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Faculty of **AgriSciences**

Dean:

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MScAgric, PhD (Agric) (Stell)



CALENDAR 2012
PART 7





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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 and Information Services 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 Language Plan of Stellenbosch University were 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 that 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 and/or the coordination 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 Language Plan of SU, which were 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 sport 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 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 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 10 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) or 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

Centre for Student Affairs (Non-academic matters)

Neelsie
Private Bag X1
MATIELAND
7602

USEFUL TELEPHONE AND FAX NUMBERS

For divisions or sections not listed below, please contact the Stellenbosch University Contact Centre on the Stellenbosch Campus at 021 808 9111, with fax number 021 808 3822 and e-mail info@sun.ac.za.

AgriSciences	Telephone	E-mail
The Dean Prof ASM Karaan	021 808 4737	agric@sun.ac.za
		asmk@sun.ac.za
Faculty Secretary: Ms G Gamiet	021 808 9111	ghgamiet@sun.ac.za
Student Support: Dr N Brown	021 808 2015	nbro@sun.ac.za
Departments and Chairs		
Agricultural Economics: Prof N Vink	021 808 4899	nv2@sun.ac.za
Agronomy: Dr PJ Pieterse	021 808 4805	pjp@sun.ac.za
Animal Sciences: Departmental Chair	021 808 4747	animalstud@sun.ac.za
Conservation Ecology and Entomology: Prof MJ Samways	021 808 3728	samways@sun.ac.za
Food Science: Dr GO Sigge	021 808 3581	gos@sun.ac.za
Forest and Wood Science: Prof T Seifert	021 808 3323	seifert@sun.ac.za
Genetics: Prof MG Zaahl	021 808 5834	mjulies@sun.ac.za
Horticultural Science: Prof KI Theron	021 808 4762	kit@sun.ac.za
Institute for Plant Biotechnology: Prof JM Kossmann	021 808 3836	kossmann@sun.ac.za
Institute for Wine Biotechnology: Prof AJ Deloire	021 808 2747	deloire@sun.ac.za
Plant Pathology: Prof A Viljoen	021 808 4797	altus@sun.ac.za
Soil Science: Dr E Hoffman	021 808 4789	ehoffman@sun.ac.za
Viticulture and Oenology: Prof AJ Deloire	021 808 2747	deloire@sun.ac.za
Major entities by campus	Telephone	Fax
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
Library (=JS Gericke) (Stellenbosch)	021 808 4385	021 808 4336
Military Science, Faculty of (Saldanha)	022 702 3999	022 814 3824
School of Public Leadership (Bellville Park)	021 918 4122	021 918 4123
Telematic Services (Stellenbosch)	021 808 3563	021 808 3565
Other units		
Bursaries and Loans	021808 9111	021 808 2954
Centre for Student Communities	021 808 2848	021 808 2847
Centre for Student Counselling and Development	021 808 3894	021 808 4706
Centre for Teaching and Learning (Extended Degree Programmes)	021 808 3717	021 808 4142

Communication and Liaison	021 808 4977	021 808 3800
Examinations Section	021 808 9111	021 808 2884
Postgraduate and International Office (PGIO)	021 808 4628	021 808 3799
Research Development	021 808 4914	021 808 4537
Faculty Secretaries of other Faculties		
Arts and Social Sciences	021 808 9111	021 808 3822
Economic and Management Sciences	021 808 9111	021 808 3822
Education	021 808 9111	021 808 3822
Engineering	021 808 9111	021 808 3822
Health Sciences: Applications, Stellenbosch	021 808 9111	021 808 3822
Health Sciences: Tygerberg Campus	021 938 9204	021 931 7810
Law	021 808 9111	021 808 3822
Military Science	021 808 9111	021 808 3822
Science	021 808 9111	021 808 3822
Theology	021 808 9111	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, 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

PROGRAMMES	QUALIFICATIONS
Bachelor's programme in Plant and Soil Sciences	BScAgric
Honours programme in Plant Pathology	BScHons
Master's programme in Entomology or Plant Pathology	MSc
Master's programme in Agronomy, Genetics, Horticultural Science, Soil Science or Viticulture	MScAgric
PhD programme in Agronomy, Entomology, Genetics, Horticultural Science, Plant Pathology, Soil Science or Viticulture	PhD
DSc programme in Agronomy, Entomology, Genetics, Horticultural Science, Plant Pathology, Soil Science or Viticulture	DSc
Bachelor's programme in Food and Wine Production Systems	BSc Food Sc or BScAgric
Honours programme in Food and Wine Production Systems	BScHons (Wine Biotechnology)
Master's programme in Food and Wine Production Systems	MSc Food Sc or MSc (Wine Biotechnology) or MScAgric
PhD programme in Food and Wine Production Systems	PhD (Food Sc) or PhD
DSc programme in Food and Wine Production Systems	DSc Food Sc or DSc
Bachelor's programme in Animal Production Systems	BScAgric
Master's programme in Animal Production Systems	MScAgric
PhD programme in Animal Production Systems	PhD
DSc programme in Animal Production Systems	DSc
Bachelor's programme in Agricultural Economics and Management	BScAgric or BAgricAdmin
Honours programme in Agricultural Economics and Management	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 Wood Sciences	BScFor

Postgraduate Diploma in Forestry and Wood Sciences	PGDipFor
Honours programme in Forestry and Wood Sciences	BScForHons
Master's programme in Forestry and Wood Sciences	MScFor
PhD programme in Forestry and Wood Sciences	PhD (For)
DSc programme in Forestry and Wood 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). or www.elsenburg.com).

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*
- Institute for Plant Biotechnology**

*Forms part of the Department of Viticulture and Oenology

**Forms part of the Department of Genetics

MODULES

The summarised content of the modules presented by these departments is given in alphabetical order on pages 73 - 150.

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

GENERAL RULES FOR UNDERGRADUATE PROGRAMMES BScAgric, BScFor, BScConsEcol, BSc Food Sc and BAgriAdmin

UNDERGRADUATE ENROLMENT MANAGEMENT

In order to meet the targets of Council with regard to the *size* (the total number of students) and *shape* (fields of study and diversity profile) of the student body of Stellenbosch University (SU), it is necessary to manage the undergraduate enrolments at SU.

SU's total number of enrolments is managed to be accommodated by its available capacity.

SU offers a balanced package of programmes covering all of three main study areas, namely (a) the humanities, (b) the economic and management sciences, and (c) the natural sciences, agricultural sciences, health sciences and engineering (Science, Engineering and Technology or SET).

SU is committed to the advancement of diversity.

Undergraduate enrolment management at SU adheres to the framework of the national higher-education system. A well grounded cohesion between national and institutional goals, respecting important principles such as institutional autonomy, academic freedom and public responsibility, is pursued. The following points of departure apply:

- The expansion of academic excellence by maintaining high academic standards.
- The maintenance and improvement of high success rates.
- The fulfilment of SU's commitment to correction, to social responsibility and to contributing towards the training of future role models from all population groups.
- The expansion of access to higher education especially for students from educationally disadvantaged and economically needy backgrounds who possess the academic potential to study at SU with success.

Due to the limited availability of places and the strategic and purposeful management of enrolments, not all undergraduate applicants who meet the minimum requirements of a particular programme will automatically gain admission.

Details about the selection procedures and admission requirements for undergraduate programmes are given on www.maties.com and on the faculty's web page at <http://www.sun.ac.za/agric/>.

All undergraduate prospective students with the 2013 intake and beyond in mind must write the National Benchmarking Test (NBT). Consult the NBT web site (www.nbt.ac.za) or the SU web site at www.maties.com for more information on the National Benchmarking Test.

The results of the National Benchmarking Tests may be used by SU for the following purposes (details are available at www.maties.com):

- Supporting decision-making about the placement of students in extended degree programmes,
- selection, and
- curriculum development.

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 55%, 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 Soil and Water Management:

- Afrikaans or English (Home Language or First Additional Language) 4
- Mathematics 5
- 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. 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 9111).

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 less than 33 credits (with a maximum of two modules) 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).

Postgraduate Diplomas

Programmes in postgraduate diplomas in specific fields of study are followed after obtaining a related bachelor's degree or equivalent qualification from this or any other university approved by Senate for this purpose. The postgraduate diploma programme is a composite programme of a number of prescribed and elected modules.

Master's programmes

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

The MSc, MScAgric, MScConsEcol, MScFor, MSc Food Sc or MAgricAdmin 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.

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.)

Doctoral Programmes

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

- (a) hold the degree MSc, 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.

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, DSc Food Sc or DSc degrees are 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 MSc, 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, DSc Food Sc or DSc 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, DSc Food Sc or DSc degree must provide before 1 September (for graduation in December) or before 1 December (for graduation in March) 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 DSc degree.

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 Plant and Soil Sciences, 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 BAgricAdmin degree) is taken mainly 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 offered mainly in the Faculty of AgriSciences.

In the case of the BAgricAdmin programme, students join the programme in the first year offered mainly in the Faculty of AgriSciences.

PLANT AND SOIL SCIENCES

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://consent.sun.ac.za/> (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/ (Department of Viticulture and Oenology)

BACHELOR'S PROGRAMME

The undergraduate (bachelor's) programme in Plant and Soil Sciences 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 73 - 150. For compulsory vacation work in Soil Science and Viticulture and for practical training in Soil Science and Viticulture see pages 151 - 152.

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

Bachelor's programme in Plant and Soil Sciences (BScAgric)

Crop Productions

First Year (124 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Crop Production	152(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16) * or
Economics	114(12), 144(12) * and
Oenology	142(8) *

**Students taking Agricultural Economics must take Economics 114 and 144 and Oenology 142; all other students take Physics (Bio) 134 and 154.*

Second Year (144 credits)

Compulsory Modules

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

and

Crop Production	214(16) or
Viticulture	214(16) *

and

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

**Students taking Viticulture must take Viticulture 214*

Third Year (136 or 144 credits)

Compulsory Modules

Biometry	312(8), 342(8) *
Soil Science	314(16), 344(16)

and either

Viticulture	314(16), 322(8), 344(16)
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or

Agronomy	312(8), 362(8)
Horticultural Science	352(8)

and

Agronomy	322(8), 332(8), 342(8) **
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or

Horticultural Science	314(16), 342(8) **
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and two of:

Agricultural Economics	314(16), 364(16) ***
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and/or

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

Genetics	314(16), 344(16)
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and/or

Plant Pathology	314(16), 344(16)
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* Students taking Genetics as major subject have to take Biometry 312 and 342. All other students take either Agronomy 312 and Horticultural Science 352 or Viticulture 322.

** Students taking Agronomy as major subject have to take Agronomy 322, 332 and 342 while students with Horticultural Science as major subject take Horticultural Science 314 and 342.

*** Agricultural Economics 314(16), 364(16) and Entomology 314(16), Nematology 344(16) may not be taken concurrently.

Fourth Year (128 credits)

Compulsory Modules

Viticulture	444(16), 454(16), 478(32)
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or

Applied Plant Physiology	414(16), 464(16) and
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Agronomy	424(16), 454(16) * or
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Horticultural Science	434(16), 444(16) *
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and

Agricultural Economics	414(16), 424(16), 444(16), 454(16)
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or

Entomology	418(32), 454(16), 464(16)
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or

Genetics	324(16), 354(16), 414(16), 444(16)
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or

Plant Pathology	414(16), 444(16), 478(32)
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* Students taking Agronomy as major subject have to take Agronomy 424 and 454 while students with Horticultural Science as major subject take Horticultural Science 434 and 444.

Bachelor's programme in Plant and Soil Sciences (BScAgric) Crop Protection and Breeding

First Year (124 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Crop Production	152(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16) * or
Economics	114(12), 144(12) * and
Oenology	142(8) *

*Students taking Agricultural Economics must take Economics 114 and 144 and Oenology 142; all other students take Physics (Bio) 134 en 154.

Second Year (144 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Crop Protection	244(16)
Genetics	214(16), 244(16) or
Agricultural Economics	234(16), 242(8), 262(8)
Soil Science	214(16), 244(16)

and

Crop Production	214(16) or
Viticulture	214(16) *

*Students taking Viticulture must take Viticulture 214

Third Year (136 to 144 credits)

Compulsory Modules

Biometry	312(8), 342(8) *
Entomology	314(16)
Genetics	314(16), 344(16) or
Soil Science	314(16), 344(16)
Nematology	344(16)
Plant Pathology	314(16), 344(16)

and /either:

Viticulture	314(16), 322(8), 344(16) or
Agronomy	312(8), 362(8)
Horticultural Science	352(8) and
Agronomy	322(8), 332(8), 342(8) ** or
Horticultural Science	314(16), 342(8) **

* Students taking Genetics as major subject have to take Biometry 312 and 342. All other students take either Agronomy 312 and Horticultural Science 352 or Viticulture 322.

**** Students taking Agronomy as major subject have to take Agronomy 322, 332 and 342 while students with Horticultural Science as major subject take Horticultural Science 314 and 342.**

Fourth Year (128 credits)

Compulsory Modules

Plant Pathology	414(16), 444(16), 478(32)
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and

Entomology	418(32), 454(16), 464(16) or
Genetics	324(16), 354(16), 414(16), 444(16) or
Soil Science	414(16), 424(16), 444(16), 454(16) *

** The major combination of Plant pathology and Soil Science can only be taken if it can be scheduled on the time table.*

Bachelor's programme in Plant and Soil Sciences (BScAgric)

Soil and Water Management

First Year (124 or 140 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Crop Production	152(8)
Mathematics (Bio)	124(16) or
Mathematics	114(16), 144(16) *
Physics (Bio)	134(16), 154(16) ** 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) 134 and 154.*

Second Year (144 credits)

Compulsory Modules

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

and

Crop Production	214(16) or
Viticulture	214(16) *

**Students taking Viticulture must take Viticulture 214*

Third Year (128 to 144 credits)

Compulsory Modules

Chemistry	224(16), 254(16) *
Plant Pathology	314(16), 344(16)
Soil Science	314(16), 344(16)

and

Agronomy	312(8), 362(8)
Horticultural Science	352(8) and
Agronomy	322(8), 332(8), 342(8) ** or
Horticultural Science	314(16), 342(8) **

or

Viticulture	314(16), 322(8), 344(16)
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* *Chemistry 254 is only for students who major in Soil Science and Chemistry*

** *Students taking Agronomy as major subject have to take Agronomy 322, 332 and 342 while students with Horticultural Science as major subject take Horticultural Science 314 and 342.*

Fourth Year (128 or 136 credits)

Compulsory Modules

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

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

Plant Pathology	414(16), 444(16), 478(32) *
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or

Viticulture	444(16), 454(16), 478(32)
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or

Applied Plant Physiology	414(16), 464(16) and
Agronomy	424(16), 454(16) ** or
Horticultural Science	434(16), 444(16) **

**The major combination of Plant pathology and Soil Science can only be taken if it can be scheduled on the time table.*

** *Students taking Agronomy as major subject have to take Agronomy 424 and 454 while students with Horticultural Science as major subject take Horticultural Science 434 and 444.*

HONOURS PROGRAMME

Honours programme in Plant Pathology (HonsBSc)

Programme Description

The one-year honours programme in Plant Pathology leads to the qualification BScHons in Plant Pathology. The programme consists of further specialised study in Plant Pathology. Supplementary studies may sometimes be required. The modules and study tasks add greater depth of learning, building further on a bachelor's programme with Microbiology or Genetics or Botany or Biotechnology as major subject. An average performance mark of 60% in the modules of the major subject is required. The programme is research- and career-oriented and is based on modern technology and the most recently available research in Plant Pathology. It links up with research projects carried out in the Department.

The programme consists of the following four modules:

32891 : Plant Pathology	771(30): Advanced plant disease dynamics
32891 : Plant Pathology	772(30): Advanced disease management
32891 : Plant Pathology	773(10): Research methodology
32891 : Plant Pathology	774(50): Project management and presentation

MASTER'S PROGRAMMES

Master's programmes in Agronomy, Entomology, Genetics, Horticultural Science, Plant Pathology, Soil Science and Viticulture (MScAgric or MSc)

These programmes have a minimum duration of one year, but may take longer to complete depending on the field of study. Admission to the MScAgric follows on completion of the BScAgric, while admission to the MSc follows on completion of the BScAgric or an BScHons in an applicable field of study. Depending on the field of study, the programme may consist of a research component only or a research component and prescribed modules. The programmes are as follows:

Master's programme in Agronomy (MScAgric)

Programme Description

Research on a particular aspect of tillage, weed control, crop production, stress physiology, vegetable production or pasture management is undertaken. The modular component of the programme is aimed at the acquisition of generic research skills to support the research component of the programme. A further objective is the deepening of subject knowledge on general crop physiology through self-study.

55565 : Agronomy	878(174): Masters thesis
11061 : Biometry	711(6): Postgraduate biometry

Master's programme in Entomology (MSc)

Entomology

Programme Description

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.

34576 : Entomology	878(180): Master's thesis
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Master's programme in Genetics (MScAgric)

Programme Description

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.

13285 : Genetics	878(180): MSc in Genetics
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Master's programme in Soil Science (MScAgric)

Programme Description

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. With regards to the modular component of the programme, the candidate selects two out of the four modules in consultation with his study supervisor and in consideration of the thesis topic.

14176 : Soil Science	771(30): Specialised pedology and soil genesis
14176 : Soil Science	772(30): Specialised soil physics and water management
14176 : Soil Science	773(30): Specialised soil chemistry and fertilisation
14176 : Soil Science	774(30): Soil biology
14176 : Soil Science	878(120): Master's thesis

Master's programme in Horticultural Science (MScAgric)

Programme Description

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, postharvest 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. The modular component of the programme is aimed at the acquisition of generic research competencies to support the research component of the programme. A further objective is the deepening of subject knowledge on general plant physiology through self study.

11061 : Biometry	711(6): Postgraduate biometry
39632 : Horticultural Science	878(174): Master's thesis

Master's programme in Plant Pathology (MSc)

Programme Description

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.

32891 : Plant Pathology	878(180): Master's thesis
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Master's programme in Food and Wine Production Systems (MScAgric Viticulture and Oenology)

Viticulture

Programme Description

The programme comprises formal lectures, as well as seminars, self-study and experimental work in Viticulture. The composition of the modules is determined by students' academic background and field of interest and in conjunction with the lecturers involved. The following modules are offered: molecular aspects of key processes in grapevines; advanced grapevine physiology; analysis of spatial patterns, the concept of terroir, berry ripening and new technologies. Students are required to perform self-study on the South African wine industry and to perform independent research in Viticulture. The modular component of the programme is aimed at attaining generic research skills in support of the research component as well as in-depth subject knowledge on different aspects of viticulture.

33081 : Viticulture	871(20): Research methodology
33081 : Viticulture	872(15): The concept of terroir, climate change and sustainable viticulture
33081 : Viticulture	874(25): Concepts in molecular biology and advanced grapevine physiology
33081 : Viticulture	878(120): Master's thesis

DOCTORAL PROGRAMMES

PhD programmes in Agronomy, Entomology, Genetics, Horticultural Science, Plant Pathology, Soil Science and Viticulture (PhD)

Programme Description

These programmes focus on research in various fields of specialisation in the plant and soil sciences and train 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 at the highest academic level with the knowledge and expertise he needs for entering the research industry or some other professional field. Students thus become professionals who can, either as a team member or individually, play a meaningful role, nationally or internationally, in research, teaching and policy making in specialist fields concerned with sustainable and environmentally friendly food production and food safety.

55565 : Agronomy	978(360): Doctoral dissertation
34576 : Entomology	978(360): Doctoral dissertation
13285 : Genetics	978(360): PhD in Genetics
14176 : Soil Science	978(360): Doctoral dissertation
39632 : Horticultural Science	978(360): Doctoral dissertation
32891 : Plant Pathology	978(360): Doctoral dissertation
33081 : Viticulture	978(360): Doctoral dissertation

DSc programme in Agronomy, Entomology, Genetics, Horticultural Science, Plant Pathology, Soil Science or Viticulture (DSc)

Programme Description

The degree DSc is awarded to candidates who, for at least five years, have held the PhD or PhD (Agric) degree from this University or some other qualification found by the Senate to be adequate, or who, for at least seven years, have held the MSc or MScAgric degree of this University or some other qualification found by the Senate to be adequate, who 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 base of an agricultural discipline.

55565 : Agronomy	998(360): DSc research collection
34576 : Entomology	998(360): DSc research collection
13285 : Genetics	998(360): DSc in Genetics
14176 : Soil Science	998(360): DSc research collection
39632 : Horticultural Science	998(360): DSc research collection
32891 : Plant Pathology	998(360): DSc research collection
33081 : Viticulture	998(360): DSc research collection

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/ (Department of Viticulture and Oenology)

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 postharvest 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; and
- 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 73 - 150. For compulsory industry training in Food Science, Viticulture and Oenology, see page 151.

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.

Bachelor's programme in Food Production Systems (BSc Food Sc)

Food Science with Biochemistry

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Food Science	144(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (128 credits)

Compulsory Modules

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)

Compulsory Modules

Biochemistry	314(16), 345(16)
Food Science	314(16), 324(16), 334(16), 344(16), 354(16)
Microbiology	354(16)

Fourth Year (144 credits)

Compulsory Modules

Food Factory Machinery	414(15), 444(15)
Food Science	434(16), 454(16), 478(48), 488(32)

**Bachelor's programme in Food Production Systems (BSc Food Sc)
Food Science with chemistry**

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Food Science	144(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (128 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Chemistry	214(16), 224(16)
Microbiology	244(16)
Food Science	214(16), 244(16)

Third Year (128 credits)

Compulsory Modules

Chemistry	344(16), 354(16)
Food Science	314(16), 324(16), 334(16), 344(16), 354(16)
Microbiology	214(16)

Note: in 2012, third year students must follow the 2011 Calendar, as follows:

Chemistry	334(16), 344(16)
Microbiology	214(16)
Food Science	314(16), 324(16), 334(16), 344(16), 354(16)

Fourth Year (144 credits)

Compulsory Modules

Food Factory Machinery	414(15)
Food Science	434(16), 454(16), 478(48), 488(32)
Microbiology	354(16)

See also Bachelor's Programme in Agricultural Economics and Management (BScAgric):

1) Agricultural Economic Analysis and Management with Food Science and 2) Agricultural Economic and Food Science.

**Bachelor's programme in Food and Wine Production Systems (BScAgric)
Viticulture and Oenology General**

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Crop Production	152(8)

Mathematics (Bio)	124(16)
Oenology	142(8)
Physics (Bio)	134(16), 154(16)

Second Year (144 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Crop Protection	244(16)
Oenology	214(16), 244(16)
Soil Science	214(16), 244(16)
Viticulture	214(16)

Third Year (144 credits)

Compulsory Modules

Oenology	314(16), 342(8), 344(16)
Viticulture	314(16), 322(8), 344(16)

Elective Modules

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)

Compulsory Modules

Oenology	444(16), 454(16), 478(32)
Viticulture	444(16), 454(16), 478(32)

Bachelor's Programme in Food and Wine Production Systems (BScAgric) Oenology Specialised

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Crop Production	152(8)
Mathematics (Bio)	124(16)
Oenology	142(8)
Physics (Bio)	134(16), 154(16)

Second Year (144 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Chemistry	214(16), 244(16)
Oenology	214(16), 244(16)
Soil Science	214(16)
Viticulture	214(16)

Third Year (128 credits)

Compulsory Modules

Chemistry	224(16), 334(16), 344(16)
Oenology	314(16), 342(16), 344(16)
Viticulture	314(16), 322(8), 344(16)

Fourth Year (128 credits)

Compulsory Modules

Oenology	444(16), 454(16), 478(32)
Viticulture	444(16), 454(16), 478(32)

POSTGRADUATE PROGRAMMES

Postgraduate programmes in Food and Wine Production Systems follow on 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 with Honours, Master of Science in Agriculture, Master of Science in Food Science, Doctor of Philosophy, Doctor of Philosophy (Food Science), Doctor of Science in Food Science, Oenology, Viticulture or Wine Biotechnology.

HONOURS PROGRAMME

Honours programme in Food and Wine Production Systems (BScHons)

The honours programme in Food and Wine Production Systems leads to the qualification BScHons (Wine Biotechnology). The honours programme extends over one year and consists of further study in one of the majors for the degree BScAgric, BSc or BEng; 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 programme is research- and career-oriented and is based on modern technology and the most recently available research in the field of wine production systems.

Honours programme in Food and Wine Production Systems (BScHons) Wine Biotechnology

Programme Description

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.

50997 : Wine Biotechnology	714(5): Chemical components of grapes and wine
50997 : Wine Biotechnology	771(40): Research methodology for grapevine and wine biotechnology
50997 : Wine Biotechnology	772(25): Techniques in grapevine and wine biotechnology

50997 : Wine Biotechnology	773(30): Biotechnology of wine-related microbes
50997 : Wine Biotechnology	774(20): Vine structure and functioning and grapevine improvement

MASTER'S PROGRAMMES

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

The master's programme in Food and Wine Production Systems leads to one of the following qualifications: MScAgric (Oenology), MScAgric (Viticulture), MScAgric (Wine Biotechnology), MSc (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 only an applicable bachelor's 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 a suitable honours degree is held, the programme consists only of a research component. Students holding the BSc Food Sc degree follow only the research component of the MSc Food Sc programme. No additional modules need to be followed. The syllabus for the MSc Food Sc, MSc Agric and MSc is as follows:

Master's programme in Food and Wine Production Systems (MSc Food Sc) Food Science

Programme Description

Research on an appropriate subject within one of the following departmental research programmes: food processing, food fermentation, food processing waste management, food molecular biology, cereal quality, cereal science, near-infrared spectroscopy, sensory science and food microbiology.

21210 : Food Science	878(180): Master's thesis
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Master's programme in Food and Wine Production Systems (MScAgric Viticulture and Oenology) Oenology

Programme Description

The programme comprises formal lectures, as well as seminars, self-study and experimental work in Oenology. Research projects can be chosen from the following themes: terroir and its impact on wine quality; genetic properties and improvement of wine yeasts; advanced alcoholic fermentation; wine evaluation; wine aroma; advanced malolactic fermentation; enzymes in wine preparation; the role of phenols in grapes and wine; environmental management. Students are required to perform self-study on the South African wine industry and to perform independent experimental research in Oenology. The modular component of the programme is aimed at attaining generic research skills in support of the research component as well as in-depth subject knowledge on different aspects of oenology.

33103 : Oenology	871(20): Research methodology
33103 : Oenology	872(20): Advanced wine microbiology
33103 : Oenology	874(20): Wine chemistry and analysis
33103 : Oenology	878(120): Master's thesis

Master's programme in Food and Wine Production Systems (MScAgric Viticulture and Oenology)

Viticulture

Programme Description

The programme comprises formal lectures, as well as seminars, self-study and experimental work in Viticulture. The composition of the modules is determined by students' academic background and field of interest and in conjunction with the lecturers involved. The following modules are offered: molecular aspects of key processes in grapevines; advanced grapevine physiology; analysis of spatial patterns, the concept of terroir, berry ripening and new technologies. Students are required to perform self-study on the South African wine industry and to perform independent research in Viticulture. The modular component of the programme is aimed at attaining generic research skills in support of the research component as well as in-depth subject knowledge on different aspects of viticulture.

33081 : Viticulture	871(20): Research methodology
33081 : Viticulture	872(15): The concept of terroir, climate change and sustainable viticulture
33081 : Viticulture	874(25): Concepts in molecular biology and advanced grapevine physiology
33081 : Viticulture	878(120): Master's thesis

Master's programme in Food and Wine Production Systems (MScAgric or MSc)

Wine Biotechnology

Programme Description

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.

50997 : Wine Biotechnology	878(180): Master's thesis
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DOCTORAL PROGRAMMES

Doctoral Programmes in Food and Wine Production Systems PhD programme [PhD (Food Sc), PhD]

Programme Description

This programme lead to one of the following qualifications: PhD (fields: Oenology, Viticulture or 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.

21210 : Food Science	978(360): Doctoral dissertation
33103 : Oenology	978(360): Doctoral dissertation
33081 : Viticulture	978(360): Doctoral dissertation
50997 : Wine Biotechnology	978(360): Doctoral dissertation

Doctoral Programmes in Food and Wine Production Systems (DSc programme)

Programme Description

The degree DSc 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.

21210 : Food Science	998(360): DSc research collection
33103 : Oenology	998(360): DSc research collection
33081 : Viticulture	998(360): DSc research collection
50997 : Wine Biotechnology	998(360): DSc research collection

ANIMAL PRODUCTION SYSTEMS

More information is available on the following web site:

<http://www.sun.ac.za/animal> (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;
- creating the awareness 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); and
- Animal Science with Aquaculture (Aquaculture)

The modules of the various years of study for each field are set out below; the module content is given on pages 73 - 150. For compulsory vacation work and practical training see page 152.

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 and Animal Science with Aquaculture.

Bachelor's Programme in Animal Production Systems (BScArgic) Animal Science

First Year (132 credits)

Compulsory Modules

Animal Science	144(16)
Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (144 credits)

Compulsory Modules

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

Third Year (120 credits)

Compulsory Modules

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

Fourth Year (136 credits)*Compulsory Modules*

Agronomy	324(16)
Animal Breeding Science	424(16), 454(16)
Animal Management Science	434(16), 464(16)
Animal Nutrition Science	414(16), 444(16)
Animal Product Science	334(16)
Animal Science	442(8)

Bachelor's Programme in Animal Production Systems (BScAgric)**Animal Science with Agronomy****First Year (132 credits)***Compulsory Modules*

Animal Science	144(16) or
Biology	144(16)
Chemistry	114(16), 154(16)
Biology	124(16), 154(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (144 credits)*Compulsory Modules*

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)*Compulsory Modules*

Agronomy	322(8), 332(8)
Animal Nutrition Science	324(16), 344(16)
Animal Physiology	324(16), 344(16)
Animal Product Science	352(8)
Biometry	312(8), 342(8)
Genetics	324(16), 354(16)

Fourth Year (136 credits)*Compulsory Modules*

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

**Bachelor's Programme in Animal Production Systems (BScAgric)
Animal Science with Conservation Ecology**

First Year (132 credits)

Compulsory Modules

Biology	124(16), 144(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (144 credits)

Compulsory Modules

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)

Compulsory Modules

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)

Compulsory Modules

Animal Breeding Science	424(16), 454(16)
Animal Nutrition Science	414(16), 444(16)
Animal Product Science	334(16)
Biodiversity and Ecology	344(16)

and

Conservation Ecology	448(32) or
Animal Management Science	464(16) and
Animal Science	442(8)

and

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

**Bachelor's Programme in Animal Production Systems (BScAgric)
Agricultural Economics with Animal Science**

First Year (124 credits)

Compulsory Modules

Animal Science	144(16)
Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)

Economics	114(12), 144(12)
Mathematics (Bio)	124(16)

Second Year (128 credits)

Compulsory Modules

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)

Compulsory Modules

Agricultural Economics	314(16), 364(16)
Animal Nutrition Science	324(16), 344(16)
Animal Product Science	352(8)
Animal Physiology	324(16), 344(16)

Fourth Year (120 or 128 credits)

Compulsory Modules

Agricultural Economics	414(16), 424(16), 444(16), 454(16)
Animal Nutrition Science	414(16), 444(16)
<i>and</i>	
Animal Management Science	434(16) or 464(16)

Bachelor's Programme in Animal Production Systems (BScAgric) Animal Science with Aquaculture

First Year (132 credits)

Compulsory Modules

Animal Science	144(16)
Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (144 credits)

Compulsory Modules

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

Third Year (144 credits)

Compulsory Modules

Animal Physiology	324(16), 344(16)
Animal Nutrition Science	324(16), 344(16)

Aquaculture	314(16), 344(16)
Biometry	312(8), 342(8)
Genetics	324(16), 354(16)

Fourth Year (128 credits)

Compulsory Modules

Animal Breeding Science	424(16)
Animal Nutrition Science	414(16), 444(16)
Aquaculture	414(16), 444(16), 478(32)
Conservation Ecology	424(16)

MASTER'S PROGRAMMES

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

Programme Description

The master's programme in Animal Production Systems leads to the qualification MScAgric (with Animal Science or Aquaculture). The programme consists of a two-year MScAgric if the student holds a BScAgric degree with an average mark of at least 60%. The student must follow the research component of the programme (120 credits) and the prescribed modules (60 credits) as listed below.

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.

Programme Outcomes

After the successful completion of the theoretical modules, 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.

20826 : Animal Science	878(120): Master's thesis
46213 : Aquaculture	878(120): Master's thesis

Animal Science

20826 : Animal Science	871(18): Fundamental ruminant nutrition
20826 : Animal Science	872(18): Fundamental monogastric nutrition
20826 : Animal Science	874(18): Fundamental animal breeding
20826 : Animal Science	875(18): Fundamental animal physiology
20826 : Animal Science	876(18): Applied animal physiology
20826 : Animal Science	881(18): Fundamental meat science
20826 : Animal Science	882(18): Applied ruminant nutrition

20826 : Animal Science	883(18): Applied monogastric nutrition
20826 : Animal Science	884(18): Applied animal breeding

Biometry

11061 : Biometry	711(6): Postgraduate biometry
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Aquaculture

46213 : Aquaculture	874(18): Aquaculture products
46213 : Aquaculture	875(18): Aquaculture ecology
46213 : Aquaculture	876(18): Aquaculture nutrition

MScAgric Animal Science

Stipulation: Biometry 711 is compulsory. Besides the prescribed module, the student can choose one of the following groups of Animal Science elective modules:

Ruminant nutrition

20826 : Animal Science	871(18): Fundamental ruminant nutrition
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and

20826 : Animal Science	872(18): Fundamental monogastric nutrition
------------------------	--

and

20826 : Animal Science	882(18): Applied ruminant nutrition
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OR

Monogastric nutrition

20826 : Animal Science	871(18): Fundamental ruminant nutrition
------------------------	---

and

20826 : Animal Science	872(18): Fundamental monogastric nutrition
------------------------	--

and

20826 : Animal Science	883(18): Applied monogastric nutrition
------------------------	--

OR

Animal breeding

20826 : Animal Science	874(18): Fundamental animal breeding
------------------------	--------------------------------------

and

20826 : Animal Science	884(18): Applied animal breeding
------------------------	----------------------------------

and one of

20826 : Animal Science	871(18): Fundamental ruminant nutrition
------------------------	---

20826 : Animal Science	872(18): Fundamental monogastric nutrition
------------------------	--

20826 : Animal Science	875(18): Fundamental animal physiology
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20826 : Animal Science	876(18): Applied animal physiology
------------------------	------------------------------------

20826 : Animal Science	881(18): Fundamental meat science
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20826 : Animal Science	882(18): Applied ruminant nutrition
------------------------	-------------------------------------

or

20826 : Animal Science	883(18): Applied monogastric nutrition
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OR

Animal physiology

20826 : Animal Science	875(18): Fundamental animal physiology
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and

20826 : Animal Science	876(18): Applied animal physiology
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and one of

20826 : Animal Science	871(18): Fundamental ruminant nutrition
20826 : Animal Science	872(18): Fundamental monogastric nutrition
20826 : Animal Science	874(18): Fundamental animal breeding
20826 : Animal Science	881(18): Fundamental meat science

or

20826 : Animal Science	882(18): Applied ruminant nutrition
20826 : Animal Science	883(18): Applied monogastric nutrition

or

20826 : Animal Science	884(18): Applied animal breeding
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OR

Meat science

20826 : Animal Science	881(18): Fundamental meat science
------------------------	-----------------------------------

and one of

20826 : Animal Science	871(18): Fundamental ruminant nutrition
------------------------	---

or

20826 : Animal Science	872(18): Fundamental monogastric nutrition
------------------------	--

and one of

20826 : Animal Science	882(18): Applied ruminant nutrition
20826 : Animal Science	883(18): Applied monogastric nutrition
20826 : Animal Science	884(18): Applied animal breeding
20826 : Animal Science	874(18): Fundamental animal breeding
20826 : Animal Science	875(18): Fundamental animal physiology

or

20826 : Animal Science	876(18): Applied animal physiology
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MScAgric Aquaculture

Stipulation: Biometry 711 is compulsory. Besides the prescribed module, the student must follow at least two of the following Aquaculture elective modules:

46213 : Aquaculture	874(18): Aquaculture products
46213 : Aquaculture	875(18): Aquaculture ecology
46213 : Aquaculture	876(18): Aquaculture nutrition

AND

one of the MScAgric Animal Science modules, as listed above, in agreement with the relevant study leader.

DOCTORAL PROGRAMMES

PhD programme in Animal Production Science [PhD]

Programme Description

This programme in Animal Production Systems leads to the qualification PhD (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.

20826 : Animal Science	978(360): Doctoral dissertation
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DSc programme in Animal Production Systems [DSc]

Programme Description

The degree DSc is awarded to candidates who have held the PhD (Agric) or PhD 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.

20826 : Animal Science	998(360): DSc research collection
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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 five related fields of study with corresponding degree qualifications: Agricultural Economic Analysis (BScAgric), Agricultural Economic Analysis and Management (BScAgric), Agricultural Economic Analysis and Management with Food Science (BScAgric), Agricultural Economics with Food Science (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 (Agricultural Economic Analysis and Management).

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

- access a wide variety of professions in and outside agriculture and be able to switch professions with greater ease in our rapidly-changing environment, because their training spans the physical, biological and social sciences;
- understand the integrated nature of the physical, biological and social aspects of a farming enterprise in order to manage it better;
- plan and manage the processing of farming commodities in order to add value;
- manage agribusinesses that supply farming requisites such as seed, pesticides and herbicides and finance to farmers;
- manage agribusinesses that process and market farm products. The combination of Food Science with commerce subjects, for example, provides an excellent background to prospective managers of food manufacturers;
- analyse agricultural and broader economic policy and take part in policy recommendations;
- provide management advice to farmers and other agribusinesses as professional consultants;

- manage the logistical aspects of the provision of farm requisites and farm products, as well as non-agricultural products;
- conduct in-depth and professional research and find solutions to complex problems that arise in the management of farms and other agribusinesses and in the agricultural economy generally;
- understand the process of planning and executing the concepts of pricing, promotion and the distribution of ideas, products and services in agricultural markets;
- understand agricultural market institutions, market processes and issues of organization, control and public policy; and
- apply fundamental analytical tools to various marketing problems in agricultural food markets.

The prescribed modules of the various years of study for each field are set out below; the module content is given on pages 73 - 150.

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

The undergraduate programme in Agricultural Economics and Management is divided into five fields of study: Agribusiness Management as a field of study for the qualification BAgriAdmin, and Agricultural Economic Analysis, Agricultural Economic Analysis and Management, Agricultural Economic Analysis and Management with Food Science and Agricultural Economics with Food Science as fields of study for the qualification BScAgric.

Bachelor's Programme in Agricultural Economics and Management (BAgriAdmin)

Agribusiness Management

First Year (122 credits)

Compulsory Modules

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

Second Year (136 credits)

Compulsory Modules

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

or

Financial Management	214(16)
Logistics Management	214(16), 244(16)

and

Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)

or

Animal Production	214(16)
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and

Animal Science	244(16)
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Third Year (128 credits)

Compulsory Modules

Agricultural Economics	314(16), 334(16), 354(16), 364(16)
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Elective Modules

Select 48 credits from the following modules as per timetable

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)

one of the following

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

Bachelor's Programme in Agricultural Economics and Management (BScAgric)

Agricultural Economic Analysis

First Year (124 credits)

Compulsory Modules

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

Second Year (134 credits)

Compulsory Modules

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

Third Year (128 credits)

Compulsory Modules

Agricultural Economics	314(16), 364(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)
Horticultural Science	222(8)
Viticulture	244(16)

or

Animal Production	214(16)
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and

Animal Science	244(16)
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or

Aquaculture	314(16), 344(16)
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Fourth Year (144 credits)

Compulsory Modules

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

Bachelor's Programme in Agricultural Economics and Management (BScAgric)

Agricultural Economic Analysis and Management

First Year (126 credits)

Compulsory Modules

Animal Reproduction Physiology	112(8)
Business Management	113(8), 142(6)
Crop Production	152(8)
Computer Skills	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)

Compulsory Modules

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

and

Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)

or

Animal Production	214(16)
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and

Animal Science	244(16)
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Elective Modules

Select a minimum of 48 credits from one of the following groups

Financial Management	214(16)
Investment Management	254(16)
Marketing Management	214(16), 244(16)

or

Entrepreneurship and Innovation Management	214(16), 244(16)
Financial Management	214(16)
Investment Management	254(16)

or

Entrepreneurship and Innovation Management	214(16)
Investment Management	254(16)
Logistics Management	214(16), 244(16)

or

Logistics Management	214(16), 244(16)
Marketing Management	214(16), 244(16)

or

Entrepreneurship and Innovation Management	214(16), 244(16)
Logistics Management	214(16), 244(16)

Third Year (136 credits)

Compulsory Modules

Agricultural Economics	314(16), 364(16)
Crop Protection	244(16)

Elective Modules

Select a minimum of 88 credits from one of the following groups ()*

Economics	214(16), 244(16)
Entrepreneurship and Innovation Management	318(24)
Financial Management	314(12), 324(12), 354(12)
Financial Accounting	288(32)
Logistics Management	318(24), 348(24)
Strategic Management	344(12)

or

Economics	214(16), 244(16)
Entrepreneurship and Innovation Management	318(24)
Financial Accounting	288(32)
Logistics Management	318(24), 348(24)
Marketing Management	314(12), 324(12), 344(12)
Strategic Management	344(12)

or

Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	314(12), 324(12), 354(12)
Logistics Management	318(24), 348(24)
Strategic Management	344(12)
Transport Economics	214(16)

or

Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	314(12), 324(12), 354(12)
Logistics Management	318(24), 348(24)
Marketing Management	314(12), 324(12), 344(12)
Strategic Management	344(12)

(*) Only if the class, test and exam timetable allow the specific combination of modules.

Fourth Year (144 credits)

Compulsory Modules

Agricultural Economics	414(16), 424(16), 444(16), 454(16), 478(32)
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Elective Modules

Select a minimum of 48 credits from one of the following groups

Economics	318(24), 348(24), 388(24)
Financial Accounting	389(48)
Financial Management	314(12), 324(12), 344(12), 354(12)
Investment Management	314(12), 324(12), 344(12), 348(12)
Project Management	378(24) or
Strategic Management	344(12)

or

Economics	318(24), 348(24), 388(24)
Financial Accounting	389(48)
Investment Management	314(12), 324(12), 344(12), 348(12)
Marketing Management	314(12), 324(12), 344(12), 354(12)
Project Management	378(24) or
Strategic Management	344(12)

or

Economics	318(24), 348(24), 388(24)
Financial Accounting	389(48)
Investment Management	314(12), 324(12), 344(12), 348(12)
Logistics Management	318(24), 348(24)
Project Management	378(24) or
Strategic Management	344(12)

(*) Only if the class, test and exam timetable allow the specific combination of modules.

**Bachelor's Programme in Agricultural Economics and Management
(BScAgric)
Agricultural Economic Analysis and Management with Food Science
First Year (142 credits)**

Compulsory Modules

Animal Reproduction Physiology	112(8)
Business Management	113(8), 142(6)
Crop Production	152(8)
Computer Skills	171(4)
Economics	114(12), 144(12)
Food Science	144(16)
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)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Financial Accounting	188(24)
Food Science	214(16), 244(16)

and

Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)

or

Animal Production	214(16)
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and

Animal Science	244(16)
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Elective Modules

Select a minimum of 16 credits from the following group

Entrepreneurship and Innovation Management	214(16), 244(16)
Marketing Management	214(16), 244(16)

Third Year (136 credits)

Compulsory Modules

Agricultural Economics	314(16), 364(16)
Crop Protection	244(16)
Financial Management	214(16)
Food Science	314(16), 344(16)

Elective Modules

Select a minimum of 32 credits from the following group

Economics	214(16), 244(16)
Financial Accounting	288(32)
Logistics Management	214(16), 244(16)

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

Fourth Year (144 credits)

Compulsory Modules

Agricultural Economics	414(16), 424(16), 444(16), 454(16)
Food Science	434(16), 454(16)

Elective Modules

Select a minimum of 48 credits from the following group (*)

Economics	318(24), 348(24), 388(24)
Financial Accounting	389(48)
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)

(*) Only if the class, test and exam timetable allow the specific combination of modules.

Bachelor's Programme in Agricultural Economics and Management (BScAgric)

Agricultural Economic and Food Science

First Year (130 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Economics	114(12), 144(12)
Food Science	144(16)
Mathematics (Bio)	124(16)
Theory of Interest	152(6)

Second Year (136 credits)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Financial Accounting	188(24)
Food Science	214(16), 244(16)
Microbiology	214(16)

and

Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)

or

Animal Production	214(16)
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and

Animal Science	244(16)
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Third Year (124 credits)

Compulsory Modules

Agricultural Economics	314(16), 364(16)
Crop Protection	244(16)
Food Science	314(16), 344(16)

Elective Modules

Select a minimum of 44 credits from one of the following groups:

Financial Accounting	288(32)
Financial Management	214(16)
Logistics Management	214(16), 244(16)
Transport Economics	214(16)

Fourth Year (144 credits)

Compulsory Modules

Agricultural Economics	414(16), 424(16), 444(16), 454(16)
Food Science	434(16), 454(16)

Elective Modules

Select a minimum of 48 credits from one of the following groups:

Financial Accounting	389(48)
Financial Management	314(12), 324(12), 344(12), 354(12)

HONOURS PROGRAMME

Honours programme in Agricultural Economics and Management (BAgricAdminHons)

Agricultural Economics

Programme Description

The honours programme in Agricultural Economics and Management leads to the following qualification: 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 training of agricultural economists at a high level. Agricultural Economics forms the central component of the programme. The programme focuses on the management of agriculture-related enterprises.

Elective modules

Select a minimum of 72 credits from the following modules:

15504 : Agricultural Economics	414(16): National and international market analysis
15504 : Agricultural Economics	424(16): Foundations of Agricultural Economics: an institutional approach
15504 : Agricultural Economics	444(16): Environmental policy
15504 : Agricultural Economics	454(16): Agricultural policy in the South African context
15504 : Agricultural Economics	771(20): Farm management
15504 : Agricultural Economics	772(20): Topical issues in agricultural policy
15504 : Agricultural Economics	773(20): Wine marketing

15504 : Agricultural Economics	774(20): Resource and environmental economics
15504 : Agricultural Economics	775(20): Agricultural production and resource management
15504 : Agricultural Economics	776(20): International trade and marketing
15504 : Agricultural Economics	780(20): Rural development

Students can elect from the honours modules following the 300-level modules of their other major subject(s) up to a maximum of 48 credits, subject to the permission of the relevant department, to contribute to a total of 120 credits.

MASTER'S PROGRAMMES

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

Agricultural Economics

Programme Description

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 includes a research component 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. The research component focuses on 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. Advanced coursework, preceding the thesis, is required for the degree MScAgric.

Master's programme in Agricultural Economics and Management (MAgricAdmin)

Agricultural Economics

15504 : Agricultural Economics	878(180): Master's thesis
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Master's programme in Agricultural Economics and Management (MAgric)

Agricultural Economics

Elective Modules

Select a minimum of 80 credits from one of the following modules

15504 : Agricultural Economics	871(20): Strategic farm management
15504 : Agricultural Economics	872(20): Agricultural policy analysis
15504 : Agricultural Economics	874(20): Strategic marketing of wine
15504 : Agricultural Economics	875(20): Topical issues in agricultural resource use
15504 : Agricultural Economics	876(20): Agricultural production economics and decision analysis
15504 : Agricultural Economics	880(20): South African agriculture
15504 : Agricultural Economics	881(20): Rural development

and

15504 : Agricultural Economics	882(100): Master's thesis
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DOCTORAL PROGRAMMES

Doctoral Programmes in Agricultural Economics and Management (PhD programme [PhD (Agric)])

Programme Description

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.

15504 : Agricultural Economics	978(360): Doctoral dissertation
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Doctoral Programmes in Agricultural Economics and Management (DSc programme [DscAgric])

Programme Description

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 MAgriAdmin 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.

15504 : Agricultural Economics	998(360): DSc research collection
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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 and Wood Sciences (BScFor) degree. Within the programme there are two fields of study, namely: Forestry and Natural Resources Sciences and Wood and Wood Products Sciences.

Forestry and Natural Resource Sciences

The first year of study in Forestry and Natural Resource Science consists of one Forestry module plus the first year of study in the Biological Sciences programme in the Faculty of Science. The second year of study 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 Forestry Development.

Forestry and Natural Resource Sciences students participate in a week-long practical exposure session during vacations in each of the first three years of study. In the fourth year students 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.

Upon successful completion of the programme in *Forestry and Natural Resource Sciences* 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 artificial 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 a usable format;
- communicate effectively with peers, superiors and subordinates, using information-technology support for oral or written discourse and the presentation of reports and submissions;
- apply scientific research methodology and state-of-the-art technology in order to effectively undertake a research project investigating 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 humankind.

Wood and Wood Products Sciences

For Wood and Wood Products Sciences, modules are taken in the Faculties of AgriSciences, Science and Engineering from the first year of study. The Wood and Wood Products Sciences field of study includes a variety of modules concerned not only with the properties of wood as a material, but also with sawmilling, veneer manufacture, industrial furniture production and the construction and design of wood products. Wood and Wood Products Sciences modules are complemented by a series of engineering-based modules such as Industrial Ergonomics, Engineering Drawing, Engineering Mathematics, Industrial Management, Engineering Economics and Quality Assurance. Students in Wood and Wood Products Sciences participate in practical sessions during vacations from their first to fourth year.

Upon successful completion of the field of study in *Wood and Wood Products Sciences*, 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 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 to further the requirements of forest product research by presenting results in a usable format;
- communicate effectively with peers, superiors and subordinates, using information-technology support for oral or written discourse and the 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 the utilisation of forest resources for the benefit of humankind.

The prescribed modules and elective modules of the various years of study for each field are set out below; the module contents are given on pages 73 - 150. For compulsory practical work, see pages 152 - 153.

The Undergraduate Programme in Forestry and Wood Sciences is subdivided into the following fields of study: Forestry and Natural Resources Sciences and Wood and Wood Products Sciences.

Bachelor's Programme in Forestry and Wood Sciences (BScFor) Forestry and Natural Resource Science

First Year (124 credits)

Compulsory Modules

Biology	124(16), 144(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Forest Science	171(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16)

Second Year (133 credits)

Compulsory Modules

Biometry	212(8), 242(8)
Computer Skills	272(5)
Forest Science	212(8), 234(8), 274(16), 254(16)
Geography and Environmental Studies	214(16)
Soil Science	214(16)
Wood Product Science	144(16), 244(16)

Third Year (136 credits)

Compulsory Modules

Biometry	312(8)
Conservation Ecology	314(16)
Forest Science	314(16), 344(16), 354(16), 355(16), 364(16)

Genetics	214(16)
Soil Science	314(16)

Fourth Year (140 credits)

Compulsory Modules

Offered until 2013

Forest Science	414(16), 422(8), 424(16), 434(16), 468(32)
Industrial Psychology (Special)	354(12)
Project Management	412(12)
Strategic Management	344(12)
Wood Product Science	454(16)

Offered from 2014

Forest Science	414(16), 424(16), 434(16), 435(8), 468(32)
Industrial Psychology (Special)	354(12)
Project Management	412(12)
Strategic Management	344(12)
Wood Product Science	454(16)

Bachelor's Programme in Forestry and Wood Sciences (BScFor) Wood and Wood Products Sciences

First Year (126 credits)

Compulsory Modules

Applied Mathematics B	124(15)
Communication	110(0)
Computer Skills	171(4)
Computer Programming	143(12)
Engineering Chemistry	123(15)
Engineering Drawings	123(15)
Engineering Mathematics	115(15), 145(15)
Strength of Materials	143(15)
Wood Product Science	112(8), 144(16)

Elective Modules

Conditional:

Language Skills (Afrikaans)	176(8) *
Language skills (English)	153(8) *
Language Skills (Afrikaans)	163(8) *

**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. Language skills (Afrikaans) 176 is a year module presented at beginners level for students who want to further develop their Afrikaans language skills. Language skills (Afrikaans) 163 is a semester module presented at an advance level in the second semester for students who want to improve their Afrikaans language skills. Language skills (English) 153 is a semester module presented at intermediary level in the second semester for students who want to improve their English language skills.*

Second Year (129 credits)

Compulsory Modules

Engineering Mathematics	214(15)
Forest Science	171(8), 274(16)
Industrial Programming	244(15)
Production Management	214(15)
Professional Communication	113(12)
Wood Product Science	244(16), 234(16), 264(16)

Elective Modules

Conditional:

Language Skills (Afrikaans)	276(12) *
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*Language Skills (Afrikaans) 276 is only relevant to students who completed Language Skills (Afrikaans) 176

Third Year (124 credits)

Compulsory Modules

Engineering Economy	312(8)
Engineering Statistics	314(15)
Forest Science	355(16)
Industrial Management	354(15)
Operations Research (Eng)	415(15)
Quality Assurance	344(15)
Wood Product Science	312(8), 334(16), 335(16)

Fourth Year (132 credits)

Compulsory Modules

Business Design	444(15)
Environmental Engineering	442(8)
Industrial Ergonomics	414(15)
Operations Research (Eng)	345(15)
Quality Management	444(15)
Wood Product Science	414(16), 434(16), 454(16), 464(16)

POSTGRADUATE PROGRAMMES

Postgraduate programmes in Forestry and Wood 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: Postgraduate Diploma in Forestry and Wood Sciences (PGDipFor), Bachelor of Science in Forestry and Wood Sciences with Honours (BScForHons), Master of Science in Forestry and Wood Sciences (MScFor), Doctor of Philosophy in Forestry and Wood Sciences [PhD (For)] or Doctor of Science in Forestry and Wood Sciences (DScFor) in the fields of Forestry and Natural Resource Sciences or Wood and Wood Products Sciences.

In order to pursue postgraduate studies in the Department of Forest and Wood Science, students must have achieved a minimum of 60% at the undergraduate level in all their modules or in the major module related to the intended postgraduate study direction. Deviations from this requirement are at the discretion of the chairperson of the Department.

POSTGRADUATE DIPLOMA

Postgraduate Diploma Programme in Forestry and Wood Sciences

Programme Description

The postgraduate diploma programme in Forestry and Wood Sciences extends over one year and leads to the qualification PGDip in Forestry and Wood Sciences. Three-year BSc degrees and BTech degrees, as well as other qualifications approved by the Senate for this purpose gives access to this programme. The PGDip programme consists of an approved curriculum which lays the foundation for specialisation in forestry disciplines. The postgraduate diploma allows access to the MScFor programme. Offer subject to accreditation.

Compulsory Modules

11290 : Forest Science	780(24): Forest science project
57584 : Wood Product Science	784(24): Wood products science project

Students must choose one of the compulsory modules.

Elective Modules

11290 : Forest Science	723(16): Sustainable land use planning
11290 : Forest Science	761(16): Bio-energy systems
11290 : Forest Science	764(16): Energy production from wood and other biomass
11290 : Forest Science	766(16): Geo information science for resource managers
11290 : Forest Science	772(32): Silviculture
11290 : Forest Science	773(32): Timber harvesting and transport logistics
11290 : Forest Science	774(32): Forest inventory and yield prediction
11290 : Forest Science	775(32): Forest management
11290 : Forest Science	776(32): Forest propagation and tree improvement
11290 : Forest Science	785(32): Forestry development
57584 : Wood Product Science	414(16): Wood products manufacturing I
57584 : Wood Product Science	424(16): Furniture design and construction
57584 : Wood Product Science	434(16): Wood products manufacturing II
57584 : Wood Product Science	464(16): Industrial wood finishing
57584 : Wood Product Science	754(16): Wood-based constructions
57584 : Wood Product Science	781(32): Wood quality factors
57584 : Wood Product Science	782(32): Primary wood processing
57584 : Wood Product Science	783(16): Mechanical properties of timber and bio-energy

Students must choose a total of 96 credits from the elective modules but may not choose more than four of the 16-credit elective modules.

HONOURS PROGRAMME

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

Programme Description

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

Compulsory Modules

11061 : Biometry	711(6): Postgraduate biometry
11290 : Forest Science	771(34): Research project

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.

Elective Modules:

Select two further modules

11290 : Forest Science	711(40): Advanced growth and yield science
11290 : Forest Science	712(40): Forest harvesting
11290 : Forest Science	713(40): Advanced nursery practice
11290 : Forest Science	714(40): Advanced tree breeding
11290 : Forest Science	715(40): Community forestry
11290 : Forest Science	716(40): Agroforestry
11290 : Forest Science	741(40): Advanced forestry planning
11290 : Forest Science	742(40): Forest roads and logistics
11290 : Forest Science	743(40): Sustainable silviculture
11290 : Forest Science	744(40): Forest eco-physiology
11290 : Forest Science	745(40): Forest economics and policy
57584 : Wood Product Science	711(40): Wood properties I
57584 : Wood Product Science	712(40): Wood processing
57584 : Wood Product Science	742(40): Wood Properties II
57584 : Wood Product Science	743(40): Wood-based constructions

Honours programme in Forestry and Wood Sciences (BScForHons) Wood and Wood Products Sciences

Programme Description

The Wood and Wood Products Sciences field of study in the honours programme in Forestry and Wood Sciences extends over one year and leads to the qualification BScForHons in Wood and Wood Products Sciences. The modules and study tasks add depth to build on the bachelor's programme. The modules have specifically been compiled for each field of study to ensure students receive specialised training in a specific field of study. The programme is research and career-oriented and is based on the most recently

available research and practices and links up with research projects carried out in the Department.

Compulsory Modules

57584 : Wood Product Science	741(40): Industrial research and practice
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Wood Products Science 741 is compulsory.

Elective Modules

Select two further modules:

11290 : Forest Science	711(40): Advanced growth and yield science
11290 : Forest Science	712(40): Forest harvesting
11290 : Forest Science	713(40): Advanced nursery practice
11290 : Forest Science	714(40): Advanced tree breeding
11290 : Forest Science	715(40): Community forestry
11290 : Forest Science	716(40): Agroforestry
11290 : Forest Science	741(40): Advanced forestry planning
11290 : Forest Science	742(40): Forest roads and logistics
11290 : Forest Science	743(40): Sustainable silviculture
11290 : Forest Science	744(40): Forest eco-physiology
11290 : Forest Science	745(40): Forest economics and policy
57584 : Wood Product Science	711(40): Wood properties I
57584 : Wood Product Science	712(40): Wood processing
57584 : Wood Product Science	742(40): Wood Properties II
57584 : Wood Product Science	743(40): Wood-based constructions

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 Wood Sciences (MScFor) Forestry and Natural Resource Sciences or Wood and Wood Products Sciences

Programme Description

The master's programme in Forestry and Wood Sciences leads to the qualifications MScFor in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. The programme consists of a one-year MScFor and the four-year BScFor degree. A relevant honours degree, the Postgraduate Diploma in Forestry and Wood Sciences, as well as other qualifications approved by the Senate for this purpose give access to the programme.

11061 : Biometry	711(6): Postgraduate biometry
11290 : Forest Science	875(14): Forest Science research methodology
11290 : Forest Science	878(120): Master's thesis
57584 : Wood Product Science	875(14): Wood Product Science research methodology
57584 : Wood Product Science	878(120): Master's thesis

Students must register for Biometry 711 and can choose between Forest Science 875 in combination with Forest Science 878 or Wood Product Science 875 in combination with Wood Product Science 878.

Elective Modules

11290 : Forest Science	881(40): Advance forest eco-physiology
11290 : Forest Science	882(40): Advance timber harvesting logistics
11290 : Forest Science	883(40): Advance forest management
11290 : Forest Science	884(40): Forest growth and wood formation
11290 : Forest Science	885(40): Advance forestry development
11290 : Forest Science	886(40): Advanced nursery practice and tree improvement
57584 : Wood Product Science	880(40): Wood mechanics and wood-based constructions
57584 : Wood Product Science	881(40): Wood quality factors
57584 : Wood Product Science	882(40): Physical wood properties

Students must choose one of the 40-credit elective modules.

DOCTORAL PROGRAMMES

PhD programme in Forestry and Wood Sciences [PhD (For)]

Programme Description

This programme leads to the qualification PhD (For) in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. 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.

11290 : Forest Science	978(360): Doctoral dissertation
57584 : Wood Product Science	978(360): Doctoral dissertation

DSc programme in Forestry and Wood Sciences (DScFor)

Programme Description

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.

11290 : Forest Science	998(360): DSc research collection
57584 : Wood Product Science	998(360): DSc research collection

CONSERVATION ECOLOGY

More information is available on the following web site:

<http://consent.sun.ac.za/> (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 73 - 150.

Bachelor's Programme (BSc) in Conservation Ecology

First Year (132 credits)

Compulsory Modules

Biology	124(16), 144(16), 154(16)
Chemistry	114(16), 154(16)
Computer Skills	171(4)
Geo Environmental Science	124(16), 154(16)
Mathematics (Bio)	124(16)

Second Year (141 credits)*Compulsory Modules*

Biodiversity and Ecology	212(16), 264(16), 214(16), 224(16), 254(16)
Computer Skills	272(5)
Conservation Ecology	212(8), 244(16)
Geography and Environmental Studies	214(16)
Microbiology	244(16)

Third Year (136 - 140 credits)*Compulsory Modules*

Biometry	212(8), 242(8)
Biodiversity and Ecology	324(16), 334(16)*, 364(16)*
Conservation Ecology	314(16), 344(16)
Industrial Psychology (Special)	354(12)

*Modules to be followed from 2013.

Choose two of the four modules (as possible within the timetable).

Genetics	214(16) and/or
Soil Science	214(16) and/or
Zoology	315(16) and/or
Sociology	334(12)

Note: in 2012, third-year students must follow the 2011 Calendar, as follows:

Biometry	212(8), 242(8)
Biodiversity and Ecology	344(16), 354(16)
Conservation Ecology	314(16), 344(16)
Industrial Psychology (Special)	354(12)
Zoology	334(16)

Choose two of the four modules (as possible within the timetable).

Genetics	214(16) and/or
Soil Science	214(16) and/or
Zoology	315(16) and/or
Sociology	334(12)

Fourth Year (136 credits)*Compulsory Modules*

Agricultural Economics	262(8)
Agronomy	424(16)
Conservation Ecology	414(16), 424(16), 448(32)
Entomology	464(16), 418(32) or 454(16) and
Soil Science	314(16)

Note: in 2012, fourth-year students must follow the 2010 Calendar, as follows:

Agricultural Economics	262(8)
Agronomy	424(16)
Conservation Ecology	414(16), 424(16), 448(32)
Entomology	464(16), 418(32) or
Geography and Environmental Studies	214(16) and
Soil Science	314(16)

MASTER'S PROGRAMMES

Master's programme in Conservation Ecology (MScConsEcol)

Programme Description

The master's programme in Conservation Ecology leads to the MScConsEcol degree. Under the guidance of their supervisors, students are encouraged to produce any combination of the following products: comprehensive review articles on conservation ecology, conference posters, verbal presentations, popular articles and their own scientific manuscripts. The research component (minimum time span six months, 180 credits at NQF level 8a) entails independent research on an approved topic in conservation ecology, conducted by the student under the supervision of their supervisor. As part of the process, students are expected to present a seminar to the Department of Conservation Ecology and Entomology on their proposed thesis and, on completion of the thesis, to present a seminar in which they defend their thesis. The results must be written up and submitted in the format of a thesis, which must meet the requirements for a master's thesis as prescribed by the Department of Conservation Ecology and Entomology and Stellenbosch University. The thesis will be examined by two examiners, at least one of which must be an external examiner.

55638 : Conservation Ecology	878(180): Master's thesis
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DOCTORAL PROGRAMMES

PhD programme with specialisation in Conservation Ecology (PhD)

Programme Description

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.

55638 : Conservation Ecology	978(360): Doctoral dissertation
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AGRICULTURAL PRODUCTION AND MANAGEMENT

BACHELOR'S PROGRAMME

*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 or www.elsenburg.com).

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:

55565 AGRONOMY				
324	16	Pasture management	3L,3P	T

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

324(16) (the 16 will normally be written in brackets) is the module code of the module Agronomy 324(16) with the module subject: Pasture management.

The module code 324(16) has the following meaning:

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

Second digit: 2 - 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 324(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 324(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)

15504 AGRICULTURAL ECONOMICS				
234	16	South African agriculture	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.				
Home department: AGRICULTURAL ECONOMICS				
242	8	Agricultural production economics and methods of financial analysis	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.				
<i>P Economics 114 or Economics 178 C Agricultural Economics 234</i>				
Home department: AGRICULTURAL ECONOMICS				
262	8	The economics of agricultural resources	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.				
Home department: AGRICULTURAL ECONOMICS				
314	16	Farm management	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>				
Home department: AGRICULTURAL ECONOMICS				
334	16	Agricultural and food marketing	3L, 3P	A
This module is designed to introduce a comprehensive and balanced treatment of food marketing systems. It blends marketing and economic theory with real-world analytical tools in order to assist students in better understanding the food system and making profitable marketing decisions.				
Home department: AGRICULTURAL ECONOMICS				
354	16	Agricultural policy analysis	3L	A
Investigation of priority policy issues in South African agriculture; the influence on South Africa of the Agreement on Agriculture and subsequent attempts to order international trade in agricultural products; changes in the structure of food supply chains				

and the globalisation of food trade; BEE and transformation in South African agriculture; the linkages of agriculture to the rest of the economy. Home department: AGRICULTURAL ECONOMICS				
364	16	Farm planning and decision making	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> Home department: AGRICULTURAL ECONOMICS				
414	16	National and international market analysis	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 Biometry 212, 242 or</i> <i>P Statistics 186 or</i> <i>P Statistical Methods 176</i> Home department: AGRICULTURAL ECONOMICS				
424	16	Foundations of Agricultural Economics: an institutional approach	3L	T
This module is designed to introduce a range of problems, decision-making situations and institutional settings relevant to the study of agriculture and resource economics. Home department: AGRICULTURAL ECONOMICS				
444	16	Environmental policy	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 144, 144 or 178</i> Home department: AGRICULTURAL ECONOMICS				
454	16	Agricultural policy in the South African context	3L	A
The theoretical base of economic policy in agriculture; analysis of the 'farm problem' in historical and contemporary context; the management of market failures in agriculture: South and Southern Africa; international trade policy. Home department: AGRICULTURAL ECONOMICS				

478	32	Agricultural economics research project	1L	A
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
771	20	Farm management		
<p>Strategic planning and decision making focused on environmental scanning; concepts and tools of futures research as tools for strategic management; analysis and planning of the farm system; long-term investment decision making, planning and control of financial goals.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
772	20	Topical issues in agricultural policy		
<p>The mechanisms of policy implementation; the policy analysis matrix; in-depth study of agricultural policy issues in South Africa; the management of policy processes.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
773	20	Wine marketing		
<p>Structure, conduct and performance of the South African wine industry; design and report on a marketing strategy and marketing plan for a specific wine brand.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
774	20	Resource and environmental economics		
<p>Resource demand and availability; economic models of biological resource dynamics; economy of sustainable resource use; key environmental economic themes; assistance in the use of environmental system analysis, like functional analysis of ecosystem services, cost-benefit analysis, scenario analysis, environmental indicators, multi-criteria analysis, lifecycle analysis, environmental impact determination.</p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
775	20	Agricultural production and resource management		
<p>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.</p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
776	20	International trade and marketing		
<p>International trade theory and trade policy, international marketing and marketing strategies for the export market in general and for South Africa.</p> <p><i>Subject to continuous assessment.</i></p>				

Home department: AGRICULTURAL ECONOMICS				
780	20	Rural development		
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. <i>Subject to continuous assessment.</i>				
Home department: AGRICULTURAL ECONOMICS				
871	20	Strategic farm management		
Systems philosophy and the systems approach to strategic planning and decision making on sector level; environmental scanning, concepts and tools of futures research as tools for strategic management; planning and management of the strategic management process; analysis and planning of the farm system; levels of decision making; long-term investment decision making, planning and control of financial goals. <i>Subject to continuous assessment.</i>				
Home department: AGRICULTURAL ECONOMICS				
872	20	Agricultural policy analysis		
The theoretical structure of agricultural policy analysis; public choice and institutional approaches; in-depth study of agricultural policy issues in a global context; the management of policy processes. <i>Subject to continuous assessment.</i>				
Home department: AGRICULTURAL ECONOMICS				
874	20	Strategic marketing of wine		
Environmental scanning of the world within which wine must be marketed; strategy determination in wine marketing. <i>Subject to continuous assessment.</i>				
Home department: AGRICULTURAL ECONOMICS				
875	20	Topical issues in agricultural resource use		
Assignments on themes like the influence of population growth and income growth on the volume and nature of food consumption, the development of an inventory of bottom quality and quantity, the interdependency of the demand for food, fibre and bio-energy, and prevention and adaption strategies in resource consumption to deal with climate change; application of systems thinking in the determination of sustainable resource development strategies; planning assistance that can be used in environmental systems analysis.				
Home department: AGRICULTURAL ECONOMICS				
876	20	Agricultural production economics and decision analysis		
Deepening and broadening of topics in agricultural production economics; production systems and relationships; modelling, simulation and programming techniques; orientation to problem solving; decision analysis and incorporation of risk and uncertainty in decision-making and planning; problems, challenges and issues regarding agricultural production factors; case studies.				
Home department: AGRICULTURAL ECONOMICS				

880	20	South African agriculture		
International economics: international trade theory and policy, world agricultural markets and marketing strategies. <i>Subject to continuous assessment.</i> Home department: AGRICULTURAL ECONOMICS				
881	20	Rural development		
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. <i>Subject to continuous assessment.</i> Home department: AGRICULTURAL ECONOMICS				
882	100	Master's thesis		
Home department: AGRICULTURAL ECONOMICS				

55565 AGRONOMY				
212	8	Agronomical crop production	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 152 or P Biology 154</i> Home department: AGRONOMY				
312	8	Greenhouse production techniques	1.5L, 1.5P	T
Soilless production techniques (hydroponics) for seedlings and crops; effect of different growth mediums; different types of climate control; optimum concentrations of nutrient solutions for different crops. Home department: AGRONOMY				
322	8	Cultivation of annual agronomical crops	1.5L, 1.5P	T
Introduction to the morphology and development of important annual agronomical crops for the winter rainfall region; identification and production of these crops; soil and climatic requirements of these crops, as well as their utilisation and economic importance. Home department: AGRONOMY				
324	16	Pasture management	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. Home department: AGRONOMY				
332	8	Cultivation of future crops	1.5L, 1.5P	T
Identification, morphology and growth requirements of new potentially important food, fibre, medicinal and industrial crops; morphology and growth requirements of selected				

crops; management practices for sustainable maximal production of these crops. Home department: AGRONOMY				
342	8	Weed management	1.5L, 1.5P	T
Characteristics of weeds; methods of weed control; principles of weed management programmes; mechanisms of chemical herbicide action. Home department: AGRONOMY				
362	8	Vegetable crops for intensive production systems	1.5L, 1.5P	T
Identification of the most important vegetable crops that are cultivated in intensive production systems; morphology and physiology of these crops; production techniques in intensive plant production systems for these crops. Home department: AGRONOMY				
424	16	Physiological and ecological principles of natural pasture management	3L, 3P	T
Development and ecology of South African veld types; morphology and physiology of pasture plants; physiology of defoliation and plant respons; physiological principles of veld management; determination of veld condition; veld burning; bush encroachment; veld management on game farms; causes and control of erosion. <i>Subject to continuous assessment.</i> <i>P Agronomy 314 or</i> <i>P Conservation Ecology 314</i> Home department: AGRONOMY				
454	16	Production physiology and technology for annual agronomical crops	3L, 3P	T
Physiological processes involved in yield increase in cool weather crops and cultivated pastures; crop rotations and biological management for sustainable production; quality requirements and utilisation of crops and pastures. <i>P Agronomy 314, 322</i> Home department: AGRONOMY				

56901 ANIMAL BREEDING SCIENCE				
424	16	Production traits improvement	3L, 3P	E
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> Home department: ANIMAL SCIENCES				

454	16	Applied breeding plans	3L, 3P	E
<p>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; Intergis; breeder associations; group breeding schemes; veld bull and veld ram evaluations and the functioning of the National Livestock Improvement Schemes for all livestock species.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Genetics 354</i></p> <p>Home department: ANIMAL SCIENCES</p>				

54801 ANIMAL MANAGEMENT SCIENCE				
434	16	Intensive management systems	3L, 3P	A
<p>Biology and morphology and development of modern lines of pigs and poultry; housing requirements and ventilation regarding pig and poultry housing as influenced by the various growth and development phases; management programmes for pig and poultry diseases; management of breeding animals, weaners and grower; management of breeders, layers, broilers and hatcheries; biosecurity; recordkeeping.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Animal Science 244</i></p> <p><i>P Physiology and Animal Physiology 214</i></p> <p><i>P Animal Nutrition Science 344</i></p> <p>Home department: ANIMAL SCIENCES</p>				
464	16	Extensive management systems	3L, 3P	A
<p>Sheep and cattle management practices; production systems; mating systems; mating and lambing seasons; identification of animals; fattening; marketing; animal-waste management; flock and herd health and principles of wool production.</p> <p>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> <p><i>Subject to continuous assessment.</i></p> <p><i>P Animal Nutrition Science 324</i></p> <p>Home department: ANIMAL SCIENCES</p>				

56898 ANIMAL NUTRITION SCIENCE				
324	16	Introduction to ruminant nutrition	3L, 3P	T
<p>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.</p> <p>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.</p>				

C Animal Science 244
C Biochemistry 214, 244
P Physiology and Animal Physiology 214

Home department: ANIMAL SCIENCES

344	16	Introduction to monogastric nutrition	3L, 3P	T
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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.

Subject to continuous assessment.

C Biochemistry 214, 244

C Animal Science 244

P Physiology and Animal Physiology 214

Home department: ANIMAL SCIENCES

414	16	Advanced ruminant nutrition	3L, 3P	A
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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

Home department: ANIMAL SCIENCES

444	16	Advanced monogastric nutrition	3L, 3P	A
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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.

Subject to continuous assessment.

P Animal Nutrition Science 344

Home department: ANIMAL SCIENCES

11851 ANIMAL PHYSIOLOGY

324	16	Applied Physiology in Farm Animals	3L, 3P	T
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Endocrinology and cell communication; pH and electrolyte balance with reference to kidney and lung functions; control of blood pressure and patterns of distribution during various physiological circumstances (exercise; cardiovascular shock); applied digestive physiology and intermediate metabolism; temperature control in farm animals.

PP Physiology and Animal Physiology 214
C Biochemistry 214, 244

Home department: ANIMAL SCIENCES

344	16	Advanced Animal Production Physiology	3L, 3P	T
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Species comparative reproduction physiology; introduction to assisted reproduction techniques; applied immunology and disease resistance; principles and application of pharmaceuticals in animal health.

PP Physiology and Animal Physiology 214
C Biochemistry 214, 244

Home department: ANIMAL SCIENCES

11878 ANIMAL PRODUCTION

214	16	Management technology: Production animals	3L, 3P	T
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Sheep: Supplementary nutrition of grazing sheep and feedlot finishing; management systems; diseases and herd health programmes.

Beef cattle: Nutrition and husbandry of breeding herds produced under grazing and intensive systems; feedlot finishing; processing and preserving feeds.

Dairy cattle: Nutrition and husbandry of non-lactating and lactating cows and dairy calves.

Poultry: Basic principles in poultry production. Description of incubation systems. Commercial egg production. Production of broilers and broiler breeders.

Pigs: Planning of a pig production unit. Caring of pigs in different stages of life. Breeding and selection of pigs.

Practical: Feeding practices, visits to farming units and experimental trials, visual evaluation of dairy and beef cattle, discussion of prepared assignments.

C Animal Reproduction Physiology 112 or
C Biology 154

Home department: ANIMAL SCIENCES

44733 ANIMAL REPRODUCTION PHYSIOLOGY

112	8	Animal production physiology	1.5L, 1.5P	T
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An introduction to the anatomy, histology and physiology of the digestive and reproductive systems of domesticated animals; ruminants and monogastric animals. Training includes the dissection of the gastro-intestinal tract and a basic introduction to principles of animal nutrition.

Subject to continuous assessment.

Home department: ANIMAL SCIENCES

51004 ANIMAL PRODUCT SCIENCE				
334	16	Meat science	3L, 3P	T
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>				
Home department: ANIMAL SCIENCES				
352	8	Dairy science and dairy cattle management	2L, 1.5P	T
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>C Animal Science 244</i>				
Home department: ANIMAL SCIENCES				

20826 ANIMAL SCIENCE				
144	16	Animal behaviour and husbandry	3L, 3P	T
General introduction to the care and handling of farm animals. A global overview of the livestock industry. General introduction to animal production systems, viz. large stock, small stock, poultry and pigs.				
Home department: ANIMAL SCIENCES				
244	16	Basic principles of animal nutrition and management	3L, 3P	T
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. Breeds science				
Home department: ANIMAL SCIENCES				
442	8	Practical training	1.5L, 1.5P	T
Methods of gathering scientific literature; seminar preparation and presentation; training in writing and presentation skills and exposure to the industry where amongst other, students partake in a tour of relevant industries. Practical vacation work (one month) as prescribed in the "Compulsory practical vacation work" section of this part of the Calendar. Of this, preferably two weeks should be completed in a relevant commercial industrial environment and another two weeks in a farm environment. Practical vacation work: Report preparation and submission.				
Home department: ANIMAL SCIENCES				

871	18	Fundamental ruminant nutrition		
<p>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.</p> <p>Home department: ANIMAL SCIENCES</p>				
872	18	Fundamental monogastric nutrition		
<p>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.</p> <p>Home department: ANIMAL SCIENCES</p>				
874	18	Fundamental animal breeding		
<p>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.</p> <p>Home department: ANIMAL SCIENCES</p>				
875	18	Fundamental animal physiology		
<p>Fundamental animal physiology, with species comparisons of the gastrointestinal tract of domesticated animals (digestive processes, nutrient absorption and intermediary metabolism, as well as endocrine control thereof), as well as species comparisons of the reproductive system of male and female domesticated animals (spermatogenesis, oogenesis, fertilization, gestation, lactation, and endocrine control thereof).</p> <p>Home department: ANIMAL SCIENCES</p>				
876	18	Applied animal physiology		
<p>Homeostatic control of intermediary metabolism and abnormal metabolic conditions; assisted reproductive techniques for the improvement of the reproduction efficiency of farm animals (collection, evaluation and storage of semen, synchronisation of oestrus cycles, artificial insemination, superovulation, collection and transfer of embryos, transgenetics).</p> <p>Home department: ANIMAL SCIENCES</p>				
881	18	Fundamental meat science		
<p>A study of different abattoir practices, abattoir design for the slaughtering of different animal species and ethical aspects pertaining to the slaughter of animals; 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.</p> <p>Home department: ANIMAL SCIENCES</p>				
882	18	Applied ruminant nutrition		
<p>Emphasis is placed particularly on the application of advanced dynamic models, such as the latest versions of the Cornell Net Carbohydrate and Protein System for small stock and cattle, as well as CPM Dairy. The biology underlying the models is also explained.</p> <p>Home department: ANIMAL SCIENCES</p>				

883	18	Applied monogastric nutrition		
Diet formulation, the use of predictive growth and simulation models, applied nutritional systems and feed-manufacturing techniques; 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. Home department: ANIMAL SCIENCES				
884	18	Applied animal breeding		
The animal, its environment and homeostasis. National and international programmes for livestock improvement. Ethical aspects of genetic modification in livestock. Home department: ANIMAL SCIENCES				

20753 APPLIED MATHEMATICS B				
124	15	Statics	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 of action of the resultant; equilibrium of a rigid body; friction; centre of mass; centroid; volumes; definite integration; moment of inertia of areas. Home department: APPLIED MATHEMATICS				

12487 APPLIED PLANT PHYSIOLOGY				
414	16	Ecophysiology of horticultural and agronomical crops	3L, 3P	T
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. <i>P Soil Science 344 and P Horticultural Science 314 or P Agronomy 322</i> Home department: HORTICULTURAL SCIENCE				
464	16	Nutrition of horticultural and agronomical crops	3L, 3P	T
Phloem transport and carbohydrate partitioning. Root anatomy, mineral application, uptake and partitioning. Crop-based nutritional requirements and application strategies; management of vegetative and reproductive balances and the role of rootstocks. Factors affecting mineral uptake. Practicals: i.e. an orchard report. Cultivation of alternative crops. <i>P Soil Science 244 and P Horticultural Science 314 or P Agronomy 342</i> Home department: AGRONOMY				

46213 AQUACULTURE				
314	16	Introduction to aquaculture	3L, 3P	A
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: GENETICS</p>				
344	16	Aquaculture production and processing	3L, 3P	A
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Aquaculture 314</i></p> <p>Home department: GENETICS</p>				
414	16	Freshwater aquaculture	3L, 3P	A
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Aquaculture 344</i></p> <p>Home department: GENETICS</p>				
444	16	Marine aquaculture	3L, 3P	A
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Aquaculture 414</i></p> <p>Home department: GENETICS</p>				
478	32	Aquaculture research project	3L, 3P	A
<p>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.</p> <p><i>P Aquaculture 314, 344</i></p> <p>Home department: GENETICS</p>				

711	24	Aquaculture production and management systems I		
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. Home department: GENETICS				
712	24	Aquaculture products		
Processing technology and management practices in aquaculture. Product quality, food and health standards. Product development. Home department: ANIMAL SCIENCES				
741	24	Aquaculture production and management systems II		
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. Home department: GENETICS				
742	24	Aquaculture ecology		
Water ecology and water quality parameters in aquaculture. Water quality management practices. Environmental impact. Recirculation systems and technology. Home department: GENETICS				
743	24	Aquaculture nutrition		
Feeding behaviour of aquaculture species. Nutrition management practices of aquaculture species. Nutrition and food quality of aquaculture species. Home department: GENETICS				
771	36	Aquaculture management practice		
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. Home department: GENETICS				
772	30	Aquaculture research practice		
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. Home department: GENETICS				
874	18	Aquaculture products		
Processing technology and management practices in aquaculture. Product quality, food and health standards. Product development. Home department: GENETICS				
875	18	Aquaculture ecology		
Water ecology and water quality parameters in aquaculture. Water quality management practices. Environmental impact. Recirculation systems and technology. Home department: GENETICS				

876	18	Aquaculture nutrition		
Feeding behaviour of aquaculture species. Nutrition management practices of aquaculture species. Nutrition and food quality of aquaculture species.				
Home department: GENETICS				

11053 BIOCHEMISTRY				
214	16	Structure, Function Relationships	3L, 3P	A
Structures, characteristics and functions of bio-molecules (bio-elements, water, nucleic acids, proteins, enzymes, coenzymes, carbohydrates, lipids).				
<i>Continuous assessment</i>				
<i>PP Chemistry 114 or 154 and a final mark of at least 40% in the remaining Chemistry module</i>				
<i>P Biology 124</i>				
Home department: BIOCHEMISTRY				
244	16	Intermediary Metabolism	3L, 3P	A
Bioenergetics; metabolism of carbohydrates, lipids and nitrogenous compounds; integration of metabolism.				
<i>Continuous assessment</i>				
<i>P Biochemistry 214</i>				
Home department: BIOCHEMISTRY				
314	16	Specialised Biochemical Topics I	3L, 3P	A
Advanced protein biochemistry: Basic protein purification techniques and structure/function relationships studied in the context of a number of specialised complex protein systems. Intracellular signal transduction pathways; receptors; hormones; cAMP; networks and cross talk; biochemistry of vision, biochemistry of smell.				
<i>Continuous assessment</i>				
<i>PP Biochemistry 214, 244</i>				
Home department: BIOCHEMISTRY				
345	16	Specialized Biochemical Topics II	3L, 3P	T
Bioinformatics of proteins: Amino acid sequence alignment of proteins by means of suitable software packages, amino acid sequence searches through GenBank using Blastp and tBlastx for specific protein motifs, protein motif visualisation and three-dimensional modelling, protein structure/function relationships.				
The biochemistry of certain antibiotics and anti-microbial agents.				
Immunology: Innate and specific acquired immunity; antibody structure and function; defence mechanisms against pathogenic organisms; vaccinations; allergies; immune disorders; Aids.				
<i>Continuous assessment</i>				
<i>P Biochemistry 314</i>				
Home department: BIOCHEMISTRY				

53953 BIODIVERSITY AND ECOLOGY				
212	16	Statistics and Other Tools for Biologists	3L, 3P	T
<p>This module is a thorough introduction to the key numerical skills and processes underpinning the good practice of biological sciences. It covers statistical analyses; the concept of null and alternative hypotheses, data handling and logical interpretation; data presentation and scientific communication; advanced use of Microsoft Excel and PowerPoint and the use of Statsoft Statistica. Hands-on statistical exercises cover a range of parametric, non-parametric and contingency-based analyses from descriptive statistics through to combinations of analysis of variance and regression analysis. Applied scientific investigatory principles to biology are explored using experimental design, ethics, scientific and popular publication processes, and the use of scientific literature.</p> <p><i>PP Computer Skills 171</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
214	16	Principles of Ecology	3L, 3P	E
<p>The basics of aquatic biology and population ecology are taught by integrating theory and practical field work. Topics will focus on population growth and life history strategies used by organisms to maximise fitness. This module will be closely integrated with Biodiversity and Ecology 212 where students will be taught how to analyse ecological data. There will be a three-day, compulsory field course where students conduct their own research projects.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biology 144</i> <i>PP Mathematics (Bio) 124 or</i> <i>PP Mathematics 114 and 144</i> <i>C Biodiversity and Ecology 212 or</i> <i>C Probability Theory and Statistics 114 or 144</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
224	16	Diversity and Function of Invertebrates	3L, 3P	T
<p>The focus is invertebrate diversity and physiology. Major evolutionary morphological features (form) within each of the phyla that allow animals to survive in their respective habitats and eventually colonise the terrestrial environment will be explored. Within each environment (marine, freshwater and terrestrial), students will be exposed to the physiological challenges animals have to endure in order to survive. Major physiological changes within major invertebrate phyla will be explored in relation to their evolution. The practical component of the module will entail both laboratory and field work.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biology 144, 154</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
244	16	Principles of Evolution	3L, 3P	E
<p>The principal evolutionary mechanisms which shape the biological world will be dealt with. It provides a historical perspective on the development of the major ideas in evolutionary thinking and tackles the interface between evolutionary research and the public's perception of it. Topics covered include theoretical genetic models which underlie modern molecular genetic approaches, natural selection and how it operates, the distinctions and links between micro- and macroevolution and how species are formed</p>				

and lost. In addition to theoretical understanding, students will be exposed to the design and execution of experiments in evolution.

PP Biology 124, 144, 154

PP Mathematics (Bio) 124 or

PP Mathematics 114 and 144

C Biodiversity and Ecology 212, 224, 254, 264

Home department: BOTANY AND ZOOLOGY

254	16	Vertebrate Life	3L, 3P	T
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The Vertebrate story: where they originated, present diversity, how they evolved, what they do and how they work. Topics include characteristic features of vertebrates and their body plans; the broad pattern of the evolutionary relationships of vertebrates; ontogeny of vertebrates and the evolutionary implications of developmental mechanisms; basic anatomy, physiology and evolution of vertebrate organ systems; reproductive biology and strategies: sex determination; hormonal control; seasonal cycles; evolution of viviparity; thermo-energetics; water balance, osmoregulation and excretion; surviving in extreme environments. This module includes practical sessions/workshops and a research project with data collected in the laboratory or during a field excursion.

Continuous assessment

PP Biology 124, 154

P Chemistry 114, 154

Home department: BOTANY AND ZOOLOGY

264	16	Diversity of Plant Form and Function	3L, 3P	T
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Plants occupy the most diverse habitats on earth. A wide range of morphological and physiological adaptations are required to conquer these habitats. The diversity of plant form and function will be explored as interlinked themes to understand how plants grow, respond to natural cycles, capture resources and survive in adverse conditions. The theory and practicals will explore each theme in a complimentary way that will include formal lectures, group discussions, laboratory and field experiments.

PP Biology 144, 154

Home department: BOTANY AND ZOOLOGY

344	16	Population and Conservation Ecology	3L, 3P	E
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Use of quantitative methods to answer questions about natural populations and communities; factors influencing population growth, dynamics, structure and management (including the influence of HIV/Aids on human populations); matrix modelling of populations; metapopulations; factors contributing to species extinctions; landscape ecology; macro-ecology; local adaptations and diversity; conservation ecology, fragmentation, conservation evaluation and repeated selection of priorities for conservation; application of theory and techniques for conservation research and planning.

Weekly tutorials.

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

Subject to continuous assessment

PP Botany and Zoology 214

Home department: BOTANY AND ZOOLOGY

354	16	Environmental Stress and Ecotoxicology	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. Adapting to chemicals: acclimation and adaptation (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. Biomarkers and their ecological relevance.</p> <p><i>Presented by the Department of Botany and Zoology</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				

25046 BIOLOGY				
124	16	Cell Biology	3L, 3P	A & E
<p>Origin and early history of life. Cytology. Cell chemistry, biological membranes and cellular respiration. Fixation, transfer and expression of genetic information. Evolution.</p> <p><i>Presented by the Departments of Biochemistry, of Botany and Zoology and of Genetics</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
144	16	Biodiversity and Ecology	3L, 3P	A & E
<p>Classification of organisms. Diversity of microorganisms, plants and animals. Ecological principles and global changes.</p> <p><i>Presented by the Departments of Botany and Zoology and of Microbiology</i></p> <p><i>C Biology 124 and</i> <i>C Chemistry 114, 154</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
154	16	Functional Biology	3L, 3P	A & E
<p>Plant anatomy and morphology. Photosynthesis. Water relations and phloem transport. Functional biology of animals. Introduction to biotechnology.</p> <p><i>Presented by the Departments of Botany and Zoology and of Genetics</i></p> <p><i>C Biology 124 and</i> <i>C Chemistry 114, 154</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
212	5	Doing Science	1L, 1T	T
<p>Philosophy of Science: The nature of "science"; interaction between science and society; scientific methodology; the role of models in science. Scientific data analysis: Data description; statistical probability, hypothesis testing, comparisons between samples, analysis of categorical data; correlation and regression. Data presentation.</p>				

Exam-based assessment

Responsible department: Botany and Zoology

Home department: BOTANY AND ZOOLOGY

11061 BIOMETRY

212	8	Introductory biometry	2L, 1T	A & E
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Methods of tabulation and graphical representation of data; descriptive measures of locality, variation and association; simple linear regression; the elementary principles of randomness, distributions, sampling and estimation; contingency tables and chi-square tests; calculation of standard errors; F-test for heterogeneity of variance.

P Mathematics (Bio) 124 or

P Mathematics 114

Home department: GENETICS

242	8	Applications in biometry	2L, 1T	A & E
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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; multiple linear regression.

PP Biometry 212

Home department: GENETICS

312	8	Biometrical inference	1L, 1P, 1T	T
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Linear and multiple regression; statistical inference; prediction and calibration; testing the assumptions; diagnosis of outliers and influential observations; data transformations; data processing with Excel.

P Biometry 242 or 274

Home department: GENETICS

342	8	Linear models in biometry	1L, 1P, 1T	T
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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.

P Biometry 312

Home department: GENETICS

711	6	Postgraduate biometry		
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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 (χ^2 tests); Logistic regression. This module is presented in two blocks of five half days each during the first semester.

Subject to continuous assessment.

P Biometry 212 and 242 or 274 or any other similar module

Home department: GENETICS

61476 BOTANY AND ZOOLOGY				
214	16	Principles of Ecology	3L, 3P	E
<p>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 terrestrial and marine ecosystems from throughout South Africa and the world. The module includes an introduction to the abiotic environment in which plants and animals live.</p> <p>The module includes a three-day compulsory fieldtrip during which students conduct their own research projects. They have the opportunity to develop testable hypotheses, conduct the relevant fieldwork, analyse the results, apply the appropriate statistical tests and write a research paper.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biology 144</i> <i>PP Mathematics (Bio) 124</i> <i>C Biology 212 or</i> <i>C Biometry 212</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				

48550 BUSINESS MANAGEMENT				
113	8	Business Management	2L, 1P	A & E
<p>General and strategic management; idea generation and entrepreneurship; marketing and market research; product development; establishment issues; size of the enterprise and sources of financing; enterprise forms; franchising; purchasing management; risk and insurance; managing the enterprise's environment; contemporary managerial issues.</p> <p>Home department: BUSINESS MANAGEMENT</p>				
142	6	The investment decision	1.5L, 1P	A & E
<p>The investment cycle; the role and functioning of the JSE Securities Exchange SA; investment risks; factors that influence share prices; fundamental and technical analysis of companies.</p> <p><i>Continuous assessment.</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

NB: 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.

11479 CHEMISTRY				
114	16	Introductory Inorganic and Physical Chemistry	3L, 3P	A & E
Revision of atomic structure and orbital theory, electron configurations, stoichiometry; chemical bonding theories; molecular geometry and structure according to Lewis and VSEPR; chemical equilibrium both quantitative and qualitative; reaction equations in aqueous medium (precipitation, complex, acid-base and redox); solubility problems; pH calculations and buffer systems. Practical exercises: gravimetric analysis, acid-base and redox titrations. Home department: CHEMISTRY AND POLYMER SCIENCE				
154	16	Introductory Organic Chemistry	3L, 3P	A & E
Introductory study of organic compounds with a variety of functional groups, multifunctional compounds; mechanisms of reactions; stereo-isomerism. <i>C Chemistry 114</i> Home department: CHEMISTRY AND POLYMER SCIENCE				
214	16	Organic Chemistry	3L, 3P	T
Reaction mechanisms; stereochemistry; systematic aliphatic and aromatic chemistry. <i>PP Chemistry 114, 154</i> Home department: CHEMISTRY AND POLYMER SCIENCE				
224	16	Analytical Chemistry	3L, 3P	T
Introduction to classical analytical chemistry; errors and uncertainty in analytical data; basic statistical methods; volumetric methods (acid-base, redox and complexometric analysis); introduction to analytical molecular spectroscopy, UV/visible and infrared spectrophotometry. An introduction to separation science with emphasis on chromatography. <i>PP Chemistry 114, 154 and P Mathematics 114, 144 or P Mathematics (Bio) 124 or P Engineering Mathematics 115, 145</i> Home department: CHEMISTRY AND POLYMER SCIENCE				
244	16	Inorganic Chemistry	3L, 3P	E
Periodic trends; structure and bonding in molecules; structure and bonding in solids; chemistry in solution; main group elements. Coordination chemistry: Introduction, types of ligands, nomenclature; isomerism in coordination compounds; different geometries; formation constants; crystal field theory. <i>PP Chemistry 114</i> Home department: CHEMISTRY AND POLYMER SCIENCE				
254	16	Physical Chemistry	3L, 3P	A
Chemical thermodynamics; colligative properties; phase diagrams; reaction kinetics; electrochemistry. <i>P Mathematics 114, 144</i> Home department: CHEMISTRY AND POLYMER SCIENCE				

324	16	Physical Chemistry	3L, 3P	A
<p>Quantum mechanical description of atoms and molecules; vibrational and rotational spectra; statistical thermodynamics. <i>P Chemistry 254</i> <i>PP Mathematics 114, 144</i> Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
334	16	Inorganic Chemistry	3L, 3P	E
<p>Stereochemical non-rigidity; structure and strength correlations for acids and bases; industrial importance; structure and reactivity of transition metal complexes; selective complexation; kinetics and mechanisms of selected reactions; the role of metal complexes in biological systems; introduction to organometallic chemistry; the synthesis and characterisation of inorganic compounds (practicals). <i>PP Chemistry 244</i> Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
344	16	Organic Chemistry	3L, 3P	T
<p>Advanced systematic acyclic and aromatic chemistry; stereochemistry; syntheses. <i>PP Chemistry 214</i> Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
354	16	Analytical Chemistry	3L, 3P	E
<p>Advanced instrumental analysis. Molecular spectroscopy: review of basic principles; ¹H and ¹³C nuclear magnetic resonance spectroscopy and molecular structure. Error theory in quantitative chemical analysis and calibration in instrumental analysis. Introduction to atomic spectroscopy: atomic absorption and atomic emission spectroscopy for quantitative elemental analysis (ICP-OES/MS). Separation science with emphasis on chromatographic methods. <i>P Chemistry 224</i> <i>C Chemistry 344</i> Home department: CHEMISTRY AND POLYMER SCIENCE</p>				

46132 COMMUNICATION

110	0	Communication	1P	A & E
<p>Language skills tests are written at the beginning of the first year. Students whose language skills are deficient in Afrikaans must take and pass Language Skills (Afrikaans) 176 and 276 in order to gain admission to third-year modules, while students whose language skills are deficient in English must take and pass Language Skills (English) 153 in order to gain admission to second-year modules. Home department: ENGINEERING (ADMIN)</p>				

30317 COMPUTER PROGRAMMING

143	12	Computer Programming	3L, 2P	T
<p>Introduction to computer systems. Introduction to a programming environment; expressions; conditional statements; iterative structures; data types; static- and dynamic data structures; file handling; abstract data types; objects; structured programme design. Emphasis is placed on modular programming for engineering applications. [Presented by the Department of Electrical and Electronic Engineering (75%) and by the</p>				

Department of Mechanical and Mechatronic Engineering (25%)]

Examination

Home department: ELECTRIC AND ELECTRONIC ENGINEERING

Formula for Final mark: $P=0,4K+0,6E$

50040 COMPUTER SKILLS

171	4	Computer Skills	1L	T
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Study load: 26 lectures in total, presented as 2L per week for 13 weeks, distributed over the year

Introduction to general computer usage with the focus on the development of skills in using software for word processing, skills in using spreadsheets to perform calculations in creating meaningful graphs and skills in using presentation software.

An optional test can be written during the first term to obtain exemption from the module.

The class mark will serve as the final mark.

Home department: COMPUTER SCIENCE

272	5	Computer Skills	2L	T
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Study load: 35 lectures in total

The main objective of this module is to equip the student with the relevant skills required to successfully and efficiently perform tasks identified as fundamental to the scientific process. Each topic is presented using an appropriate computer software package. Specific attention is given to the following topics: obtaining relevant literature, data capturing and analysis, creation and technical maintenance of electronic documents for reporting and presentation.

Continuous assessment

P Computer Skills 171

Home department: COMPUTER SCIENCE

55638 CONSERVATION ECOLOGY

212	8	Conserving nature	2L, 1P	E
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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.

Subject to continuous assessment.

PP Biology 144

Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY

244	16	Conservation censusing	3L, 3P	E
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Planning and conducting monitoring and biodiversity surveys for major plant and animal taxa, including indices for river system health and ecological integrity; social censusing and its importance in conservation; developing experience in indices of species richness and diversity; introduction to community similarity and differences.

<i>Subject to continuous assessment.</i>				
<i>PP Conservation Ecology 212</i>				
Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				
314	16	Biome ecology	3L, 3P	E
Introduction to biomes and ecosystem services; key drivers of dynamics and biome-level management issues; 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>				
<i>PP Conservation Ecology 244</i>				
Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				
344	16	Introduction to conservation management	3L, 3P	E
History of the relationship between society and the natural environment; history and philosophy of conservation; environmental ethics; participatory methods in conservation research; cultural conservation; government and community influences on conservation; environmental legislation; challenges in conservation management; land-use and hydrology; fire ecology and management; ecotourism and recreation; management plans and research.				
<i>Subject to continuous assessment.</i>				
<i>PP Conservation Ecology 314</i>				
Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				
414	16	Nature conservation management	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. There is a compulsory field trip during the Easter vacation.				
<i>Subject to continuous assessment.</i>				
<i>PP Conservation Ecology 344</i>				
Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				
424	16	Wildlife management in a changing environment	3L, 3P	E
Decision-making in the face of uncertainty; sustainable harvesting – terrestrial and marine environments; managing for current climate change; wildlife management – principles, habitat and game assessment, grazing management, sustainable utilisation, game capture and translocation, wildlife diseases, nutrition; planning and executing conservation-based research; case studies in conservation research.				
<i>Subject to continuous assessment.</i>				
Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				

448	32	Conservation plan/research project	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> Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				

14052 CROP PRODUCTION				
152	8	Introduction to applied plant science	1.5L, 1.5P	T
Classification systems and classification of agricultural crops; structure of plants of agricultural significance; plant growth regulators; ecological principals and introductory agricultural ecology. Home department: VITICULTURE AND OENOLOGY				
214	16	Plant propagation	3L, 3P	T
Principles and practices of plant propagation: brief overview of different crop types and the aim of plant propagation. Plant life cycles and phases and their relative importance in plant propagation. Principles of sexual versus asexual propagation. Seed propagation and seed production. Asexual propagation by means of cuttings, grafting, layering and tissue culture. Propagation of plants from specialised roots and stems. Pathogens during the propagation process and their control. Propagation of specific commercial crops. Legal protection of cultivars. <i>P Biology 154</i> <i>C Biology 124</i> <i>P Biology 144 or</i> <i>P Crop Production 152</i> Home department: HORTICULTURAL SCIENCE				

53961 CROP PROTECTION				
244	16	Introductory Plant Pathology and Entomology	3L, 3P	T
The nature and causes of plant diseases, the impact of pathogens and pests on agriculture, the biology of important pathogens and pests, factors influencing disease development, diagnosis of plant diseases and principles of plant disease control. <i>Subject to continuous assessment.</i> Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY				

12084 ECONOMICS				
114	12	Economics	3L, 1T	A & E
<p>The economic problem: scarcity, priorities and opportunity cost. Introductory microeconomics: 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.</p> <p>Home department: ECONOMICS</p>				
144	12	Economics	3L, 1T	A & E
<p>Introductory macroeconomics: income and production theory, the foreign sector and monetary economics. National Accounting and macroeconomic data. The South African economy: history and features.</p> <p><i>C Economics 114</i></p> <p>Home department: ECONOMICS</p>				
214	16	Economics	3L, 1T	A
<p>Macroeconomics: the IS-LM-model, total demand and supply, inflation, monetary transmission mechanism, stabilisation policy.</p> <p>Microeconomics: goods and factor markets, demand theory, production and cost theory, market structures and the theory of the firm, welfare theory.</p> <p><i>PP Economics 114, 144</i></p> <p>Home department: ECONOMICS</p>				
244	16	Economics	3L, 1T	A
<p>South African monetary policy. International trade and finance: the theory of international trade, barriers to free trade, the World Trade Organisation and regional economic integration, the balance of payments, international financial markets, adjustment mechanisms, policy options, exchange rate determination, the international monetary system and South African exchange rate policy.</p> <p><i>PP Economics 114, 144</i></p> <p><i>C Economics 214</i></p> <p>Home department: ECONOMICS</p>				
318	24	Economics	4L, 1S	A
<p>Macroeconomics: economic growth, business cycle, monetary and fiscal policy. Quantitative economics: general data analysis, mathematical and econometric techniques, input/output analysis. Microeconomics: industrial structures, market structures, the theory of the firm, introduction to game theory.</p> <p><i>PP Economics 214</i></p> <p><i>P Economics 244</i></p> <p>Home department: ECONOMICS</p>				
348	24	Economics	4L, 1S	A
<p>This module focuses on the economic policy debate in a developing country. This includes economic policy criteria, structural characteristics of the South African economy, economic thought and systems, and growth and development policies, which include demand and supply aspects of economic growth, sectoral and spatial development, distribution of income and social expenditure, competition policy, environmental economics, labour policy, education and investment in human capital and</p>				

the macroeconomic policy debate.

PP Economics 214

P Economics 244

C Economics 318

Home department: ECONOMICS

388	24	Economics	2L, 2T	A
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Introductory applied econometrics: statistical concepts, the classical linear model of regression, multicollinearity, autocorrelation, heteroscedasticity, dummy variables, estimation of regression models.

Labour economics and labour econometrics: labour market, demand and supply, demographic tendencies, trade unions, the South African labour market. Management economics: mathematical techniques, analysis of demand, cost and production, price determination, introduction to linear programming.

South African economic issues.

Continuous assessment

PP Economics 214

P Economics 244

C Economics 318

Home department: ECONOMICS

49484 ENGINEERING CHEMISTRY

123	15	Chemistry for Engineering Students	4L, 2T	A & E
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Basic concepts, units and dimensions, significant figures, conversion between unit systems; components of matter, atomic structure, the periodic table and chemical bonding; stoichiometry; chemical reactions (acid-base, precipitation and redox); properties of mixtures and solutions; chemical equilibrium; electrochemistry; gas laws, state functions and (T,P,V) relationships; thermodynamics and thermochemistry; introduction to basic engineering applications.

Examination

C Engineering Mathematics 115

Home department: PROCESS ENGINEERING

Formula for Final mark: $P=0,4K+0,6E$

46825 ENGINEERING DRAWINGS

123	15	Orthographic Drawings	2L, 1P, 3T	A & E
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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; 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.

Examination

Home department: MECHANICAL AND MECHATRONIC ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

18791 ENGINEERING ECONOMY				
312	8	Engineering Economics	2L, 2T	T
Introduction to accounting: financing, tax and growth of a business. Income, balance sheet and cash flow statements. Financial ratios.				
<i>Examination</i>				
Home department: INDUSTRIAL ENGINEERING				
Formula for Final mark: $P = 0,5K + 0,5E$				

38571 ENGINEERING MATHEMATICS				
115	15	Introductory Differential and Integral Calculus	5L, 2T	A & E
Mathematical induction and the binomial theorem; functions; limits and continuity; derivatives and rules of differentiation; applications of differentiation; the definite and indefinite integral; integration of simple functions				
Home department: MATHEMATICS				
145	15	Further Differential and Integral Calculus	5L, 2T	A & E
Complex numbers; transcendental functions; integration techniques; improper integrals; conic sections; polar coordinates; partial derivatives; introduction to matrices and determinants.				
<i>P Engineering Mathematics 115</i>				
Home department: MATHEMATICS				
214	15	Differential Equations and Linear Algebra	4L, 2T	A & E
Ordinary differential equations of first order; linear differential equations of higher orders; Laplace transforms and applications. Matrices: linear independence, rank, eigenvalues. Laplace transforms and applications.				
<i>PP Engineering Mathematics 115 or 145</i>				
<i>P Engineering Mathematics 145</i>				
Home department: MATHEMATICS				

59498 ENGINEERING STATISTICS				
314	15	Engineering Statistics	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; μ^2 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>Examination</i>				
<i>PP Engineering Mathematics 115, 145</i>				

Home department: Statistics and Actuarial Science

Formula for Final mark: $P=0,4K+0,6E$

59501 BUSINESS DESIGN

444	15	Enterprise Design	2L, 2T	A
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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 organizational architectures.

Examination

Final-year enrolment

Home department: INDUSTRIAL ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

34576 ENTOMOLOGY

314	16	Insect pest management	3L, 3P	T
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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.

Subject to continuous assessment.

Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY

418	32	Insect diversity	6L, 6P	T
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Introduction to the Arthropoda and its classes; nomenclature of insects, generalised morphology, physiology 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.

Subject to continuous assessment.

Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY

454	16	Applied insect ecology	3L, 3P	E
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Economically important insects: their biology and population dynamics; application of integrated pest management (IPM) tactics on selected crops; ecosystem services.

Practicals: Visits to appropriate institutions; pest-risk determination of invasive or outbreak species.

Subject to continuous assessment.

Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY

464	16	Insect conservation ecology	3L, 3P	E
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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.

Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY

58335 ENTREPRENEURSHIP AND INNOVATION MANAGEMENT				
214	16	Introduction to entrepreneurship	4L	A
Introduction to the world of entrepreneurship in South Africa; Drivers of entrepreneurship; introduction to the identification of opportunities and development of ideas; the analysis of the entrepreneurial process; feasibility analysis; building a new venture team; Assessing a new venture's financial strength and viability; ethics and legal considerations; getting finance; the importance of intellectual property; the importance of growth; growth strategies; buying an existing business. Home department: BUSINESS MANAGEMENT				
244	16	Small business management	4L	A
The scope and nature of small business development in South Africa; the important role of SMMEs in the South African economy; management of entrepreneurial opportunities; small business marketing management, purchasing, manufacturing and financial management; alternative routes to entrepreneurship; financing of opportunities in the market environment; management of growth of the small business; legal requirements which small businesses must adhere to; E-commerce and the entrepreneur; compilation of the business plan with the emphasis on the layout; different elements of the plan, balance sheet, income statement and cash flow statement; broad-based black economic empowerment and opportunities for SMMEs. <i>P Entrepreneurship and Innovation Management 214</i> Home department: BUSINESS MANAGEMENT				
318	24	Creativity and innovation management	4L	A
The importance of technological innovation; sources of innovation: creativity and organisational creativity; translating creativity into innovation; types and patterns of innovation; standards battles and design dominance; timing of entry; innovation strategies; choosing innovation projects; collaboration strategies; protecting innovation; introduction to the new product development process. <i>P Entrepreneurship and Innovation Management 214 or 244</i> Home department: BUSINESS MANAGEMENT				

50431 ENVIRONMENTAL ENGINEERING				
442	8	Engineering and the Environment	3L, 2T	T
<i>for 7 weeks.</i> 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) [Presented by the Department of Process Engineering (50%) and by the Department of				

Civil Engineering (50%)]

Examination

Prerequisite for Engineering students: All the prescribed modules for the first 2 years of the relevant BEng programme

Prerequisite for Agricultural Sciences students: All the modules for the first 2 years of the wood products science programme

Home department: PROCESS ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

26883 FINANCIAL ACCOUNTING

188	24	Financial Accounting	4L	A & E
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Theoretical principles of International Financial Reporting Standards; accounting systems; preparation and presentation of financial statements for different enterprises and introduction to group statements.

Note

Students who did not pass Accounting in their matric year must attend five lectures in Financial Accounting 188 per week in the first semester.

Home department: ACCOUNTING

288	32	Financial Accounting	4L	A
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Continuation of generally accepted accounting practice.

Preparation and presentation of financial statements for different enterprises.

PP Financial Accounting 178 or 188

Home department: ACCOUNTING

389	48	Financial Accounting	4L	A
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Advanced aspects of International Financial Reporting Standards; continuation of group statements and consolidated cash flow statements.

PP Financial Accounting 278 or 288

Home department: ACCOUNTING

51047 FINANCIAL MANAGEMENT

214	16	Introduction to Financial Management	3L, 1P	A
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Compiling of the statement of financial position, the statement of comprehensive income and the statement of cash flow; the measurement and evaluation of financial performance with reference to profitability, liquidity and solvency analysis; case studies about financial analysis; introduction to the investment decision; the financing decision; sources of finance; the dividend decision; financial planning and the management of working capital with specific reference to cash, trade receivables and inventory control; financial failures; international financial management.

Subject to continuous assessment

C Business Management 142 or

Mathematics 114 or

Mathematics (Bio) 124

Home department: BUSINESS MANAGEMENT

314	12	Financial planning and control	2L	A
<p>Calculation of the weighted average cost of capital, as well as the costs associated with the different capital components; financial valuation of enterprises; financial forecasting; the influence of inflation on annual financial statements.</p> <p><i>C Financial Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
324	12	Short-term insurance	2L	A
<p>Insurance management with special reference to the application of financial and risk management in the South African context; the financial significance of the basic principles of short-term insurance; financial management practices and annual financial statements of short-term insurers; the calculation of the office premium; the significance of the solvency margin for short-term insurers; types of short-term insurance; the financial aspects when obtaining short-term insurance as well as the claim procedure; the financial aspects of reinsurance; the government as an insurer; international aspects of insurance management.</p> <p>Home department: BUSINESS MANAGEMENT</p>				
344	12	Capital investments	2L	A
<p>The application of the following financial selection measures on large capital projects: payback period method, method of the equivalent uniform annual cost, net present value method and the internal rate of return method; the impact of inflation when assessing investment projects and the calculation of the cost of capital; priority determination for multiple mutually exclusive projects.</p> <p><i>C Financial Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
354	12	Mergers and acquisitions	2L	A
<p>Processes during mergers and acquisitions; financial and strategic aspects; theories; relevance of competition and other legislation; empirical information; LBOs; MBOs; defensive strategies; joint ventures and alliances; unbundling; management guidelines.</p> <p><i>C Financial Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

21180 FOOD FACTORY MACHINERY				
414	15	Food engineering fundamentals	3L, 3P	E
<p>Engineering approach to problem solving; thermodynamic properties of water and an ideal gas; conservation of mass, momentum and energy, and entropy; thermodynamic processes in closed and open systems; generation, usage and reticulation of steam; pump and pipe systems; fans and ducts; steady-state conduction, convection and radiation; air-water vapour mixtures and air conditioning processes.</p> <p><i>Examination</i></p> <p>Home department: MECHANICAL AND MECHATRONIC ENGINEERING</p> <p>Formula for Final mark: $P=0,5K+0,5E$</p>				
444	15	Food process engineering	3L, 2P, 2T	E
<p>Behaviour and properties of Newtonian and non-Newtonian fluids; the refrigeration cycle and refrigeration components and equipment; storage of food products by cooling and freezing; heat transfer, including the determination of heat transfer coefficients, boiling</p>				

and condensation; transient heat transfer during heating, freezing and thawing; mass transfer; thermal processing of foodstuffs; evaporation and concentration; drying theory and drying equipment; mixing; process control.

Examination

P Food Factory Machinery 414

Home department: MECHANICAL AND MECHATRONIC ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

21210 FOOD SCIENCE

144	16	Introduction to food science	3L, 3P	T
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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.

Home department: FOOD SCIENCE

214	16	Commercial food processing and preservation I	3L, 3P	T
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Commercial food processing: introduction to principles and methods; microbial growth and food spoilage and control; technological principles of heating, chilling, freezing, dehydration and concentration; effect of processing on nutritional value, sensory characteristics and microbial growth. Compulsory factory visits.

Home department: FOOD SCIENCE

244	16	Commercial food processing and preservation II	3L, 3P	T
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Commercial food processing and preservation: technological principles of chemical control and irradiation and the effect on nutritional value, sensory characteristics and microbial growth; chemical and physical characteristics of milk; technological principles of fermented foods and enzymes; environmental management in the food industry; compulsory factory visits.

P Food Science 214

Home department: FOOD SCIENCE

314	16	Animal food products	3L, 3P	T
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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.

Subject to continuous assessment.

PP Food Science 244

Home department: ANIMAL SCIENCES

324	16	Nutrition for the food scientist	3L, 3P	A
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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.

PP Food Science 244

Home department: FOOD SCIENCE

334	16	Reading and writing skills for food science students	3L, 3P	E
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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.

Subject to continuous assessment.

PP Food Science 214

Home department: FOOD SCIENCE

344	16	Food of plant origin	3L, 3P	A
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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.

PP Food Science 244

Home department: FOOD SCIENCE

354	16	Sensory analysis	3L, 3P	T
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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.

PP Food Science 244

PP Biometry 242

Home department: FOOD SCIENCE

434	16	Quality management systems	3L, 3P	A
<p>Principles and advantages of quality and food safety management systems; 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 prerequisite programmes; definitions, guidelines, requirements and interpretation of the ISO 22000:2005 standard; construction of a process flow diagram; twelve stages and seven principles of HACCP; identification of food risks, physical, chemical and biological food hazards and critical control points; completion of the HACCP plan and HACCP control chart.</p> <p><i>Subject to continuous assessment. No examination, class mark serves as final mark.</i></p> <p>Home department: FOOD SCIENCE</p>				
454	16	Food packaging	3L, 3P	A
<p>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; compulsory factory visits.</p> <p><i>PP Food Science 214, 244</i></p> <p>Home department: FOOD SCIENCE</p>				
478	48	Trial design and product development	3L, 6P	A
<p>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.</p> <p><i>No examination, class mark serves as final mark.</i></p> <p><i>PP Food Science 324, 344, 354</i></p> <p>Home department: FOOD SCIENCE</p>				
488	32	Food chemistry and analysis	3L, 3P	T
<p>Advanced analysis of foods. Chemistry of proteins, carbohydrates, fats, enzymes, water, food additives and complex food systems.</p> <p><i>PP Food Science 324, 334</i></p> <p><i>PP Biochemistry 244</i></p> <p>Home department: FOOD SCIENCE</p>				
771	15	Advanced studies in Food Science		
<p>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</p> <p>Home department: FOOD SCIENCE</p>				

772	40	Advanced laboratory techniques		
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. Home department: FOOD SCIENCE				
773	60	Training in research methodology		
Execution of research proposal, data synthesis, scientific writing, evaluation and statistical analysis, discussion and conclusion, recommendation, presentation and defence. Home department: FOOD SCIENCE				
774	5	Sensory science		
Sensory analysis in research: Analytical panels and consumer panels, advanced statistical analysis of data. Home department: FOOD SCIENCE				

11290 FOREST SCIENCE				
171	8	Introduction	1L, 1P	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> Home department: FOREST AND WOOD SCIENCE				
212	8	Natural forest ecosystems	2L, 2P	E
The importance of natural forests and their functions, including products for livelihoods and industry and the management of woodlands and savannas 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> Home department: FOREST AND WOOD SCIENCE				
234	8	Forest and environmental policy and law	2L, 2P	E
Background to the Forestry business environment in South Africa; 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> Home department: FOREST AND WOOD SCIENCE				
254	16	Forest mensuration and inventory	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; quantitative description of forest structure, sampling techniques and their application in forest inventory. <i>Subject to continuous assessment.</i> <i>P Mathematics (Bio) 124</i> Home department: FOREST AND WOOD SCIENCE				
274	16	Forest botany	1L, 2P	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 of the most important commercial species of the genera <i>Pinus</i> , <i>Eucalyptus</i> and <i>Acacia</i> , as well as selected tropical and temperate hardwood and softwood species. <i>Subject to continuous assessment.</i> Home department: FOREST AND WOOD SCIENCE				
314	16	Silviculture I	3L, 3P	E
Silviculture systems; agroforestry, including dry or temperate and silvopastoral systems; site preparation; plantation establishment and regeneration; vegetation management; environmental factors that influence tree and stand growth; species-site-market matching; the eco-physiological basis for forest production. <i>Subject to continuous assessment.</i> Home department: FOREST AND WOOD SCIENCE				
344	16	Forestry development	3L, 3P	E
Background to forestry development; knowledge, skills and attitudes for successful forestry developers; interaction, participation and facilitation with communities; development of participatory methods and tools for planning, monitoring and evaluation; 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 forestry development; introduction to urban forestry; definitions and terminology for land use and agroforestry (AF); different agroforestry management techniques; problem solving, development, sustainable management and monitoring of agroforestry projects; principles of soil rehabilitation and the advantage for commercial and community forestry; marketing of agroforestry products and economic sustainability. <i>Subject to continuous assessment.</i> Home department: FOREST AND WOOD SCIENCE				
354	16	Forest growth and yield science	3L, 3P	E
Theory of tree growth, site evaluation; development of site index equations; growing stock and stand density; prediction of current yield; prediction of future yield, growth modelling. One week of practical work in June to be completed satisfactorily as part of this module. <i>Subject to continuous assessment.</i>				

<i>P Forest Science 254</i>				
Home department: FOREST AND WOOD SCIENCE				
355	16	Forest finance, economics and marketing	3L, 3P	E
Forestry finance; financial analysis and feasibility studies of forestry projects; valuation of land and plantations; forest resource economics; basic principles of forest product marketing; international forestry marketing; timber and non-timber forestry products; forestry business environment.				
<i>Subject to continuous assessment.</i>				
Home department: FOREST AND WOOD SCIENCE				
364	16	Timber harvesting	3L, 3P	E
Introduction to timber-harvesting techniques; timber-harvesting equipment and systems; evaluation and selection of timber-harvesting systems; introduction to 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 (power-saw course) in April to be satisfactorily completed as part of this module.				
<i>Subject to continuous assessment.</i>				
<i>C Forest Science 254</i>				
Home department: FOREST AND WOOD SCIENCE				
414	16	Silviculture II	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 forests; management of fire, climatic, biological and other risks to promote environmental, socio-political and economic sustainability.				
<i>Subject to continuous assessment.</i>				
<i>C Forest Science 314</i>				
Home department: FOREST AND WOOD SCIENCE				
422	8	Forest and environmental policy and law	2L, 2P	E
(Presented until 2013)				
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>				
Home department: FOREST AND WOOD SCIENCE				
424	16	Forest management and planning	3L, 3P	E
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.				
<i>Subject to continuous assessment.</i>				
<i>P Forest Science 254</i>				
Home department: FOREST AND WOOD SCIENCE				
434	16	Forest roads and transport	3L, 3P	E
Introduction to secondary timber transport; 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 and 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; impacts of roads on the environment and forest certification; road network management systems.				
<i>Subject to continuous assessment.</i>				
<i>C Forest Science 364</i>				
Home department: FOREST AND WOOD SCIENCE				
435	8	Silviculture III	2L, 2P	E
From 2014				
Genetic tree improvement of forestry species; principles and practices of tree propagation and nursery management; principles of sexual and asexual tree propagation; population genetics, quantitative traits and continuous variation within forestry species; developing, monitoring and evaluating nursery and tree improvement experiments.				
<i>Subject to continuous assessment.</i>				
<i>C Genetics 214</i>				
Home department: FOREST AND WOOD SCIENCE				
468	32	Management plan	3L, 3P	E
A study of the total industry or of a chosen or allocated management unit in the forest industry. This 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.				
The 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 planning. It will then be used for the compilation of a comprehensive management plan on the basis of which the module will be assessed.				
A study tour during the fourth year is a compulsory part of this module.				
<i>C Forest Science 414, 424, 434</i>				
Home department: FOREST AND WOOD SCIENCE				
Formula for Final mark: <i>No examination is written; class mark serves as final mark.</i>				
711	40	Advanced growth and yield science		
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. Scenario simulation and decision support tools.				

Home department: FOREST AND WOOD SCIENCE			
712	40	Forest harvesting	
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.			
Home department: FOREST AND WOOD SCIENCE			
713	40	Advanced nursery practice	
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.			
Home department: FOREST AND WOOD SCIENCE			
714	40	Advanced tree breeding	
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.			
Home department: FOREST AND WOOD SCIENCE			
715	40	Community forestry	
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>			
Home department: FOREST AND WOOD SCIENCE			
716	40	Agroforestry	
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>			
Home department: FOREST AND WOOD SCIENCE			
723	16	Sustainable land use planning	
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>			
Home department: FOREST AND WOOD SCIENCE			
741	40	Advanced forestry planning	
Advanced 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, risk management.			
Home department: FOREST AND WOOD SCIENCE			

742	40	Forest roads and logistics		
<p>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.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
743	40	Sustainable silviculture		
<p>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.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
744	40	Forest eco-physiology		
<p>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.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
745	40	Forest economics and policy		
<p>Advance micro and macro forest and environmental economic concepts. International trade theory, market instruments and certification. Economics and policies related to: green and renewable technology; carbon trading; socio-economic development.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
761	16	Bio-energy systems		
<p>Bio-energy systems: production; harvesting and supply; biomass conversion; energy production; marketing of bio-energy; economics and political framework. Sources of biomass; global biomass production; biomass in southern Africa; potential and limitations; principles in biomass production systems; agriculture, forestry and agroforestry systems.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
764	16	Energy production from wood and other biomass		
<p>Conversion of wood into energy, processing methods, determination of calorific values and other properties, comparison of different biofuels, environmental aspects, emissions.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
766	16	Geo information science for resource managers		
<p>The use of GIS in the context of natural resource research and management (agriculture, forestry, conservation); the nature of geographical data, data models, coordinate systems and map projections; sources of spatial data in Southern Africa; GPS and Remote Sensing technology use in GIS; GIS processes: data capture, ordering, storage and manipulation; specific emphasis on analysis of spatial patterns for natural resources; visual output for research publication.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

771	34	Research project		
<p>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.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
772	32	Silviculture		
<p>Basic forest eco-physiology; silvicultural systems; characteristics of commercially important species and hybrids; site-species-market matching; stand regeneration; site, vegetation and nutrient management; pruning; thinning; risk management and sustainability.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
773	32	Timber harvesting and transport logistics		
<p>Sustainable application of timber-harvesting operations and related logistics. This will include timber-harvesting techniques and nomenclature, harvesting methods and systems selection; harvest planning; optimal utilisation of forest biomass; work study and ergonomics; forest road network analysis and management and secondary transport operations and access development to satisfy sustainability principles.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
774	32	Forest inventory and yield prediction		
<p>Coverage of forest mensuration techniques to determine tree diameter, tree height, stem form and volume, stem weight, biomass and carbon content; quantitative characterisation methods of forest structure; layout and implementation of forest inventories in natural and plantation forests; consideration of spatial aspects as well as aspects of accuracy and efficiency of inventories; theories of tree growth; tree growth and its relation to wood quality; simulation of tree and stand growth with empirical models.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
775	32	Forest management		
<p>Forestry planning and planning systems, forestry business environment and levels of planning; forest finance and economic analysis, forest investments, trade in forest products, forestry markets, valuation of forests, land and services; international resource policies, REDD, carbon trade, renewable energy policies, forest certification.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
776	32	Forest propagation and tree improvement		
<p>Genetic tree improvement of forestry species; principles and practices of tree propagation and nursery management; principles of sexual and asexual tree propagation; population genetics, quantitative traits and continuous variation within forestry species.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

780	24	Forest Science Project		
<p>Research in the context of the forestry value chain; research design and methods; data capture and analysis; formulation of results and conclusions.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
785	32	Forestry development		
<p>Agroforestry systems; community-based natural resource management; non-timber forest products; integrated land-use systems and green landscapes; land resources and productivity in forest systems, socioeconomic aspects of forest systems, planning for agroforestry diagnosis and design, management and sustainability of forest ecosystems.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
875	14	Forest Science research methodology		
<p>Critical reading of scientific papers, literature searches, development of research proposals, scientific writing and presentation skills, forest science research environment, research ethics.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
881	40	Advance forest eco-physiology		
<p>Radiation interception, soil water availability, nutrient dynamics and nutritional sustainability in forest ecosystems; forest disturbance and regeneration processes; eco-physiological modelling of stand growth, carbon sequestration and the mechanisms whereby stands respond to silvicultural operations.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
882	40	Advance timber harvesting logistics		
<p>Assessment and sustainable application of timber-harvesting operations and related logistics. This will include timber-harvesting techniques and nomenclature, harvesting methods and systems selection; harvest planning; optimal utilisation of forest biomass; work study and ergonomics; forest road network analysis and management and secondary transport operations and access development to satisfy sustainability principles.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
883	40	Advance forest management		
<p>Forces and trends impacting on the forestry business environment; advanced concepts in forest economics; forestry investments, trade in forest products, forestry markets; international resource policies, climate change, carbon trade; forest-management information systems, business and technical planning.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

884	40	Forest growth and wood formation		
<p>A theory-driven approach to forest and tree growth and the correlations to wood quality; advanced methods for tracing and analysing changes in tree and forest growth; effects of environmental stress on growth and relevant wood properties; modelling and simulation of tree and forest growth and wood quality.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
885	40	Advance forestry development		
<p>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; agroforestry systems, practices and technologies; diagnosis and design in agroforestry; resource use in agroforestry, including competition, complementarity for water, nutrients and light; agroforestry research and development approaches, including on-farm research for technology development and dissemination.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
886	40	Advanced nursery practice and tree improvement		
<p>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; 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. Identify, plan and develop nursery and tree improvement projects.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

13285 GENETICS				
214	16	Introductory Genetics	3L, 3P	T
<p><i>Part I: Principles of Heredity</i></p> <p>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.</p> <p><i>Part II: Population Genetics</i></p> <p>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.</p> <p><i>P Biology 124 or 144 or 154</i></p> <p>Home department: GENETICS</p>				

244	16	Introductory Molecular Biology	3L, 3P	T
<p>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.</p> <p><i>P Genetics 214</i></p> <p>Home department: GENETICS</p>				
314	16	Cytogenetics	3L, 3P	T
<p>The module focuses on the organisation, structure and functionality of chromosomes and covers the following: chromosome structure during the different phases of cell division; 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 chromosome regions; multiple copy genes (rRNA and tRNA genes); protein coding gene families (globin, immunoglobulin and histone gene families); deviant chromosome types (ring, telocentric, dicentric and acentric chromosomes, iso and pseudo-iso chromosomes, etc.); DNA methylation, gene expression and epigenetic effects; chromosome deviations that result from non-synthetic recombination of large repeat sequences or short tandem repeats; chromosome pairing, chiasm 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 behaviour; genetics of development; gene therapy.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Genetics 244</i></p> <p>Home department: GENETICS</p>				
324	16	Population Genetics	3L, 3P	T
<p>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.</p> <p><i>Subject to continuous assessment</i></p> <p><i>P Genetics 244</i></p> <p>Home department: GENETICS</p>				
344	16	Advanced Molecular Genetics	3L, 3P	T
<p>Study of 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,</p>				

comparison of genomes); creation and applications of transgenic animals, animal models for human genetic diseases.				
Function of the genome: role of DNA binding proteins, initiation of transcription; synthesis and processing of RNA and the proteome; regulation of genome activity				
<i>Subject to continuous assessment.</i>				
<i>PP Genetics 244</i>				
Home department: GENETICS				
354	16	Quantitative genetics	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 212, 242 or</i>				
<i>P Biology 272</i>				
Home department: GENETICS				
414	16	Plant breeding techniques	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>				
Home department: GENETICS				
444	16	Quantitative traits and selection methods	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>				
Home department: GENETICS				

56502 GEOGRAPHY AND ENVIRONMENTAL STUDIES				
214	16	Geographical Information Systems	3L, 3P	E
Introductory overview and comprehension of GIS in the context of geo-information science; the nature of geographical data, data models, coordinate systems and map projections; GIS processes: data capturing, ordering and storage, manipulation and analysis; map design and cartographical visualisation with a GIS; GIS applications.				
<i>Continuous assessment</i>				
Home department: GEOGRAPHY AND ENVIRONMENT STUDY				

324	16	Introduction to Geographical Information Systems	3L, 3P	E
<p>Definition and technical overview of GIS; principles of spatial data structures; South African co-ordinate and projection systems; input, capture, manipulation, analysis and presentation of geo-data; integration and exchange of South African national data sets: censuses, topographic data, research; practical GIS application: South African case studies decision support in socio-economic and physical environmental problems.</p> <p><i>Subject to continuous assessment</i></p> <p>Home department: GEOGRAPHY AND ENVIROMENT STUDY</p>				
334	16	Spatial modelling	3L, 3P	E
<p>Models in science; Spatial models: types, construction, design and development; Cartographic modelling: terminology, methodology, in- and outputs, functions.</p> <p><i>Subject to continuous assessment</i></p> <p><i>P Geography and Environmental Studies 214</i></p> <p>Home department: GEOGRAPHY AND ENVIROMENT STUDY</p>				

64165 GEO ENVIRONMENTAL SCIENCE				
124	16	Introduction to Human-Environmental Systems	3L, 3P	T
<p>Nature of human geography; Demography of world population; Food resources; Urbanisation: models of urban structure, functional areas in cities, cities in developing countries; Politico-geographical organisation: nations and states in conflict, regions in the news; Environmental systems on a global scale: fluvial, arid, karst, coastal and glacial environments; Ecosystems and humans; Utilisation of environmental resources: global occurrence, use and depletion of non-renewable energy, water and soil resources; Practical mapping and graphics.</p> <p>Home department: EARTH SCIENCES</p>				
154	16	Introduction to Earth Systems Science	3L, 3P	T
<p>Introduction to Earth systems science; Star-forming processes; The solar system and the earth; Internal earth processes; Mineral- and rock-forming processes; Origin of magma and igneous rocks; External structure of the earth; Formation of continents; Plate tectonics; Sedimentary rocks and the geological record; Geological time scale; Metamorphic rocks and mountain building; Humans and tectonics: earthquakes and volcanoes; The hydrosphere; Surface water processes; Groundwater processes; Theory of the origin and evolution of life; Practical mapping.</p> <p>Home department: EARTH SCIENCES</p>				

39632 HORTICULTURAL SCIENCE				
222	8	Fruit production	1.5L, 1.5P	T
<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>P Crop Production 152 or Biology 154</i></p>				

Home department: HORTICULTURAL SCIENCE				
Formula for Final mark: <i>No examination, class mark serves as final mark.</i>				
314	16	Deciduous fruit production	3L, 3P	T
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.				
Home department: HORTICULTURAL SCIENCE				
342	8	Citrus production	1.5L, 1.5P	T
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.				
Home department: HORTICULTURAL SCIENCE				
352	8	Ornamental, foliage and aromatic plant production systems	1.5L, 1.5P	T
Biology and technology of the production of cut flowers, foliage and herbs/aromatic plants, including orchard-based fynbos production. Production prerequisites for selected flower types, fynbos, culinary herbs and lavender as an essential oil-producing plant. Control of flower initiation, scheduling of flowering time and harvesting, colour and flavour development and other quality characteristics.				
Home department: HORTICULTURAL SCIENCE				
434	16	Applied plant physiology and tree architecture	3L, 3P	T
Lectures: 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.				
Practicals: inter alia lectures by industry specialists on relevant pre-harvest topics as well as visits to fruit production areas to illustrate and support the module content.				
<i>P Horticultural Science 314</i>				
Home department: HORTICULTURAL SCIENCE				
444	16	Postharvest physiology and technology	3L, 3P	T
Postharvest physiology of fresh plant products: structure and composition of the product, role of respiration and ethylene metabolism, fruit ripening and senescence, physiological defects or disorders, food safety.				
Postharvest technology: water relations and psychrometrics, quality and maturity parameters, harvest and packing, cooling and storage technology such as controlled				

atmosphere, transport of fresh plant products.

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.

Practicals: 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 Cape Town market in Epping, pack houses and cold stores, cut facilities and the Cape Town port for handling of export products.

Home department: HORTICULTURAL SCIENCE

44792 INDUSTRIAL ERGONOMICS

414	15	Industrial Ergonomics	3L, 1.5T	A
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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.

Examination

Home department: INDUSTRIAL ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

53937 INDUSTRIAL MANAGEMENT

354	15	Industrial Management	2L, 2T	T
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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.

Examination

P Production Management 214

Home department: INDUSTRIAL ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

47422 INDUSTRIAL PROGRAMMING

244	15	Industrial programming	2L, 3T	T
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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.

Continuous

P Engineering Mathematics 214

Home department: INDUSTRIAL ENGINEERING

Formula for Final mark: $P=K$

10553 INDUSTRIAL PSYCHOLOGY				
112	4	Introduction to Human Resource Management	1L	A & E
Role and value of Industrial Psychology in organisations; human resource planning and recruitment; selection of personnel; training and development; performance management; remuneration management; work values and attitudes; motivation within organisations; leadership; groups and teams; organisation development and change; the labour relationship; labour unions, employers, and the State; labour relations in the organisation. Home department: INDUSTRIAL PSYCHOLOGY				
314	12	Labour Relations	2L, 0.5S	A
Introduction and overview of field of study, historical development of labour relations, environmental influences of labour relations, trade unions, employers, state, labour relations in the work place (grievances, discipline and dismissal). Introduction to labour legislation: Labour Relations Act, Basic Conditions of Employment Act. <i>C Industrial Psychology 244</i> Home department: INDUSTRIAL PSYCHOLOGY				

44776 INDUSTRIAL PSYCHOLOGY (SPECIAL)				
354	12	Industrial Psychology (Special)	2L, 1S	E
Human resource management: human resource planning, recruitment, selection, induction, training and development, performance appraisal, compensation management, labour turnover, absenteeism, health and safety. Labour relations: field of study, organised labour, role of employers; labour legislation. Organisational behaviour: introduction and orientation, organisational design, the individual, groups and teamwork, motivation, leadership, organisational effectiveness. Home department: INDUSTRIAL PSYCHOLOGY				

55344 INVESTMENT MANAGEMENT				
254	16	Introduction to investment theory	3L, 1P	A
Portfolio theory and portfolio management; the relationship between risk and return; the efficient market hypothesis; valuation and risk of fixed income securities; evaluation of share investments; properties of derivative instruments; derivative strategies; valuation of options and futures; measurement and evaluation of portfolio returns. <i>P Business Management 142</i> <i>P Statistical Methods 176 or</i> <i>P Statistics 186 or</i> <i>P Probability Theory and Statistics 114 or 144</i> Home department: BUSINESS MANAGEMENT				
314	12	Equity analysis and portfolio management	1.5L, 0.5P	A
Theory of valuation; valuation models and techniques; practical implementation of valuation models; valuation variables; stock market analysis; industry analysis; company analysis and stock selection; technical analysis; equity portfolio management strategies. <i>P Investment Management 254</i>				

Home department: BUSINESS MANAGEMENT				
324	12	Fixed income securities	1.5L, 0.5P	A
Trading of fixed income securities; price sensitivity; fixed income securities in structured portfolios; indexing; liability funding; credit risk in corporate bonds; credit risk in international sovereign bonds; embedded options in bonds; securitisation; mortgage prepayment; active portfolio management; economic analysis and management of bond portfolios.				
<i>P Investment Management 254</i>				
Home department: BUSINESS MANAGEMENT				
344	12	Derived Financial instruments and Alternative investments	1.5L, 0.5P	A
Exposure to and handling of Financial risk; the risk management process, the hedging concept; the functions of the treasury and the management of negotiable value; characteristics of derived financial instruments; strategies for the use of derived financial instruments; valuation of options and futures contracts; basic arbitrage strategies with options and futures contracts; swaps and forward rate agreements; alternative investments.				
<i>P Investment Management 254</i>				
Home department: BUSINESS MANAGEMENT				
348	12	Real estate investment and financing	4L	A
Introduction to the nature and scope of real estate; real estate markets and trends; legal aspects; financial and investment analysis in respect of the acquisition, ownership and sale of real estate; the role and impact of capital gains tax; market valuation approaches; types of real estate investment and financing instruments in the real estate market.				
<i>C Financial Management 214 or C Financial Accounting 178 or 188</i>				
Home department: BUSINESS MANAGEMENT				

59439 LANGUAGE SKILLS (AFRIKAANS)				
163	8	Language skills (Afrikaans)	3L	A
This semester module is attended by students in their first year of studies , on an advanced level, whom the Faculty has identified as needing to further develop their Afrikaans language skills. The focus is on developing the student's generic language and thinking skills. All four language skills (speaking, listening, reading and writing) are developed in an integral manner, although emphasis is placed on academic reading and writing skills.				
Home department: ENGINEERING (ADMIN)				
176	12	Language Skills (Afrikaans)	3L	A
This year module is attended by students in their first year of studies , on a beginners level, whom the Faculty has identified as needing to further develop their Afrikaans language skills. The focus is on developing the student's generic language and thinking skills. All four language skills (speaking, listening, reading and writing) are developed in an integral manner, although emphasis is placed on academic reading and writing skills.				
Home department: ENGINEERING (ADMIN)				

276	12	Language Skills (Afrikaans)	3L	A
<p>This year module is attended by students in their second year of studies , on a post-beginners level, whom the Faculty has identified as needing to further develop their Afrikaans language skills. The focus is on developing the student's generic language and thinking skills. All four language skills (speaking, listening, reading and writing) are developed in an integral manner, although emphasis is placed on academic reading and writing skills.</p> <p>Home department: ENGINEERING (ADMIN)</p>				

59730 LANGUAGE SKILLS (ENGLISH)				
153	8	Language Skills (English)	3L	E
<p>This semester module is attended by students in their first year of studies , on an intermediate level, whom the Faculty has identified as needing to further develop their English language skills. The focus is on developing the student's generic language and thinking skills. All four language skills (speaking, listening, reading and writing) are developed in an integral manner, although emphasis is placed on academic reading and writing skills.</p> <p>Home department: ENGINEERING (ADMIN)</p>				

50407 LOGISTICS MANAGEMENT				
214	16	Logistics Management	3L, 1P	A
<p>Introduction to Logistics Management: the role of logistics in the firm, the elements of logistics, integrated logistics management, channels of distribution, client/customer service, strategic aspects of logistics management, organisation for effective logistics, international logistics, new trends.</p> <p><i>P Business Management 113</i></p> <p>Home department: LOGISTICS</p>				
244	16	Logistics Management	3L, 1P	A
<p>Business logistics: private (own) logistics, the outsourcing decision, professional logistics, transport management and operations, arrangement of the supply chain.</p> <p><i>PP Business Management 113</i> <i>PP Logistics Management 214</i></p> <p>Home department: LOGISTICS</p>				
318	24	Logistics Management	4L	A
<p>Logistics planning and organisation: Development, role and positioning of logistics within an organisation and the economy. Strategic and tactical aspects of logistics planning. Nature, output and contribution of logistics as well as the interactions and the underlying relationship between logistics activities. Contribution of logistics to the competitive advantage of an organisation.</p> <p><i>PP Logistics Management 214, 244</i> <i>PP Economics 114, 144</i> <i>PP Statistical Methods 176 or</i> <i>PP Statistics 186 or</i> <i>PP Probability Theory and Statistics 114 or 144</i></p> <p>Home department: LOGISTICS</p>				

348	24	Logistics Management	2L	A
<p>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.</p> <p>Client/customer requirements versus achievable logistics performance. Review of logistics goals and objectives.</p> <p><i>PP Logistics Management 214, 244, 318</i> <i>PP Economics 114, 144</i> <i>PP Statistical Methods 176 or</i> <i>PP Statistics 186 or</i> <i>PP Probability Theory and Statistics 114 or 144</i></p> <p>Home department: LOGISTICS</p>				

23795 MARKETING MANAGEMENT				
214	16	Marketing management	3L, 1P	A
<p>Modern marketing dynamics in enterprises and the community; marketing and the value creation process; customer 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; measurement and forecasting of demand; market segmentation and target market selection; product decisions; price decisions; channel decisions and place strategy; communication decisions; direct marketing and sales promotion decisions.</p> <p><i>C Financial Management 214 or</i> <i>C Financial Accounting 278 or 288 or</i> <i>C Biometry 212</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
244	16	Advertising and sales promotion	3L, 1P	A
<p>Advertising and the marketing process; the consumer audience; portfolio planning and research; functioning of advertising; advertising planning and strategy; advertising media; media planning and buying; printed media; creative advertising; integration of the elements of marketing communication.</p> <p><i>P Marketing Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
314	12	Retail management	2L	A
<p>Retail strategy and the retailing mix; location decisions; merchandise decisions; price decisions; communication decisions; consumer services and information; technology and systems; franchise agreements.</p> <p><i>P Marketing Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
324	12	Services management	2L	A
<p>Unique characteristics of services; nature and process of service delivery; differences between product and service evaluations; development, communication and delivery of services; service quality and measurement thereof; the role of service providers and the environment of service delivery; implementation of service-marketing strategies.</p> <p><i>P Marketing Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

344	12	Marketing research	2L	A
<p>Defining of the marketing problem; research design; exploratory research design for secondary data and qualitative research; surveys and observations as part of descriptive research; measurement of perceptions; questionnaire design; sampling; fieldwork and data preparation; formulation of hypotheses and basic statistical tests.</p> <p><i>P Marketing Management 214, 244</i> <i>P Probability Theory and Statistics 144</i> <i>P Statistical Methods 176 or</i> <i>P Statistics 186 or</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
354	12	Strategic marketing	2L	A
<p>Function and application of marketing in different organisations and conditions; enterprise and marketing strategy; competitive marketing strategies; international marketing strategies; the marketing system; consumer markets and buying behaviour; institutional markets and buying behaviour; marketing planning processes; marketing controls.</p> <p><i>P Marketing Management 214, 244</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

21539 MATHEMATICS				
114	16	Calculus	5L, 2T	A & E
<p>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.</p> <p>Home department: MATHEMATICS</p>				
144	16	Calculus and Linear Algebra	5L, 2T	A & E
<p>Complex numbers; transcendental functions; techniques of integration; improper integrals; conic sections; partial derivatives; introduction to matrices and determinants.</p> <p><i>P Mathematics 114</i></p> <p>Home department: MATHEMATICS</p>				

21547 MATHEMATICS (BIO)				
124	16	Mathematics for the Biological Sciences	4L, 2T	A & E
<p>Functions and their inverses: polynomial functions, rational functions, power functions, exponential functions, trigonometric functions. Solution of trigonometric equations. Composition of functions. Limits. Definition of the derivative of a function. Continuity. Rules of differentiation, certain formulae. Higher order derivatives. Implicit differentiation. Applications of differentiation: processes of growth and decay, graph sketching, optimisation problems. Indefinite integrals. Techniques of integration: substitution, integration by parts. The definite integral as the limit of a sum. The Fundamental Theorem of Calculus. Definite integrals as areas. Solution and use of simple differential equations.</p> <p>Home department: MATHEMATICS</p>				

16284 MICROBIOLOGY				
214	16	Introductory Microbiology	3L, 3P	T
<p>History, microscopy, classification, structure and function, nutritional requirements and growth factors, nutrient uptake, energy generation, culture media, growth curves, yields and effect of nutrient limitation, continuous culture, 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, microbial taxonomy.</p> <p><i>PP Biology 124 or 144</i> <i>P Chemistry 114 and 154</i></p> <p>Home department: MICROBIOLOGY</p>				
244	16	Microbial Diversity	3L, 3P	T
<p>Prokaryotes, kingdoms of life and modern classification, Archaeal cell structure and function, Gram-positive bacteria, Gram-negative bacteria, actinomycetes, cyanobacteria. Fungal divisions, cell structure and function. Structure of viruses and virus taxonomy, bacteriophages, human viruses. Microbiology of air, water and soil environments, different metabolic types of micro-organisms, the role of micro-organisms in biogeochemical cycles and energy flow in the food web, the dependence of animals and plants on micro-organisms, including symbiotic associations, microbe-plant associations and microbe-insect associations, interactions between micro-organisms.</p> <p><i>PP Biology 124 or 144</i></p> <p>Home department: MICROBIOLOGY</p>				
354	16	Industrial Microbiology	3L, 3P	T
<p>Food fermentations, traditional microbial processes: beer, wine, bread, cheese, yoghurt, salami, etc. Specialised food fermentations, e.g. biological preservatives, preparation and the role of micro-organisms. Quality control measures: HACCP, ISO 9000, etc. The occurrence of pathogens and food-spoiling bacteria and their control. Industrial production of non-food products: selected examples of industrial production of enzymes, antibiotics, pharmaceutical products, influence of substrate on production levels.</p> <p><i>PP Microbiology 214</i></p> <p>Home department: MICROBIOLOGY</p>				

43850 NEMATOLOGY				
344	16	Plant nematology	3L, 3P	A
<p>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.</p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				

33103 OENOLOGY				
142	8	Introduction to oenology	1.5L, 1.5P	T
<p>Basic grape morphology and production directions. Wine grape cultivars. 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.</p> <p><i>C Crop Production 152 and Chemistry 114</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
214	16	The wine trade	3L, 3P	T
<p>The global wine trade; trends, countries and forecasts, production and consumption. The SA wine trade; industry structure in SA; legal issues and licensing.</p> <p>Understanding SA consumer preferences, brand loyalty, product developments. Devising and using component recognition tests, discrimination tests, paired comparisons, triangular tests.</p> <p><i>PP Chemistry 114</i> <i>P Crop Production 152</i> <i>P Oenology 142</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
244	16	Wines of the world, South African wines and brandies and regulations	3L, 3P	T
<p>Wines of the world. Evaluation of wines. The South African wine industry: Wine of Origin system, legislation and regulations. Industrial health and safety in a winemaking context. Introduction to brandy and sparkling-wine production basics.</p> <p><i>P Crop Production 152</i> <i>P Oenology 142</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
314	16	Pre-fermentation processing of grapes and must	3L, 3P	T
<p>Harvesting and handling of grapes, must and skins and determining of harvest readiness. Composition of grapes, must and wine, as well as physical and chemical analyses thereof, must adjustments and appropriate legislation, enzymes. Cellar technology used in pre-fermentation processing, including methods for temperature control and colour extraction. Brandy and sparkling base wine production.</p> <p><i>P Oenology 244</i> <i>P Chemistry 114, 154</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
342	8	Post-fermentation operations	1.5L, 1.5P	T
<p>Fining and clarification of wine: fining trials, filtration of wine. Bottling principles. Wine faults. Blending of wines and evaluation.</p> <p><i>P Oenology 314</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

344	16	Applied wine microbiology	3L, 3P	T
<p>Applied aspects of yeasts, moulds and bacteria during vinification; yeast physiology; yeast and bacterial metabolic pathways; malolactic fermentation; production of aroma and flavour compounds; microbial spoilage of wines.</p> <p><i>C Oenology 314</i> <i>C Biochemistry 214, 244</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
444	16	Applied oenology	3L, 3P	T
<p>Chromatographic and spectral techniques for wine analysis, including HPLC, GC, UV/vis spectrophotometry, infrared spectrophotometric analyses (FOSS); advanced sensory and statistical analyses of datasets, as well as interpretation of research results; exposure to scientific investigations; brandy distillation and maturation; development of critical and evaluative scientific thinking through group work, designing and carrying out experiments, presentations, writing projects; fault recognition and analysis by sensory and chemical means.</p> <p><i>P Oenology 314, 344</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
454	16	Wine maturation and quality systems	3L, 3P	T
<p>Wood chemistry, phenols in grapes and wine, aging reactions, oxidation and reduction reactions, quality control systems, cooling systems, environmental management systems, product development, protein and cold stabilisation, stability tests in wine; brandy maturation.</p> <p><i>P Oenology 314, 344</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
478	32	Oenology internship	3S	T
<p>Identification and solving of a problem in the cellar or design of a product or system. Learning activities include involvement in all commercial cellar activities during the harvest season, conducting of experiments in the cellar, data gathering and processing, complete project reporting.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Oenology 314, 342, 344</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
871	20	Research methodology		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
872	20	Advanced wine microbiology		
<p>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.</p>				

Techniques and targets for the genetic improvement of wine yeasts; legal, ethical and consumer aspects relating to the use of genetically manipulated wine yeasts.

Home department: VITICULTURE AND OENOLOGY

874	20	Wine chemistry and analysis		
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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; general laboratory safety and etiquette and biological calculations; overview of the most important techniques for isolating and characterising wine compounds; physiological reactions taking place during wine tasting, basic statistical techniques for wine-tasting data analyses, different types of wine evaluation systems.

Home department: VITICULTURE AND OENOLOGY

59528 OPERATIONS RESEARCH (ENG)

345	15	Operations Research (Deterministic Models)	2L, 3T	T
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The systems approach to problem solving; problems leading to linear programming, network, integer and non-linear programming models; algorithms for solving such models; tasks, including exercises with computer packages.

P Engineering Mathematics 214

Home department: INDUSTRIAL ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

415	15	Operations Research (Stochastic Models)	2L, 3T	T
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Analysis 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; multi-criteria decision making.

Examination

P Engineering Statistics 314

Home department: INDUSTRIAL ENGINEERING

Formula for Final mark: $P=0,5K+0,5E$

13005 PHYSICS (BIO)

134	16	Introductory Physics for Biological Sciences A	3L, 3P	A & E
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Selected topics, relevant to the biological sciences, from introductory mechanics, hydrostatics and -dynamics, oscillations, waves, optics.

Home department: PHYSICS

154	16	Introductory Physics for Biological Sciences B	3L, 3P	A & E
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Selected topics, relevant to the biological sciences, from introductory electricity, magnetism, thermodynamics, gas laws, atomic physics, radioactivity.

P Physics (Bio) 134

Home department: PHYSICS

50393 PHYSIOLOGY AND ANIMAL PHYSIOLOGY

214	16	Physiological Principles and Systems	3L, 3P	T
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Textbook-based overview of the following physiological principles and systems: Homeostasis and body fluids, cell membranes, general physiological control systems, nervous, muscle, respiratory, hormonal, digestive (basic single stomach) systems, and also typical diseases applicable to these systems.

*PP Biology 124, 154 or
PP Biology (OCC) 111 or
PP Physiology 114, 144
C Biochemistry 214*

Home department: PHYSIOLOGICAL SCIENCES

244	16	Systems in Physiology	3L, 3P	T
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Textbook-based overview of the following physiological systems of the body: Special sense organs, acid/base balance, blood, cardiovascular, renal and reproductive systems.

*P Physiology and Animal Physiology 214
C Biochemistry 244*

Home department: PHYSIOLOGICAL SCIENCES

32891 PLANT PATHOLOGY

314	16	Plant disease dynamics	3L, 3P	T
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Components of plant diseases, such as the plant pathogens that cause them, the host factors that influence their development, and the environmental conditions that favour them. Diseases of national and international importance and the damage they have caused to food production in the world. The dynamics of pathogens associated with seed and nursery plants, as well as those causing soil-borne, foliar and fruit diseases before harvest, and decay and damage after harvest.

Home department: PLANT PATHOLOGY

344	16	Plant disease management	3L, 3P	T
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The underlying principles and methods used for plant disease control from pre-planting to post-harvest. This includes the role of plant quarantine, disease certification and cultivation practices on disease development, and on the epidemiological considerations for plant disease forecasting and disease assessment. Emphasis is placed on plant disease resistance, and chemical and biological control, either as primary control strategies or as components of an integrated disease control programme, to ensure efficient and sustainable protection against a diverse range of pathogens.

PP Plant Pathology 314

Home department: PLANT PATHOLOGY

414	16	Taxonomy and biology of plant pathogens	3L, 3P	T
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Morphology, taxonomy and biology of plant pathogenic fungi, oomycetes, bacteria, mollicutes (spiroplasmas and phytoplasmas) and viruses. Practicals include microscopic cultural morphology and physiological and biochemical methods used to identify the

major groups of plant pathogenic fungi, oomycetes and bacteria.				
<i>PP Plant Pathology 314, 344</i>				
Home department: PLANT PATHOLOGY				
444	16	Plant-microbe interactions	3L, 3P	T
The dynamic interaction between plants and microorganisms, both detrimental and beneficial. Aspects related to fungal diversity, genetics and genomics, and the role of microbial pathogenicity factors and secondary metabolites in plant disease development. The plant's defence mechanisms and ability to recognise and respond to pathogen attack. Enhancement of disease resistance in plants against pathogens, and the development of novel disease control strategies. Methods used for gene discovery and functional gene analyses in plants and pathogens, and concepts such as transformation and gene manipulation.				
<i>PP Plant Pathology 314, 344</i>				
Home department: PLANT PATHOLOGY				
478	32	Advanced plant pathology	3L, 3P	T
Field trips to study diseases, assess field situations and collect plant pathogens that will be identified during laboratory sessions. Formulation of disease management strategies. Relevant and current experimental approaches and methods of analysis used in plant pathology. Topical issues in plant pathology related to food security and environmental challenges. Exercises in project planning and execution conducted under supervision.				
<i>Subject to continuous assessment.</i>				
<i>PP Plant Pathology 314, 344</i>				
Home department: PLANT PATHOLOGY				
771	30	Advanced plant disease dynamics		
Components of plant diseases, such as the plant pathogens that cause them, the host factors that influence their development and the environmental conditions that favour them. Diseases of national and international importance and the damage they cause to food production in the world. The dynamics of pathogens associated with seed and nursery plants, as well as those causing soil-borne, foliar and fruit diseases before harvest, and decay and damage after harvest.				
<i>Subject to continuous assessment.</i>				
Home department: PLANT PATHOLOGY				
772	30	Advanced disease management		
The importance of epidemiology in control and management of plant diseases through the integration of cultivation practices, physical, biological and chemical strategies (seed technology, minimum manipulation, plant quarantine, sanitation practices and resistance). The mode of action of fungicides and the management of fungicide resistance in fungal populations. Biological control. Development and production of biocontrol systems for soil-borne, plant and fruit pathogens.				
<i>Subject to continuous assessment.</i>				
Home department: PLANT PATHOLOGY				
773	10	Research methodology		
Relevant and current experimental approaches and methods of analysis used in plant pathology. Experimental design and statistical analysis, molecular methods, phylogenetic analysis, paper reviews.				
<i>Subject to continuous assessment.</i>				

Home department: PLANT PATHOLOGY				
774	50	Project management and presentation		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: PLANT PATHOLOGY</p>				

23256 PRODUCTION MANAGEMENT				
214	15	Production and Operations Management	2L, 3T	T
<p>Introduction to Operations Management, product/service design and process selection, JIT, aggregate planning, inventory control, MRP, operations scheduling and synchronous manufacturing.</p> <p><i>Examination</i></p> <p>Home department: INDUSTRIAL ENGINEERING</p> <p>Formula for Final mark: $P=0,5K+0,5E$</p>				

59447 PROFESSIONAL COMMUNICATION				
113	12	Professional Communication	3L, 2T	T
<p>Effective communication with various target audiences with specific objectives in mind; particular focus on the planning and writing of a technical report; other document types in the professional environment such as proposals and correspondence; text skills, such as coherence, appropriate style and text structure; appropriate referencing methods; introduction to oral presentation skills; written communication in teams.</p> <p><i>Project</i></p> <p>Home department: ENGINEERING (ADMIN)</p> <p>Formula for Final mark: $P=K$</p>				

51993 PROJECT MANAGEMENT				
378	24		2L	A
<p>Project lifecycle, planning, organisation (scheduling, resource allocation and cost management) and control. Quality management, risk, communication, human resource aspects and project contract management.</p> <p>(Only final-year students may enrol for this module.)</p> <p>Home department: LOGISTICS</p>				
412	12	Project Management	3L, 1T	A
<p>Project Management framework: Integration, scope, time, cost, human resources, communication, risk, safety and procurement. Project Management processes: initiating, planning, execution, control and commissioning.</p> <p>[Presented by the Department of Process Engineering (50%) and Department of</p>				

Industrial Engineering (50%)]				
<i>Examination</i>				
Home department: PROCESS ENGINEERING				
Formula for Final mark: $P=0,4K+0,6E$				

46167 Quality Assurance				
344	15	Quality Assurance	2L, 3T	A
Definition of quality, methods and techniques of quality assurance, statistical process design, sampling. Principles of robust design. Formulation of measures of system performance and quality. Identification of quality noise factors. Formulation and implementation of techniques to reduce effects of noise. Synthesis and selection of design concepts for robustness.				
<i>Continuous</i>				
<i>P Engineering Statistics 314</i>				
Home department: INDUSTRIAL ENGINEERING				
Formula for Final mark: $P=K$				

59471 Quality Management				
444	15	Quality Management	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>Examination</i>				
<i>P Engineering Statistics 314</i>				
Home department: INDUSTRIAL ENGINEERING				
Formula for Final mark: $P=0,5K+0,5E$				

19003 Sociology				
334	12	Introduction to Environmental Sociology	2L, 0.5T	T
An introduction to the field of environmental sociology; the sociological understanding of contemporary environmental issues and problems, particularly as they pertain to South Africa, and with a focus on their socially constructed and contingent nature.				
Home department: SOCIOLOGY AND SOCIAL ANTHROPOLOGY				

14176 Soil Science				
114	16	Principles of soil science	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>				

Home department: SOIL SCIENCES				
142	8	Applications of soil science	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>				
Home department: SOIL SCIENCES				
214	16	Introduction to Soil Science	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>				
Home department: SOIL SCIENCES				
244	16	Plant nutrition and fertilisation	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</i> <i>P Chemistry 114, 154</i>				
Home department: SOIL SCIENCES				
314	16	Genesis, morphology, classification and uses of soil	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>PP Soil Science 214</i> <i>PP Chemistry 114 and 154</i>				
Home department: SOIL SCIENCES				
344	16	Soil and water management	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</i> <i>P Mathematics (Bio) 124</i>				
Home department: SOIL SCIENCES				
414	16	Advanced soil physics	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</i>				
<i>P Chemistry 214, 224, 244</i>				
Home department: SOIL SCIENCES				
424	16	Advanced soil chemistry	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</i>				
<i>P Chemistry 214, 224, 244</i>				
Home department: SOIL SCIENCES				
444	16	Advanced pedology	3L, 3P	T
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.)				
<i>Subject to continuous assessment.</i>				
<i>PP Soil Science 214, 244</i>				
<i>P Soil Science 314, 344</i>				
<i>P Chemistry 214, 224, 244</i>				
Home department: SOIL SCIENCES				
454	16	Advanced resource management	3L, 3P	T
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.				
<i>Subject to continuous assessment.</i>				
<i>C Soil Science 414, 424, 444</i>				
Home department: SOIL SCIENCES				
771	30	Specialised pedology and soil genesis		
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.				
<i>Subject to continuous assessment.</i>				

Home department: SOIL SCIENCES				
772	30	Specialised soil physics and water management		
<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>				
Home department: SOIL SCIENCES				
773	30	Specialised soil chemistry and fertilisation		
<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>				
Home department: SOIL SCIENCES				
774	30	Soil biology		
<p>Carbon cycle and biological processes in soil. Soil ecology. Biodiversity in soil. Components of soil ecosystem and their interactions. Chemolithotrophic bacteria. Autotrophic 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.</p>				
Home department: SOIL SCIENCES				

19658 STATISTICS				
<i>Note</i>				
To major in Statistics for a BComm degree, the modules Statistics 186 or Statistical Methods 176, Statistics 214, 244, Mathematics for Statistics 214 and Statistics 318, 348 are required.				
214	16	Applied Statistics	3L, 2T	A
<p><i>Sampling techniques:</i> Simple random; Stratified; Systematic; Cluster; Probability proportional to size.</p> <p><i>Descriptive Statistics:</i> 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</p>				

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.

Note

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

Continuous assessment

PP Statistical Methods 176 with a final mark of at least 60 or

PP Statistics 186 or

PP Probability Theory and Statistics 114 or 144

C Mathematics for Statistics 214 (students who have passed Mathematics 114 or 144 are exempt from this)

Home department: STATISTICS AND ACTUARIAL SCIENCE

244	16	Statistical Inference	3L, 2T	A
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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.

Continuous assessment

P Statistics 214 and

P Mathematics for Statistics 214

Home department: STATISTICS AND ACTUARIAL SCIENCE

19690 STATISTICAL METHODS

176	18	Statistical Methods with Computer Implementation	3L, 2T	A & E
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*First semester: 3L, 1½T; Second semester: 2L, 1½T

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.

Notes

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%.

Continuous assessment

Home department: STATISTICS AND ACTUARIAL SCIENCE

59587 STRATEGIC MANAGEMENT				
344	12	Strategic management	1.5L, 0.5P	A
Strategic management challenges in complex environments; business models and strategy; strategic environmental analysis; strategic resources and capability analyses; strategic leadership; strategy development; knowledge, innovation and complexity management; strategy implementation; performance measurement and change management.				
<i>C Business Management 113 **Not applicable for students in Forest Science</i>				
Home department: BUSINESS MANAGEMENT				

19712 STRENGTH OF MATERIALS				
143	15	Introduction: Mechanics of Deformable Bodies	4L, 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. Introductory materials science: crystalline and amorphous solids, crystalline structures, defects and applications.				
[Presented by the Department of Civil Engineering (80%) and by the Department of Mechanical and Mechatronic Engineering (20%)]				
<i>Examination</i>				
<i>C Engineering Mathematics 115</i>				
<i>C Applied Mathematics B 124</i>				
Home department: CIVIL ENGINEERING				
Formula for Final mark: $P=0,4K+0,6E$				

59080 SUPPLY CHAIN MANAGEMENT				
144	12		3L, 1P	A & E
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.				
<i>Business Management 113</i>				
Home department: LOGISTICS				

38784 THEORY OF INTEREST				
152	6	Theory of Interest	2L, 1T	A & E
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.				
Home department: STATISTICS AND ACTUARIAL SCIENCE				

21008 TRANSPORT ECONOMICS				
214	16	Transport Economics	3L, 1P	A
Introduction to transport economics: Role and functions of transport. Nature of the transport demand. Economic, physical and service characteristics of air, road rail and sea transport, as well as pipelines. Cost principles and dilemmas of different forms of transport. Economic efficiency in the transport market. Evolution of freight transport regulation.				
<i>PP Economics 114, 144</i>				
Home department: LOGISTICS				

33081 VITICULTURE				
214	16	Wine grape cultivars and their establishment and maintenance; grapevine abnormalities	3L, 3P	T
Origin, morphology, description, identification and cultivation properties of wine grape cultivars. Anatomical and morphological abnormalities associated with abiotic and biotic factors (including specific virus and virus-like diseases) and their identification under field conditions. Establishment of a vineyard: planting of vines, young vine development. Vineyard maintenance: winter pruning based on biological principles.				
<i>C Crop Production 152</i>				
Home department: VITICULTURE AND OENOLOGY				
244	16	Grape production	3L, 3P	T
Advanced 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.				
<i>P Crop Production 152 or Biology 154</i>				
Home department: VITICULTURE AND OENOLOGY				
314	16	Table and raisin grape production, packaging and storage	3L, 3P	T
Table and raisin grape production: the global industries, cultivars, production practices, spring/summer manipulations, pre-harvest physiology. Harvest and packaging, cooling and storage, post-harvest quality factors.				
<i>P Crop Production 152 C Viticulture 214</i>				
Home department: VITICULTURE AND OENOLOGY				

322	8	Grapevine physiology	1.5L, 1.5P	T
<p>Molecular biology and biochemistry of core processes in grapevines and their hormonal control; grapevine vegetative growth and phenology; physiology of dormancy, nitrogen and carbon assimilation, reproductive growth and ripening, vine water status.</p> <p><i>P Crop Production 152</i> <i>C Viticulture 214</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
344	16	Plant material improvement, propagation and cultivation	3L, 3P	T
<p>Improvement of grapevine material (importance, methods, schemes), success of improved material. Vegetative propagation: collection, storage (material), multiplication, grafting techniques, nursery layout and facilities, physiology and anatomy of graft union healing, top-grafting methods. Rootstock cultivars. Plant spacing (utilisation of above- and below ground space). Light environment and canopy management, trellis systems.</p> <p><i>P Viticulture 214</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
444	16	Advanced perspectives on wine and table grape cultivation	3L, 3P	T
<p>Global perspectives on vineyard cultivation; geographical indications; site selection, vineyard planning and modern/alternative vineyard practices. Advanced table grape cultivation practices.</p> <p><i>PP Viticulture 314, 322, 344</i> <i>C Viticulture 454, 478</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
454	16	Advanced vineyard management	3L, 3P	T
<p>Human resource and supply chain management; strategies for fertilisation with macro- and micronutrients; irrigation regimes for optimal production of wine grapes and table grapes; biology of weed growth and reproduction, strategies for weed control; management of vineyard pest and diseases.</p> <p><i>PP Viticulture 314, 322, 344</i> <i>C Viticulture 444, 478</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
478	32	Viticulture internship	3S	T
<p>Practical viticultural experience in the wine and table grape industry. Experience in all aspects of commercial vineyard management and the industry are acquired. Identification and solving of a problem or design of a product or system in the workplace. Learning activities include the conducting of experiments in the field, data acquisition and analysis, testing, complete project reporting.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Viticulture 314, 344</i> <i>C Viticulture 322, 444, 454</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

871	20	Research methodology		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
872	15	The concept of terroir, climate change and sustainable viticulture		
<p>Methods for the identification and characterisation of terroirs and their impact on vine cultivation and berry growth and ripening; techniques for the measurement and evaluation of vine 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; climate change and its impact on viticulture practices.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
874	25	Concepts in molecular biology and advanced grapevine physiology		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

50997 WINE BIOTECHNOLOGY				
714	5	Chemical components of grapes and wine		
<p>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.</p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
771	40	Research methodology for grapevine and wine biotechnology		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

772	25	Techniques in grapevine and wine biotechnology		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
773	30	Biotechnology of wine-related microbes		
<p>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.</p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
774	20	Vine structure and functioning and grapevine improvement		
<p>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.</p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

57584 WOOD PRODUCT SCIENCE				
112	8	Wood processing	2L, 2P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
144	16	Wood anatomy and identification	3L, 3P	E
<p>Introduction to tree growth; macroscopic and microscopic anatomy and identification of types of woods; descriptions of cell wall ultrastructure, wood variability and wood quality.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
234	16	Mechanics of wood products	3L, 3P	E
<p>Analysis of beams, columns and axially loaded elements. Elastic behaviour and deformation of materials. Design and scaling. Timber as a structural material: Influence</p>				

of moisture, long-term load, chemical pressure treatment, load sharing. Strength grading of timber. The SABS timber design code.

P Strength of Materials 143

Home department: FOREST AND WOOD SCIENCE

244	16	Wood chemistry and preservation	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 Engineering Chemistry 123 or Chemistry 154</i>				
Home department: FOREST AND WOOD SCIENCE				
264	16	Wood physics and drying	3L, 3P	E
The physics of water in and around wood, moisture content, the concept of humidity, equilibrium moisture content 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>				
Home department: FOREST AND WOOD SCIENCE				
312	8	Bio-energy	2L, 2P	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>				
Home department: FOREST AND WOOD SCIENCE				
334	16	Design and construction of wood products	3L, 3P	E
Introduction to wood products design; theory, ergonomics and product development; technical documentation and technical drawings used in the woodworking industry.				
Home department: FOREST AND WOOD SCIENCE				
335	16	Wood adhesives and composite products	3L, 3P	E
Adhesion; types and properties of adhesives. 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.				
<i>Subject to continuous assessment.</i>				
Home department: FOREST AND WOOD SCIENCE				

414	16	Wood products manufacturing I	3L, 3P	E
<p>Basic wood products manufacturing with a focus on the primary manufacturing sector. Background to and economics of wood products manufacturing. Focus on production of solid wood (industrial or furniture wood) in sawmills and further processing in secondary industries; Processing equipment; introduction to computer-based equipment.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
424	16	Furniture design and construction	3L, 3P	E
<p>Introduction to the history of furniture design, theory of furniture design, ergonomics of furniture, product development, construction of furniture and joinery products (e.g. windows, doors and staircases), machining principles, technical documentation used in the woodworking industry.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
434	16	Wood products manufacturing II	3L, 3P	E
<p>The manufacturing of secondary wood products such as furniture and joinery products. Fundamental principles, wood cutting principles, manufacturing methodologies (such as nested-based manufacturing). Material preparation, material machining, CNC technologies, case studies of manufacturers, wood working machinery.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
454	16	Forest products value chain	3L, 3P	E
<p>A study of the value chain of typical forest products using case studies. The full value chain of solid sawn, pulp and paper and board products is studied, from the planting of trees to the manufacturing of the final products.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
464	16	Industrial wood finishing	3L, 3P	E
<p>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.</p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
711	40	Wood properties I		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

712	40	Wood processing		
Further studies of the processes, economics and management of primary and secondary wood processing industries seen holistically. <i>Subject to continuous assessment.</i> Home department: FOREST AND WOOD SCIENCE				
741	40	Industrial research and practice		
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. Home department: FOREST AND WOOD SCIENCE				
742	40	Wood Properties II		
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> Home department: FOREST AND WOOD SCIENCE				
743	40	Wood-based constructions		
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> Home department: FOREST AND WOOD SCIENCE				
754	16	Wood-based constructions		
Structural analyses of wood-based constructions; the design and scaling of beams, columns and axially loaded elements; durability, dimensional stability, load duration, moisture and load sharing in wood-based constructions; structural grading; timber design codes. <i>Subject to continuous assessment.</i> Home department: FOREST AND WOOD SCIENCE				
781	32	Wood quality factors		
Tree growth; Bulk, macroscopic, cellular, cell wall, ultra-structural and molecular properties of wood; Tree to tree and within tree variability of the most important anatomical, physical and chemical properties; Wood quality. <i>Subject to continuous assessment.</i> Home department: FOREST AND WOOD SCIENCE				

782	32	Primary wood processing		
<p>Theory of wood drying; drying technology: drying methods, kiln types and schedules; drying defects. Physical/chemical and biological degradation of wood; wood-protecting chemicals and treatment methods; environmental aspects of treatments, preservatives and preservative treated products. Adhesion; structure, types, properties and application of adhesives; manufacture and properties of composite products: particleboard, plywood, fibreboard, wood cement, wood plastic, laminated wood and paper; analytical methods.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
783	16	Mechanical properties of timber and bio-energy		
<p>Testing and methods of analysis used to evaluate and grade structural timber; factors having an influence on the mechanical performance of the timber; conversion of wood into energy, processing methods, determination of calorific values and other properties, comparison of different biofuels, environmental aspects, emissions.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
784	24	Wood products science project		
<p>Wood Products Science research project with a focus on any aspect of materials science, product development or manufacturing; research design and methods, data capture and analysis, formulation of results and conclusions.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
875	14	Wood Product Science research methodology		
<p>Critical reading of scientific papers, literature searches, development of research proposals, scientific writing and presentation skills, wood product science research environment, research ethics.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
880	40	Wood mechanics and wood-based constructions		
<p>Focus on structural timber and the design, manufacture, and properties of wood-based structures. It includes the influence that processes like grading, drying, chemical treatment and surface treatments have on the material. Joints and joining methods; durability and performance testing.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
881	40	Wood quality factors		
<p>Tree growth; bulk, macroscopic, cellular, cell wall, ultrastructural and molecular properties of wood; tree-to-tree and within-tree variability of the most important anatomical, physical and chemical properties; wood quality.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

882	40	Physical wood properties		
<p>In this module advanced physical properties are determined in wood and wood-based products; advanced analytical techniques are introduced. The effect of these properties on the final product will be evaluated.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

59412 ZOOLOGY				
315	16	Behavioural Ecology	3L, 3P	E
<p>In this module we will cover a variety of topics relating to the principles of behavioural ecology. This module 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>This module may include either a two-week field course run during the latter half of January or a field trip of a shorter duration in the mid-semester break.</p> <p><i>Continuous assessment.</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
334	16	Environmental Biology of Vertebrates	3L, 3P	T
<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 and hormonal control; evolution of viviparity; scaling in physiology and ecology; physiography of southern Africa; terrestrial habitats and adaptive zones; life history strategies; sexual size dimorphism; day versus night activity; phenotypic plasticity and ecological morphology; resource partitioning; foraging strategies; anti-predation strategies; group living; vertebrate venom systems; communication; orientation; migration.</p> <p>This module includes practical sessions/workshops and a research project. Data for the research project will be collected during a compulsory field excursion of at least three</p>				

days (scheduled for a weekend in February).

Continuous assessment

Home department: BOTANY AND ZOOLOGY

Compulsory Practical Vacation Work

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 during their summer and/or winter vacation at an approved agricultural institution (the period for Soil Science en Animal Science is two months and for Viticulture and Oenology a minimum of six months). The institution where practical work is to be done must be chosen in consultation with the department(s) in which the student follows the major(s). The practical work has to be approved by the chairperson(s) of the departments(s) concerned before vacation work is undertaken. The student must write a satisfactory report on his practical vacation work and it must be submitted on the dates specified by the department(s) concerned. 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 and Oenology entails mainly practical work from the end of the third year to the middle of the fourth year in grape vineyards and pertains to pruning during winter, canopy management during summer and work in a commercial wine cellar. Specific minimum qualifications pertaining to the number of weeks to be spent on these aspects will be communicated to the students by the Department of Viticulture and Oenology. 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.

To enable students to perform practical work during the harvest season, final-year students are excused from lectures until the second semester.

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 and Animal Sciences:

Soil Science

In order to gain the necessary practical experience, all students taking any module of Soil Science of the 300 or 400 series 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.

Animal Sciences

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 (five-day course) is given during the June holiday and must be attended by all final-year students taking Animal Science as a major.

FOREST AND WOOD SCIENCES STUDENTS

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.

FORESTRY AND NATURAL RESOURCE SCIENCES STUDENTS

Study tours

All students following the BScFor degree programme must undertake, during the winter vacation of 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 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 and 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.

Plans and reports

All students taking the degree BScFor in Forestry and Natural Resource Sciences 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 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.

WOOD AND WOOD PRODUCTS SCIENCES STUDENTS

All students taking the BScFor (Wood and Wood Products Sciences) programme must complete two periods of practical vacation work and submit satisfactory reports to the Department Forest and Wood Science before the degree can be awarded. The compulsory practical work consists of the following:

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

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

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.

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