week during the second and third year of study or during the week preceding the start of the academic year. It is also expected of students to collect data during vacations in their final year of study for their management plan.

All students taking the BScFor degree programme (except students in the study field Wood Products Science) must, during the summer vacation preceding the final year, take part in a three-week summer school.

### **Practical training in Wood Products Science**

All students taking the BScFor (Wood Products Science) programme must complete 4 periods of practical vacation work and submit satisfactory reports to the Department before the degree can be awarded. The compulsory practical work consists of the following modules: Wood Products Science 211, 241, 341 and 441.

#### *Wood Products Science 211*

Three weeks of practical work at Furntech, Cape Town in the December/January holidays (end of the 1st year or beginning of 2nd year). A satisfactory written report must be submitted to the Department within two weeks after completion of the work.

#### *Wood Products Science 241*

One week chainsaw course in the September holiday of the 2nd year. A satisfactory certificate must be presented to the Department.

*Wood Products Science 341*

Three weeks of practical work in industry or on a research project in the Department in the December/January holiday (end of the 2nd year or beginning of 3rd year) and/or the June/July holiday of the 3rd year. A satisfactory written report must be submitted to the Department within two weeks after completion of the work, followed by an oral presentation of the report.

*Wood Products Science 441*

Three weeks of practical work in industry or on a research project in the Department in the December/January holiday (end of the 3rd year and beginning of 4th year) and/or the June/July holiday of the 4th year. A satisfactory written report must be submitted to the Department within two weeks after completion of the work, followed by an oral presentation of the report.

All students for whom practical work is prescribed, must submit, in accordance with the instructions, reports of their practical work to the satisfaction of the lecturers concerned. Students must themselves bear any expenses incurred in respect of demonstrations and practical work. In addition to the above, students may also be expected to carry out other practical work during vacations.

**Please note: The University is not liable for any injury sustained during practical work or tours or for any claims arising from such injuries.**

**Plans and reports**

All students taking the degree BScFor (excluding the study field Wood Products Science) must, during the second semester of the fourth year of study, hand in a complete management plan or project, based on data collected during the summer school, as set out above, as well as during the winter vacation (or an earlier long vacation).

The completed project or management plan must be handed in before 1 November of the year in which the student expects to obtain the degree. A final mark of at least 50 is required in order to obtain a pass for the project or management plan. If the student obtained a final mark of 40 to 49 during November, a modified project or management plan may be submitted before the January examinations of the following year if the student wants to obtain the degree during the supplementary graduation ceremony in March. A student obtaining a final mark of less than 40 in November, or failing to obtain a final mark of at least 50 in January, must repeat the practical work for the project or management plan.

# Undergraduate Exchange Programme

By agreement between Stellenbosch University and Virginia Polytechnic Institute and State University (SU and VPI) in Blacksburg, Virginia, USA, two third-year forestry students from each institution may be selected as exchange students every year. The Department of Forestry at VPI and SU is part of the School of Forestry and Wildlife Resources and ranks amongst the best educational forestry institutions in the world. The selected students enrol and pay their tuition at their home university but attend classes at the host university. Participating students are responsible for all costs, such as air travel, visas, books and accommodation, while at the host university.

The American academic year commences with their "Fall Quarter". This starts in late August, so students from Stellenbosch will be in America for the second semester of their third year and the first semester of their fourth year.

It is not possible to guarantee that exchange students will have exactly the same suite of courses as the other students, but this is not regarded as a major obstacle. Their chosen combination of courses will be subject to approval by the lecturers concerned.

Applications for participation in the exchange programme must be lodged with the Dean of the Faculty of Agrisciences before the end of April. Should there be more than two applicants, selection will be made on the basis of academic merit and personal disposition, at the sole discretion of the Dean.

In order to qualify for an exchange (J1) visa, applicants will have to prove to the United States Ambassador that they have guaranteed funding of at least US \$6 500 (to cover books, food and accommodation) plus health insurance. The exchange visa will permit successful applicants to accept part-time employment in order to supplement their income while in the USA, but the time available for such work will be a limiting factor. The above assumes that exchange students will earn about \$2 000 for the six weeks during the summer before they return home.

# Research and Service Bodies

## INSTITUTE FOR WINE BIOTECHNOLOGY

The Institute for Wine Biotechnology (IWBT) was established at Stellenbosch University at the end of 1995 and is part of the Department of Viticulture and Oenology. The Institute strives to develop, in conjunction with other role players in the dynamic South African wine industry, a sustainable basis of forefront technology and human resources so that the industry's international competitiveness may be significantly improved. Wine Biotechnology comprises the integration of molecular and genetic viticultural and oenological sciences to make it possible for the wine industry to produce cost-effective, high-quality wines and other vine-related products, using environmentally friendly technologies. The most important goals of the IWBT are:

to co-ordinate, commission and support research in wine biotechnology at Stellenbosch University;

to study on a physiological, biochemical and molecular genetic level and genetically manipulate wine yeast, wine-associated bacteria and vine fungi;

to develop new and desired cultivar and product-specific wine yeast strains using genetic crosses and recombinant DNA technology;

to develop disease-resistant cultivars with improved characteristics by means of tissue-culture cytogenetic and molecular biology techniques.

Postgraduate students and postdoctoral fellows conduct research at the IWBT. The multi-disciplinary nature of the IWBT's research projects results in close co-operation with several departments of Stellenbosch University, as well as with other South African and foreign role players. The Institute has modern and sophisticated research facilities and equipment at its disposal.

## EXPERIMENTAL FARMS

The University owns two experimental farms (*Welgevallen* and *Mariendahl*) that are used mainly for the training of undergraduate students and for research projects of postgraduate students and academic staff of the Faculty of Agrisciences. The farms serve in the first place as field laboratories where research projects are conducted under highly controlled conditions. However, the farms are managed in a way that simulates the practical conditions on commercial farms in the agricultural industry. Where feasible, the spare capacity of the experimental farms are utilised for commercial production in order to manage these farms as far as possible towards self-sufficiency.

### Welgevallen

Welgevallen was purchased in 1917 at the founding of the Faculty, specifically because it was a condition that an experimental farm be within walking distance of the campus. Its original size was 278 ha, of which only 120 ha remain available. Welgevallen is used mainly by the departments of the Faculty of Agrisciences. The entire *Department of Agronomy* is situated at Welgevallen, where it has several laboratories, controlled-climate growth chambers and plastic tunnels, as well as small experimental plots. The *Department of Horticulture* has at its disposal well-established deciduous fruit and soft citrus orchards, while the *Department of Viticulture and Oenology* has well-established vineyards producing grapes of the highest quality. An experimental wine cellar equipped with the latest technology where wine is made on a semi-commercial scale has been erected on the banks of the Eerste River. The *Department of Animal Sciences* has at its disposal excellent facilities where mainly sexual physiology studies are carried out. This Department maintains a highly productive Friesian herd as well as a sheep flock of stud quality used for practical training, but also available for research purposes. This Department furthermore has at its disposal well-equipped feeding sheds and stables where intensive nutritional

research on small and large ruminants can be carried out. Other departments that are also active on the experimental farm are *Genetics*, *Soil Science* and *Forest and Wood Science*. The *Department of Genetics* annually plants 8 000 - 13 000 segregating populations and pure lines from the wheat and triticale breeding programmes under dryland conditions at Welgevallen and Mariendahl for disease evaluation and selection. The Department utilises several greenhouses and growth chambers for making crosses, doing seedling disease typing and the execution of an extensive crossbreeding programme. The latter programme focuses on producing species hybrids and secondary hybrid derivatives in an attempt to transfer disease and salt tolerance genes from the wild species to the cultivated cereals. Even departments from other faculties, such as the *Department of Botany and Zoology* make use of the facilities on the farm.

### **Mariendahl**

Mariendahl (375 ha) adjoins the Elsenburg experimental farm and is about 14 km outside Stellenbosch. It is used mainly by the *Department of Animal Sciences*. The Faculty's excellent facilities for poultry and pig research are located at Mariendahl. The *Department of Animal Sciences* also has at its disposal a Simmentaler herd as well as a Döhne Merino and South African Mutton Merino flock. These breeds are of the highest quality and well known to the industry. These facilities are used for the training of students as well as for research for the industry.

Enquiries can be directed to the Dean, Faculty of Agrisciences, Stellenbosch University, tel. (021) 808 4737.