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Faculty of **AgriSciences**

Acting Dean:

Prof D Brink

BScHons, MScAgric, PhD (Stell)



CALENDAR 2016
PART 7

CALENDAR

Amendments, liability and accuracy

- In this publication any expression signifying one of the genders includes the other gender equally, unless inconsistent with the context.
- The University reserves the right to amend the Calendar parts at any time.
- The Council and Senate of the University accept no liability for any inaccuracies there may be in the Calendar parts.
- Every reasonable care has been taken, however, to ensure that the relevant information to hand as at the time of going to press is given fully and accurately in the Calendar parts.

Where do I find the printed versions of the Calendar parts?

- The printed versions of the Calendar parts can be obtained at the Help Desk in the Admin A Building.
- Afrikaans (Part 1 to 12) and English copies of the individual parts are available.

Where do I find the electronic versions of the Calendar parts?

- The electronic versions of the Calendar parts can be obtained at www.sun.ac.za/Calendar.

The division of the Calendar

- The Calendar is divided into 13 parts.
- Part 1, 2 and 3 of the Calendar contains general information applicable to all students. Students are urged to take note especially of the content of the provisions in Part 1 of the Calendar applicable to them.
- Part 4 to 13 of the Calendar are the faculty Calendar parts.

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Part 2	Bursaries and Loans
Part 3	Student Fees
Part 4	Arts and Social Sciences
Part 5	Science
Part 6	Education
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How to use this Calendar Part

Readers of the Calendar Part

The information in this Calendar Part is intended for the following groups of readers:

- **Prospective** undergraduate and postgraduate students who are looking for information about the programmes of study offered by the Faculty
- **Registered** undergraduate and postgraduate students of Stellenbosch University who are looking for more information about the curriculums (combinations of subjects and modules) of specific programmes of study, as well as for other information related to their studies
- **Teaching, administrative and management staff of Stellenbosch University** who are required to keep abreast of the information contained herein to be able to fulfil their various functions.

Any person who are not in one of the abovementioned groups, but who wish to use this Calendar Part as a source of information for any reason, is of course also more than welcome to do so.

How to locate information

Following are guidelines for finding information in the different chapters in this Calendar Part. Consult the table of contents for the page numbers of the chapters referred to below.

Prospective undergraduate students

- Undergraduate Programmes chapter
 - Information on undergraduate programmes of study that are offered;
 - the minimum admission requirements for the different programmes of study; and
 - the subjects and modules that must be taken for the different programmes of study each year, with choices where applicable.
- Subjects, Modules and Module Contents chapter
 - An explanation of subjects as distinct from modules;
 - definitions of the language specifications of modules;
 - definitions of prerequisite pass, prerequisite and corequisite modules; and
 - an explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter.
- General Information chapter
 - Information about the Language Policy of the University and the Faculty;
 - information about the process of enrolment management, which entails selection for admission to programmes of study; and
 - information about communication with the University, which includes an explanation of the concept “student number” and indicates applicable options for enquiries along with their contact details.

- Index
 - An index of undergraduate subjects that can be taken in programmes of study of the Faculty (as these subjects appears in the Subjects, Modules and Module Contents chapter), appears in the back of this Calendar Part.

Prospective postgraduate students

- Postgraduate Programmes chapter
 - Information on postgraduate programmes of study that are offered;
 - the minimum admission requirements for the different programmes of study;
 - information about specific closing dates for applications, and other relevant information, for example selection; and
 - the subjects and modules that must be taken for the different programmes of study each year, with choices where applicable.
- Subjects, Modules and Module Contents chapter
 - An explanation of subjects as distinct from modules; and
 - an explanation of the different digits used for the numbering of modules in the Postgraduate Programmes chapter.
- General Information chapter
 - Information about the Language Policy of the University and the Faculty; and
 - information about communication with the University, which includes an explanation of the concept “student number” and indicates applicable options for enquiries along with their contact details.

Registered undergraduate students

- Undergraduate Programmes chapter
 - Information on undergraduate programmes of study that are offered; and
 - the subjects and modules that must be taken for the different programmes of study each year, with choices where applicable.
- Subjects, Modules and Module Contents chapter
 - An explanation of subjects as distinct from modules;
 - an explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter;
 - the abbreviations and definitions used for the teaching loads of individual modules;
 - an indication at each module of what its teaching load is;
 - definitions of the language specifications of modules, as well as an indication at each module of what its language specification is;
 - the definitions of prerequisite pass, prerequisite and corequisite modules, as well as an indication at each module of which of the requisites apply to it, if any; and
 - the way in which individual modules are assessed, especially where a module is subject to continuous or flexible assessment.

- General Information chapter
 - The Faculty's policy on the granting of Dean's Concession Examinations to final-year students;
 - information about the Language Policy of the University and the Faculty; and
 - information about communication with the University, as well as applicable options for enquiries along with their contact details.
- Index
 - An index of undergraduate subjects that can be taken in programmes of study of the Faculty (as these subjects appears in the Subjects, Modules and Module Contents chapter), appears in the back of this Calendar Part.

Registered postgraduate students

- Postgraduate Programmes chapter
 - Information on postgraduate programmes of study that are offered; and
 - the subjects and modules that must be taken for the different programmes of study each year, with choices where applicable.
- Subjects, Modules and Module Contents chapter
 - An explanation of subjects as distinct from modules; and
 - an explanation of the different digits used for the numbering of modules in the Postgraduate Programmes chapter.

Teaching, administrative and management staff

Most of the information in this Calendar Part may be of value in the execution of your various duties. The table of contents is the best place to begin looking for information, but frequent use of the book will naturally lead to familiarity with all the information in the book and with where it is located.

General Information

1. Language at the University

Stellenbosch University (SU) uses Afrikaans *and* English as languages of instruction at undergraduate level in its endeavour to promote multilingualism. SU is committed to safeguarding and developing Afrikaans further as a well-established academic language, taking into consideration this endeavour to promote multilingualism. SU also recognises English as an international academic language and a medium through which most South Africans can communicate with each other. In addition, SU provides for the development of specialist terminology and communication skills in isiXhosa, and the teaching of isiXhosa in some academic programmes for students who will need it in their careers.

Many of our modules are already presented in Afrikaans *and* English through parallel medium teaching and simultaneous interpretation. However, it is not possible to present the lectures of all modules fully in Afrikaans and English. The medium of teaching is therefore indicated in the relevant faculty's Calendar part. More information concerning language at SU is available on the website www.sun.ac.za/language. Support for the acquisition of academic language proficiency in Afrikaans *and* English is provided.

Parallel medium: A class is divided into separate Afrikaans and English streams. Students provide their preferred language of teaching at registration.

Interpreting: Simultaneous interpretation into Afrikaans or English, depending on the lecturing language, can take place during class teaching.

Bilingual: A combination of teaching in Afrikaans (approximately 50%) and English (approximately 50%) in the same class.

Afrikaans and English: A small percentage of the modules are only presented in either Afrikaans or English.

2. The Faculty's language plan

The Faculty is subject to the University's Language Policy and Plan. Consult Calendar Part 1 General as well as www.sun.ac.za/language for the complete Language Policy and Plan.

3. How to communicate with the University

3.1 Use of student number

- In dealing with new formal applications for admission, the University assigns a student number to each applicant. This student number serves as the unique identification of the person concerned and has the purpose of making future communication easier.
- Once you have been informed of your student number you must please quote it in all future correspondence with the University.

3.2 Send correspondence to the following addresses

- 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 Chief Operating Officer
Stellenbosch University
Private Bag X1
MATIELAND
7602

4. Telephonic and e-mail communication with the Faculty

4.1 Important contact details of the Faculty

Faculty of AgriSciences	Telephone number	E-mail address
Acting Dean: Prof D Brink	021 808 4737	db@sun.ac.za
The Vice-Dean: Vacant		
Faculty Secretary: Ms G Gamiet	021 808 9111	ghgamiet@sun.ac.za
Co-ordinator: Academic and Student Support: Dr N Brown	021 808 2015	nbro@sun.ac.za
Agricultural Economics: Prof N Vink	021 808 4899	nv2@sun.ac.za
Agronomy: Prof TN Kotze	021 808 4003	nkotze@sun.ac.za
Animal Sciences: Prof K Dzama	021 808 4740	kdzama@sun.ac.za
Conservation Ecology and Entomology: Prof K Esler	021 808 4005	kje@sun.ac.za
Food Science: Dr GO Sigge	021 808 3581	gos@sun.ac.za
Forest and Wood Science: Dr P Ackerman	021 808 3323	packer@sun.ac.za
Genetics: Prof J Burger	021 808 5858	jtb@sun.ac.za
Horticultural Science: Dr EW Hoffman	021 808 2383	ewh@sun.ac.za
Institute for Plant Biotechnology: Prof JM Kossman	021 808 3836	kossmann@sun.ac.za
Institute for Wine Biotechnology: Prof M du Toit	021 808 3772	mdt@sun.ac.za
Plant Pathology: Prof A Viljoen	021 808 4797	altus@sun.ac.za
Soil Science: Dr JE Hoffman	021 808 4789	ehoffman@sun.ac.za
Viticulture and Oenology: Prof M du Toit	021 808 3772	mdt@sun.ac.za
The Secretary		asa@sun.ac.za

For University environments not listed above, contact the Stellenbosch University Contact Centre on the Stellenbosch Campus at 021 808 9111 per telephone, 021 808 3822 per fax or info@sun.ac.za per e-mail.

4.2 Send correspondence with the Faculty to the following address:

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

4.3 Website: <http://www.sun.ac.za/agric/>

5. Preface

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.

6. 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. Eighty-one per cent 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 postharvest 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.

7. 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 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 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, postharvest 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.

8. Vision and mission of the Faculty of AgriSciences

8.1 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.

8.2 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 pioneering 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.

9. 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 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

10. Academic offering

Programmes	Qualifications
Bachelor's programme in Plant and Soil Sciences	BScAgric
Honours programme in Applied Plant Physiology	BScHons
Honours programme in Plant Pathology	BScHons
Master's programme in Entomology, Nematology or Plant Pathology	MSc
Master's programme in Agronomy, Genetics, Horticultural Science, Soil Science or Viticulture	MScAgric
PhD programme in Agronomy, Entomology, Nematology, 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 Production Systems	BSc Food Sc
Master's programme in Food Production Systems	MSc Food Sc
PhD programme in Food Production Systems	PhD (Food Sc)
DSc programme in Food Production Systems	DSc Food Sc
Bachelor's programme in Wine Production Systems	BScAgric
Honours programme in Wine Production Systems	BScHons (Wine Biotechnology)
Master's programme in Wine Production Systems	MSc (Wine Biotechnology) or MScAgric
PhD programme in Wine Production Systems	PhD
DSc programme in Wine Production Systems	DSc
Bachelor's programme in Animal Production Systems	BScAgric
Postgraduate Diploma in Animal Sciences	PgDip (Animal Sciences)
Postgraduate Diploma in Aquaculture	PgDip (Aquaculture)
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	PgDip (Forestry and Wood Sciences)
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).

11. 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

12. Modules

The summarised content of the modules presented by these departments is given in alphabetical order in the chapter “Subjects, Modules and Module Content”.

13. 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

E-mail: asa@sun.ac.za

Undergraduate Programmes

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 BAgriAdmin 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 BAgriculture programme, students join the programme in the first year offered mainly in the Faculty of AgriSciences.

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 provided at www.maties.com and on the Faculty's website at <http://www.sun.ac.za/agric/>.

All undergraduate prospective students must write the National Benchmarking Test (NBT). Consult the NBT website (www.nbt.ac.za) or the SU website 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

For university admission, a prospective student is required to be in possession of a National Senior Certificate (NSC) or school-leaving certificate from the Independent Examination Board (IEB) as certified by Umalusi, with admission to bachelor's degree studies (which requires a performance level of at least 4 (50-59%) in each of four designated university admission subjects), or an exemption certificate issued by the South African Matriculation Board to students with other school qualifications.

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

- An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
- Afrikaans or English (Home Language or First Additional Language) 4 (50%);
- Mathematics 5 (60%); and
- Physical Sciences (Physics and Chemistry) 4 (50%).

* For BScAgric with Soil Science and Chemistry as major subjects:

- An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
- Afrikaans or English (Home Language or First Additional Language) 4 (50%);
- Mathematics 6 (70%); and
- Physical Sciences (Physics and Chemistry) 4 (50%).

* For the field of study Wood and Wood Products Science:

- An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
- Afrikaans or English (Home Language or First Additional Language) 4 (50%);
- Mathematics 6 (70%); and
- Physical Sciences (Physics and Chemistry) 5 (60%).

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 (50%);
- Mathematics 4 (50%) OR Mathematical Literacy 5 (60%);
- Physical Sciences (Physics and Chemistry) 4 (50%); OR
- Life Sciences 4 (50%); OR
- Agricultural Sciences 4 (50%).

The prospective student is also required to take the National Benchmark Tests (NBT). All candidates write the Academic and Quantitative Literacy test (AQL). Students who take Mathematics as a subject also have to write the Mathematics (MAT) test.

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 two 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.

For the EDP, in two of the fields of study in the Faculty, the first year of the mainstream degree programme is spread over two years. These two fields of study are *Agribusiness Management* and *Agricultural Economic Analysis and Management*. 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, including the NBTs, prescribed by the University, a student may be advised or compelled by the Faculty to follow the EDP route.

The minimum admission requirements for the EDP in the programmes leading to BScAgric*, BScFor (Forestry and Natural Resource Management)*, BScConsEcol, BSc Food Sc and BAgricAdmin are:

- An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
- Afrikaans or English (Home Language or First Additional Language) 4 (50%);
- Mathematics 4 (between 55% and 59,9%);
- Physical Sciences (Physics and Chemistry) 3 (between 45% and 49,5%); and
- NBT between 33% and 47%.

* The minimum admission requirements for BScAgric with Soil Science and Chemistry as major subjects are:

- An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
- Afrikaans or English (Home Language or First Additional Language) 4 (50%);
- Mathematics 5 (between 60% and 69,9%)

- Physical Sciences (Physics and Chemistry) 3 (between 45% and 49,5%); and
- NBT between 33% and 47%.

* The minimum admission requirements for the field of study Wood and Wood Products Science are:

- An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
- Afrikaans or English (Home Language or First Additional Language) 4 (50%);
- Mathematics 5 (between 60% and 69,9%)
- Physical Sciences (Physics and Chemistry) 4 (between 55% and 59,9%); and
- NBT between 33% and 47%.

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 mid-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.

Compulsory practical 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 and 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 chair(s) of the department(s) concerned before practical work is undertaken. The student must write a satisfactory report on his practical 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 practical work to the Department of Animal Sciences must spend a minimum of four weeks of their two-month

practical working on the experimental farms of the University. Such practical work must be done during the vacations of the second year of study. No remuneration is available for this work. Students must also undertake the Southern Cape tour in the beginning of their final year, which forms part of Animal Science 442.

Industry training in Food Production Systems

All students taking the programme 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. A satisfactory report must be submitted, according to the instructions of the Department, in their final year to the Department of Food Science, before the degree can be awarded.

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.

Industry training in Wine Production Systems

All students pursuing the BScAgric programme with Viticulture and Oenology as majors must complete 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 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 both modules (Viticulture and Oenology 478) associated with the internship need to be passed in order to qualify for the degree BScAgric.

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 must 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 (during short vacations and/or weekends) determined by the Department of Soil Science, and 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 vacation 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.

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 two 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 term.

Forestry and Natural Resource Sciences students

Practical work

First-year students who take the BScFor in Forestry and Natural Resource Sciences 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 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 for their management plan during vacations in their final year of study.

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 in 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.

Bachelor's programmes

Plant and Soil Sciences

More information is available on the following websites:

<http://www.sun.ac.za/agron/> (Department of Agronomy)

<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/english/faculty/agri/soil-science/> (Department of Soil Science)

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, soil fertility 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 improved breeding (genetics) are dealt with. In the Soil and Water Management field of study the responsible management of soil regarding the genesis, both physical and chemical properties, and water is addressed;

- effectively liaise, 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, Plant Pathology, 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 in the chapter “Subjects, Modules and Module Content”. For compulsory practical work in Soil Science and Viticulture and for practical training in Soil Science and Viticulture see chapter on “General Information”.

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	124(16), 144(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)
<i>and</i>	
Crop Production	214(16) or
Viticulture	214(16) *
<i>and</i>	
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)
<i>and either</i>	
Viticulture	314(16), 322(8), 344(16)
<i>or</i>	
Agronomy	312(8), 362(8)
Horticultural Science	352(8)
<i>and</i>	

Agronomy	322(8), 332(8), 342(8) **
or	
Horticultural Science	314(16), 342(8) **
and two of:	
Agricultural Economics	314(16), 364(16) ***
and/or	
Entomology	314(16) ***
Nematology	344(16) ***
and/or	
Genetics	314(16), 344(16)
and/or	
Plant Pathology	314(16), 344(16)

* 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 have to 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)
or	
Applied Plant Physiology	414(16), 464(16) and
Agronomy	424(16), 454(16) * or
Horticultural Science	434(16), 444(16) *
and	
Agricultural Economics	414(16), 424(16), 444(16), 454(16)
or	
Entomology	418(32), 454(16), 464(16)
or	
Genetics	324(16), 354(16), 414(16), 444(16)
or	
Plant Pathology	414(16), 444(16), 478(32)

* Students taking Agronomy as major subject have to take Agronomy 424 and 454 while students with Horticultural Science as major subject have to 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	124(16), 144(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)
Genetics	214(16), 244(16) or
Agricultural Economics	234(16), 242(8), 262(8)
Soil Science	214(16), 244(16)
<i>and</i>	
Crop Production	214(16) or
Viticulture	214(16) *

* *Students taking Viticulture must take Viticulture 214.*

Third Year (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)
<i>and /either:</i>	

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.*

Fourth Year (128 credits)

Compulsory Modules

Plant Pathology	414(16), 444(16), 478(32)
<i>and</i>	
Entomology	418(32), 454(16), 464(16) or
Genetics	324(16), 354(16), 414(16), 444(16)

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	124(16), 144(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 (128 or 144 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Chemistry	214(16), 264(16) *
Crop Protection	244(16)
Soil Science	214(16), 244(16)
<i>and</i>	

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

* *Chemistry 264 is only for students who major in Soil Science and Chemistry.*

***Students taking Viticulture must take Viticulture 214.*

Third Year (128 or 136 or 144 credits)

Compulsory Modules

Chemistry	254(16) * 234(16)
Plant Pathology	314(16), 344(16)
Soil Science	314(16), 344(16)
<i>and</i>	
Agronomy	312(8), 362(8)
Horticultural Science	352(8) and
Agronomy	322(8), 332(8), 342(8) ** or
Horticultural Science	314(16), 342(8) **
<i>or</i>	
Viticulture	314(16), 322(8), 344(16)

* *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 have to 314 and 342.*

Fourth Year (128 or 136 credits)

Compulsory Modules

Soil Science	414(16), 424(16), 444(16), 454(16)
<i>and either</i>	
Chemistry	314(16), 324(16), 344(16), 364(16)
<i>or</i>	
Plant Pathology	414(16), 444(16), 478(32) *
<i>or</i>	
Viticulture	444(16), 454(16), 478(32)
<i>or</i>	
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 timetable.*

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

Food Production Systems

More information is available on the following website:

<http://www.sun.ac.za/foodsci>

Bachelor's programme

The undergraduate (bachelor's) programme in Food Production Systems leads to the qualification BSc Food Sc.

Food Science covers the interactions between food ingredients, the food environment, development of new products, the investigation of food structures, sensory and nutritional properties, the postharvest handling and preservation of food in an environmentally and economically acceptable manner, as well as the commercialisation of traditional food products for prospective low-income entrepreneurs.

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

- understand the terms, concepts, principles and theories regarding food science;
- identify and solve production and management problems within the food industry using critical and creative thinking to formulate well thought through solutions and theoretical arguments;
- work effectively within a team;
- organise and manage group and individual activities responsibly and effectively by setting and successfully meeting deadlines;
- obtain, analyse, compile and critically evaluate scientific information and apply this information independently;
- communicate information effectively using the latest technology;
- apply scientific methodology, procedures, and techniques; and
- demonstrate a holistic approach and understanding of the respective areas of food science.

The modules of the various years of study of this programme are set out below. The module content is given in the chapter "Subjects, Modules and Module Content". For compulsory industry training in Food Science, see the chapter on "General Information".

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

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Food Science	144(16)
Chemistry	124(16), 144(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), 264(16)
Food Science	214(16), 244(16)
Microbiology	214(16)

Third Year (128 credits)

Compulsory Modules

Biochemistry	315(16), 365(16) * or
Chemistry	314(16), 344(16)
Food Science	314(16), 324(16), 333(16), 344(16), 354(16)
Microbiology	244(16)

* Only a limited number of Food Science students will be allowed to register for Biochemistry 365 annually. Selection will be done in consultation with the Department of Food Science, based on students' performance in Biochemistry 315. This selection process replaces the prerequisite of Biochemistry 324 for Biochemistry 365. Students that are not selected for Biochemistry 365 will have to register for Biochemistry 345.

Fourth Year (126 credits)

Compulsory Modules

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

Wine Production Systems

More information is available on the following websites:

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 Wine Production Systems leads to the qualification BScAgric. In this programme students concentrate on Wine Production Systems.

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 grape and wine industries.

The fields of study of this programme are:

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 grape and wine biotechnology;
- identify and solve unfamiliar production and management problems within the grape and wine industries using evidence-based solutions and theory-driven arguments, using critical and creative thinking;
- interact effectively within a team;
- organise and manage individual and group activities responsibly and effectively by successfully meeting regular deadlines for projects, reports and tests;
- retrieve, analyse, compile and critically evaluate scientific information, and apply this information independently;
- communicate information effectively by applying scientific methodology, procedures, operations and techniques, including the use of experimental controls and relevant statistical methods and the effective evaluation of it; and
- demonstrate a holistic view and understanding of the complex nature and interdisciplinary relationships of the applied fields of wine production systems.

The modules of the various years of study for each field are set out below; the module content is given in the chapter "Subjects, Modules and Module Content". For compulsory industry training in Viticulture and Oenology, see the chapter on "General Information".

The Undergraduate Programme in Wine Production Systems is subdivided into the fields of study of Viticulture and Oenology (General) and Oenology (Specialised).

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

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(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 Wine Production Systems (BScAgric) Oenology (Specialised)

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(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), 264(16)
Oenology	214(16), 244(16)
Soil Science	214(16)
Viticulture	214(16)

Third Year (128 credits)

Compulsory Modules

Chemistry	234(16), 314(16), 344(16)
Oenology	314(16), 342(8), 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)

Animal Production Systems

More information is available on the following website:

<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 thought 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 in the chapter “Subjects, Modules and Module Content”. For compulsory practical work and training see chapter on “General Information”.

The Undergraduate Programme in Animal Production Systems is subdivided in the following fields of study: Animal Science (main field of study), Animal Science with Agronomy, Animal Science with Conservation Ecology, Agricultural Economics with Animal Science and Animal Science with Aquaculture.

Bachelor's programme in Animal Production Systems (BScAgric) Animal Science

First Year (132 credits)

Compulsory Modules

Animal Science	144(16)
Biology	124(16), 154(16)
Chemistry	124(16), 144(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	214(16)
Microbiology	244(16) or
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	124(16), 144(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	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	124(16), 144(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	214(16), 244(16)
Biodiversity and Ecology	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 (120 or 128 credits)

Compulsory Modules

Animal Breeding Science	424(16), 454(16)
Animal Nutrition Science	414(16), 444(16)
Animal Product Science	334(16)
<i>and</i>	
Conservation Ecology	448(32) or
Animal Management Science	464(16) and
Animal Science	442(8)
<i>and</i>	
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	124(16), 144(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	214(16), 244(16)

Third Year (104 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 (128 credits)

Compulsory Modules

Agricultural Economics	414(16), 424(16), 444(16), 454(16)
Animal Nutrition Science	414(16), 444(16)
Animal Management Science	434(16), 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	124(16), 144(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	214(16)
Microbiology	244(16) or
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)

Agricultural Economics and Management

More information is available on the following website:

http://www.sun.ac.za/agric_econ/ (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 BAgriAdmin. 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 (BAgriAdmin). Students also have the option to switch, after the first two years of study for BAgriAdmin (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 organisation, 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 in the chapter “Subjects, Modules and Module Content”.

For BCom 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 BAgricAdmin, 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 (BAgricAdmin)

Agribusiness Management

First Year (122 credits)

Compulsory Modules

Animal Production Physiology	112(8)
Business Management	113(12), 142(6)
Crop Production	152(8)
Computer Skills	171(4)
Economics	114(12), 144(12)
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)
<i>and one of the following groups:</i>	
Financial Management	214(16)
Marketing Management	214(16)
Financial Management	244(16) or
Investment Management	254(16) or
Marketing Management	244(16)
<i>or</i>	
Financial Management	214(16)
Logistics Management	214(16), 244(16)
<i>and</i>	

Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)
<i>or</i>	
Animal Production	214(16)
<i>and</i>	
Animal Science	244(16)

Third Year (128 credits)

Compulsory Modules

Agricultural Economics	314(16), 334(16), 354(16), 364(16)
Agronomy	324(16)

Elective Modules

Select 48 credits from the following modules as per timetable

Financial Management	314(12), 332(12), 352(12), 354(12)
Logistics Management	314(12), 324(12), 344(12), 354(12)
Marketing Management	314(12), 324(12), 344(12), 354(12)
Strategic Management	344(12)

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

Second Year (138 credits)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Animal Production Physiology	112(8)
Business Management	113(12), 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)
<i>and one of</i>	
Financial Accounting	288(32) or
Statistics	214(16), 244(16)
<i>and one of the following groups:</i>	
Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)
<i>or</i>	
Animal Production	214(16)
<i>and</i>	
Animal Science	244(16)
<i>or</i>	
Aquaculture	314(16), 344(16)

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 Production Physiology	112(8)
Business Management	113(12), 142(6)
Crop Production	152(8)
Computer Skills	171(4)
Economics	114(12), 144(12)
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)
<i>and</i>	
Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)
<i>or</i>	
Animal Production	214(16)
<i>and</i>	
Animal Science	244(16)

Elective Modules

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

Financial Management	214(16), 244(16)
Investment Management	254(16)
Marketing Management	214(16), 244(16)
<i>or</i>	
Entrepreneurship and Innovation Management	214(16), 244(16)
Financial Management	214(16), 244(16)
Investment Management	254(16)
<i>or</i>	
Financial Management	214(16), 244(16)
Investment Management	254(16)
Logistics Management	214(16), 244(16)
<i>or</i>	
Logistics Management	214(16), 244(16)
Marketing Management	214(16), 244(16)
<i>or</i>	
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 Accounting	288(32)
Financial Management	314(12), 332(12), 352(12), 354(12)
Logistics Management	314(12), 324(12), 344(12), 354(12)
Strategic Management	344(12)
<i>or</i>	
Economics	214(16), 244(16)
Entrepreneurship and Innovation Management	318(24)
Financial Accounting	288(32)
Logistics Management	314(12), 324(12), 344(12), 354(12)
Marketing Management	314(12), 324(12), 344(12)
Strategic Management	344(12)
<i>or</i>	
Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	314(12), 332(12), 352(12), 354(12)
Logistics Management	314(12), 324(12), 344(12), 354(12)
Strategic Management	344(12)
Transport Economics	214(16)
<i>or</i>	
Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	314(12), 332(12), 352(12), 354(12)
Logistics Management	314(12), 324(12), 344(12), 354(12)
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), 332(12), 352(12), 354(12)

Investment Management	314(12), 324(12), 344(12), 348(12)
Strategic Management	344(12)
<i>or</i>	
Economics	318(24), 348(24), 388(24)
Financial Accounting	389(48)
Investment Management	314(12), 324(12), 344(12), 348(12)
Strategic Management	344(12)
<i>or</i>	
Economics	318(24), 348(24), 388(24)
Financial Accounting	389(48)
Investment Management	314(12), 324(12), 344(12), 348(12)
Logistics Management	314(12), 324(12), 344(12), 354(12)
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 Production Physiology	112(8)
Business Management	113(12), 142(6)
Crop Production	152(8)
Computer Skills	171(4)
Economics	114(12), 144(12)
Food Science	144(16)
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)
<i>and</i>	
Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)
<i>or</i>	

Animal Production	214(16)
<i>and</i>	
Animal Science	244(16)

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 (128 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)
Financial Management	244(16)
Logistics Management	214(16), 244(16)
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)
Food Science	333(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), 332(12), 352(12), 354(12)
Food Factory Machinery	414(15), 444(15)
Logistics 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 Economics and Food Science

First Year (130 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(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)
<i>and</i>	
Agronomy	212(8)
Horticultural Science	222(8)
Viticulture	244(16)
<i>or</i>	
Animal Production	214(16)
<i>and</i>	
Animal Science	244(16)

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), 244(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	333(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), 332(12), 352(12), 354(12)
Food Factory Machinery	414(15), 444(15)
Logistics Management	314(12), 324(12), 344(12), 354(12)

Forestry and Wood Sciences

More information is available on the following website:

<http://www.sun.ac.za/english/faculty/agri/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 Resource Sciences and Wood and Wood Products Sciences.

Forestry and Natural Resource Sciences

The first year of study in Forestry and Natural Resource Sciences 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 forestry 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

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 in the chapter “Subjects, Modules and Module Content”. For compulsory practical work, see chapter on “General Information”.

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

Bachelor’s programme in Forestry and Wood Sciences (BScFor) Forestry and Natural Resource Sciences

First Year (128 credits)

Compulsory Modules

Biology	124(16), 144(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Forest Science	171(12)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16)

Second Year (125 credits)

Compulsory Modules

Biometry	212(8), 242(8)
Computer Skills	272(5)
Forest Science	212(8), 254(16), 274(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 (141 credits)*Compulsory Modules*

Forest Science	414(16), 424(16), 434(16), 435(8), 442(1), 468(32)
Industrial Psychology (Special)	354(12)
Strategic Management	344(12)
Wood Product Science	414(16), 444(12)

**Bachelor's programme in Forestry and Wood Sciences (BScFor)
Wood and Wood Products Sciences****First Year (130 credits)***Compulsory Modules*

Applied Mathematics B	124(15)
Computer Programming	143(12)
Engineering Chemistry	123(15)
Engineering Drawings	123(15)
Engineering Mathematics	115(15), 145(15)
Forest Science	171(12)
Strength of Materials	143(12)
Wood Product Science	144(16)

Second Year (122 credits)*Compulsory Modules*

Engineering Economy	212(8)
Engineering Mathematics	214(15)
Forest Science	274(16)
Industrial Programming	244(15)
Production Management	212(8)
Professional Communication	113(8)
Wood Product Science	234(16), 244(16), 264(16)

Third Year (136 credits)*Compulsory Modules*

Engineering Statistics	314(15)
Forest Science	354(16), 355(16), 414(16)
Industrial Management	354(15)
Operations Research (Eng)	345(15)
Quality Assurance	344(15)
Wood Product Science	314(12), 335(16)

Fourth Year (121 credits)*Compulsory Modules*

Enterprise Design	444(15)
Forest Science	442(1)
Industrial Ergonomics	414(15)
Operations Research (Eng)	415(15)
Quality Management	444(15)
Wood Product Science	414(16), 444(12), 468(32)

Conservation Ecology

More information is available on the following website:

<http://sun.ac.za/consent> (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 reserve and 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 four study years. Additionally in the fourth study year, a one-week field trip is attended. More importantly, an integral part of this programme is the production and submission of a 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 in the chapter “Subjects, Modules and Module Content”.

Bachelor’s programme (BSc) in Conservation Ecology

First Year (132 credits)

Compulsory Modules

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

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

Genetics	214(16) and/or
Soil Science	214(16) and/or
Biodiversity and Ecology	315(16) * and/or
Geographical Information Technology	241(16) and/or
Biodiversity and Ecology	345(16) and/or

* Note this is a restricted module; acceptance only through application. Classes presented outside formal term time.

Fourth Year (136 credits)*Compulsory Modules*

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

Choose 32 credits from the following modules (as possible within the timetable)

Entomology	418(32) or 454(16) and/or
Soil Science	314(16) and/or
Geographical Information Technology	312(16)

Agricultural Production and Management (Elsenburg)**Bachelor's programme in Agricultural Production and Management**

* 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).

Postgraduate Programmes

General rules for postgraduate programmes

Postgraduate diploma programmes

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.

Honours programmes

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

Master's programmes

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

The 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 Senate, and who – on written application – have been admitted by 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 Senate, and who – on written application – have been admitted by 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 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 Senate for this purpose;
- (b) after Senate's approval of the proposed research project, have carried out, to the satisfaction of the University, original research under supervision of a supervisor 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 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 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 Senate for approval. Upon approval being granted, the supervisor 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 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 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 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 Senate accepts the notification, a supervisor 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.

Plant and Soil Sciences

Postgraduate programmes in the respective fields of study can be followed after completion of the bachelor’s programme in Plant and Soil Sciences. Students can, depending on their previous qualifications, enter a suitable postgraduate programme in one of their majors and obtain one of the following degrees: Master of Science in Agriculture (MScAgric), Master of Science (MSc), Doctor of Philosophy (PhD) or Doctor of Science (DSc). Students with a BSc degree majoring in Microbiology or Genetics or Botany or Biotechnology can enter the BScHons in Plant Pathology. Students with a BSc degree majoring in Botany or Plant Biotechnology or Genetics or Biochemistry can enter the BScHons in Applied Plant Physiology.

Food Production Systems

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

Wine Production Systems

Postgraduate programmes in 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 in Wine Biotechnology, Master of Science in Agriculture in Viticulture and Oenology, Master of Science in Wine Biotechnology, Doctor of Philosophy and Doctor of Science in Oenology, Viticulture or Wine Biotechnology

Agricultural Economics and Management

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

Forestry and Wood Sciences

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), 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 chair of the Department.

Conservation Ecology

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

Postgraduate diploma programmes

Plant and Soil Sciences

More information is available on the following websites:

<http://www.sun.ac.za/agron/> (Department of Agronomy)

<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/english/faculty/agri/soil-science/> (Department of Soil Science)

Postgraduate diploma programme in Agronomy

Programme Description

The postgraduate diploma programme in Agronomy extends over one year (full time) or two years (part time) and leads to the qualification PGDip in Agronomy. Three-year BSc degrees and BTech degrees, as well as other qualifications approved by Senate for this purpose gives access to this programme. The PGDip programme consists of an approved curriculum which lays the foundation for specialisation in agronomy. The postgraduate diploma does not allow automatic access to the programme MScAgric in Agronomy. In extraordinary cases where a candidate, according to the department, shows sufficient potential, the candidate may apply for access to the programme MScAgric in Agronomy.

Notes

The programme will be offered as from 2016 by SU, pending accreditation by the HEQC.

Compulsory Modules

13327 : Crops for extensive production systems	711(18): Crops for extensive production systems
13328 : Physiological and ecol principles of nature pasture managem	712(18): Physiological and ecological principles of natural pasture management
13329 : Weed Management	741(18): Weed management
13336 : Production physiology and technology for annual agron crops	742(18): Production physiology and technology for annual agronomical crops
13334 : Intensive crop production systems	771(18): Intensive crop production systems
13335 : Agronomy Science Project	772(30): Agronomy Science Project

Animal Production Systems

More information is available on the following website:

<http://www.sun.ac.za/animal> (Department of Animal Sciences)

Postgraduate diploma in Animal Sciences OR postgraduate diploma in Aquaculture

The postgraduate diploma in Animal Sciences or Aquaculture is designed to strengthen the student's knowledge in the disciplines of Animal Sciences or Aquaculture. Generally, students with an appropriate three-year Bachelor's degree can be admitted to their chosen program. A high level of theoretical engagement will be demanded from students in order to increase their competency level to that of a four-year Bachelor's (Agric) degree (NQF level 8). In addition, students will be introduced to research methodology and writing and presentation skills will be developed.

Admission requirements

Candidates in possession of an appropriate three-year Bachelor's degree will be considered.

Postgraduate diploma in Aquaculture [PgDip (Aquaculture)]

Compulsory Modules

46213 : Aquaculture	711(16): Aquaculture production and management systems I
46213 : Aquaculture	741(16): Aquaculture production and management systems II
12910 : Aquaculture Management Science	724(16): Aquaculture review, assessment and project development I
12910 : Aquaculture Management Science	754(16): Aquaculture review, assessment and project development II
20826 : Animal Science	772(24): Scientific skills in Animal Science

Choose two of the following modules:

46213 : Aquaculture	712(16): Aquaculture products or
46213 : Aquaculture	742(16): Aquaculture ecology or
46213 : Aquaculture	743(16): Aquaculture nutrition

Postgraduate diploma in Animal Sciences [PgDip (Animal Sciences)]

Compulsory Modules

56901 : Animal Breeding Science	741(16): Animal breeding and genetics
54801 : Animal Management Science	711(16): Intensive management systems
54801 : Animal Management Science	741(16): Extensive management systems
54801 : Animal Management Science	712(16): Wildlife management
56898 : Animal Nutrition Science	711(16): Advanced ruminant nutrition
56898 : Animal Nutrition Science	741(16): Advanced monogastric nutrition
20826 : Animal Science	772(24): Scientific skills in Animal Science

Forestry and Wood Sciences

More information is available on the following website:

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

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. Appropriate three-year BSc degrees and BTech degrees, as well as other qualifications approved by Senate for this purpose, give access to this programme. The PgDip programme consists of an approved curriculum which lays the foundation for specialisation in forestry and wood sciences disciplines. The postgraduate diploma may allow access to the MScFor programme.

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	724(32): Tree propagation
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): Tree improvement
11290 : Forest Science	785(32): Forestry development
57584 : Wood Product Science	414(16): Wood products manufacturing I
57584 : Wood Product Science	754(16): Wood quality
57584 : Wood Product Science	781(32): Wood properties
57584 : Wood Product Science	782(32): Primary wood processing
57584 : Wood Product Science	783(16): Bio-energy

Students must choose a total of 96 credits from the elective modules, of which 32 credits must be from 57584 Wood Product Science or 11290 Forest Science, but may not choose more than four of the 16-credit elective modules.

Honours programmes

Plant and Soil Sciences

More information is available on the following websites:

<http://www.sun.ac.za/agron/> (Department of Agronomy)

<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/english/faculty/agri/soil-science/> (Department of Soil Science)

Honours programmes in Plant and Soil Sciences

BScHons in Plant Pathology

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.

Specific Admission Requirements

A BSc degree with Microbiology or Genetics or Botany or Biotechnology as a major. An average final mark of 60% is required in the applicable modules. Supplementary study may be required.

The programme consists of the following five modules:

32891 : Plant Pathology	771(16): Advanced plant disease dynamics
32891 : Plant Pathology	772(16): Advanced disease management
32891 : Plant Pathology	773(10): Research methodology
32891 : Plant Pathology	774(60): Project management and presentation
32891 : Plant Pathology	775(18): Advanced topics in plant pathology

BScHons in Applied Plant Physiology

Programme Description

The proposed programme aims to accommodate students with an appropriate three-year Bachelor of Science degree from a national or international institution, with an interest in postgraduate studies in Horticulture. Students in possession of an appropriate BSc degree, majoring in Botany or Biochemistry or Genetics or Plant Biotechnology and with an average performance mark of 60% in these major subjects will be considered for admission. The Honours programme in Applied Plant Physiology is designed to strengthen the student's knowledge and competencies in

the discipline of Horticultural Sciences, with emphasis on plant physiological, biochemical and molecular mechanisms, which is relevant to production and quality systems within horticultural crops. Students will be equipped in research methodology, whilst writing and presentation skills will also be developed. These skills will enable them to apply for further postgraduate studies offered in Horticulture (MScAgric).

Specific Admission Requirements

Three-year Bachelor of Science degree, majoring in Botany, Biochemistry, Genetics or Plant biotechnology. An average final mark of 60% is required in the applicable modules. Supplementary study may be required.

Modules:

12487 : Applied Plant Physiology	714(16): Ecophysiology of horticultural and agronomical crops
12487 : Applied Plant Physiology	734(16): Applied plant physiology and tree architecture
12487 : Applied Plant Physiology	744(16): Postharvest physiology and technology of horticultural and agronomical crops
12487 : Applied Plant Physiology	764(16): Nutrition of horticultural and agronomical crops
12487 : Applied Plant Physiology	771(16): Advanced plant physiology
12487 : Applied Plant Physiology	773(40): Research project

Wine Production Systems

More information is available on the following websites:

http://www.sun.ac.za/viti_oenol/ (Department of Viticulture and Oenology)

http://www.sun.ac.za/wine_biotechnology/ (Institute for Wine Biotechnology)

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

The honours programme in 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.

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

Agricultural Economics and Management

More information is available on the following website:

http://www.sun.ac.za/agric_econ/ (Department of Agricultural Economics)

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.

Compulsory Module

15504 : Agricultural Economics	781(30): Research assignment: Agricultural economics
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Elective Modules

Select a minimum of 90 credits from the following modules:

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	775(20): Agricultural production and resource management
15504 : Agricultural Economics	776(20): International trade and marketing
15504 : Agricultural Economics	780(20): Rural development
15504 : Agricultural Economics	782(16): National and international market analysis
15504 : Agricultural Economics	783(16): Foundations of Agricultural Economics: an institutional approach
15504 : Agricultural Economics	784(16): Environmental policy
15504 : Agricultural Economics	785(16): Agricultural policy in the South African context

Students can elect from the honours modules following the 300-level modules of their other major subject(s) up to a maximum of 32 credits, subject to the permission of the relevant department, to contribute to a minimum of 120 credits.

Master's programmes

Plant and Soil Sciences

More information is available on the following websites:

<http://www.sun.ac.za/english/faculty/agri/genetics/> (Department of Genetics)

<http://www.sun.ac.za/agron/> (Department of Agronomy)

<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/english/faculty/agri/soil-science/> (Department of Soil Science)

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 a 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(180): Master's thesis
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Master's programme in Entomology (MSc)

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(120): Master's thesis
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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.

14176 : Soil Science	878(180): Master's thesis
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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	881(6): Postgraduate biometry
39632 : Horticultural Science	878(180): 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, vineyards 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 Wine Production Systems (MScAgric Viticulture and Oenology)

Viticulture

Programme Description

Topics for the master's degree are determined in consultation with the relevant lecturer for every prospective student. Research projects can be selected from one of the following themes: molecular aspects of key processes in grapevines; advanced grapevine physiology; climate change; analysis of spatial patterns; berry ripening and table grapes. A further objective is the deepening of subject knowledge through self-study.

33081 : Viticulture	878(180): Master's thesis
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Food Production Systems

More information is available on the following website:

<http://www.sun.ac.za/foodsci>

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

Food Science

Programme Description

The master's programme in Food Production Systems is usually one year, but depending on the field of study could take longer to complete. Research projects for the master's programme are chosen in consultation with the supervisor of each prospective student. To be accepted into the programme a student must have a four year BSc in Food Science or a three year BSc in Food Science with a BScHons in Food Science or a three year BSc with Chemistry or Biochemistry at third year level with an honours degree. Students who only comply with the last requirement will have to do supplementary food science modules as determined by the Department of Food Science. An average mark of 60% for the final year modules is required.

21210 : Food Science	878(180): Master's thesis
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Wine Production Systems

More information is available on the following websites:

http://www.sun.ac.za/viti_oenol/ (Department of Viticulture and Oenology)

http://www.sun.ac.za/wine_biotechnology/ (Institute for Wine Biotechnology)

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

The master's programme in Wine Production Systems leads to one of the following qualifications: MScAgric (Oenology), MScAgric (Viticulture), MScAgric (Wine Biotechnology) or MSc (Wine Biotechnology). After obtaining a relevant bachelor's degree students can be admitted to the two year master's programme. The programme consists only of a research component.

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

Oenology

Programme Description

Topics for the master's degree are determined in consultation with the relevant lecturer for each prospective student. Research projects can be selected from one of the following themes: wine microbiology; wine chemistry; analytical method development, and sensory methodology and analyses. A further objective is the deepening of subject knowledge through self-study.

33103 : Oenology	878(180): Master's thesis
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Master's programme in Wine Production Systems (MScAgric Viticulture and Oenology)

Viticulture

Programme Description

Topics for the master's degree are determined in consultation with the relevant lecturer for every prospective student. Research projects can be selected from one of the following themes: molecular aspects of key processes in grapevines; advanced grapevine physiology; climate change; analysis of spatial patterns; berry ripening and table grapes. A further objective is the deepening of subject knowledge through self-study.

33081 : Viticulture	878(180): Master's thesis
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Master's programme in Wine Production Systems (MScAgric or MSc)

MScAgric or MSc in 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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Animal Production Systems

More information is available on the following website:

<http://www.sun.ac.za/animal> (Department of Animal Sciences)

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 (field: Animal Science or field: Aquaculture). After completion of the BScAgric degree and normally with an average of at least 60%, for the third and fourth year modules, the student can apply for the master's programme. The Department reserves the right to subject prospective students to an admission examination. The master's programme consists of a research component of 100% (180 credits), but students in consultation with their supervisors could be requested to follow additional modules, including Biometry 711 (Postgraduate Biometry).

Students that successfully completed the Postgraduate Diploma in Animal Science or Aquaculture (with an average of at least 60%) may apply for enrolment to the master's programme, subject to final approval by the Department of Animal Sciences.

Research is possible in the following fields: increase in the effectiveness of animal production and animal products, the improvement of product quality in the farming of large and small livestock, poultry, and intensive and extensive aquaculture systems, feeding 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 research projects in a scientific manner;
- generate new knowledge using fundamental animal husbandry and scientific principles; and
- obtain further postgraduate qualifications at various national and international institutions.

MScAgric (Animal Science)

20826 : Animal Science	878(180): Master's thesis
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MScAgric (Aquaculture)

46213 : Aquaculture	818(180): Master's thesis
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Agricultural Economics and Management

More information is available on the following website:

http://www.sun.ac.za/agric_econ/ (Department of Agricultural Economics)

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

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 the following 20-credit 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): International trade and marketing strategies
15504 : Agricultural Economics	881(20): Rural development
15504 : Agricultural Economics	883(20): Applied SAM based modelling
<i>and (compulsory)</i>	
15504 : Agricultural Economics	882(100): Master's thesis

Forestry and Wood Sciences

More information is available on the following website:

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

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 qualification MScFor in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. The programme consists of a one-year MScFor degree after the four-year BScFor degree. A relevant honours degree, the Postgraduate Diploma in Forestry and Wood Sciences, as well as other qualifications approved by Senate for this purpose give access to the programme. The master's programme consists of a 100% research component (180 credits), but students in consultation with their supervisors could be requested to follow additional modules, including Biometry 881 (Postgraduate Biometry).

11290 : Forest Science	878(180): Master's thesis
57584 : Wood Product Science	878(180): Master's thesis

Students must choose between Forest Science 878 and Wood Product Science 878.

Conservation Ecology

More information is available on the following website:

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

Master's programme in Conservation Ecology (MScConsEcol)

Programme Description

The master's programme in Conservation Ecology leads to the MScConsEcol degree. 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 a 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.

55638 : Conservation Ecology	878(180): Master's thesis
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MSc (Sustainable Agriculture)

Programme Description

The purpose of the programme is to train researchers in understanding and working within sustainable agriculture. This will be achieved by adopting a systems approach to agriculture as a point of departure. The programme comprises modules that actively seek to integrate scientific methods across disciplines to advance sustainability in spheres where agriculture interacts with natural, social and economic factors. The programme will start with a module entitled Introduction to Systems Thinking. This is followed by teaching concepts in sectoral sustainable agriculture e.g. sustainable animal production, sustainable plant production and livelihood perspectives. To generate and integrate knowledge in sustainable agriculture, modules like Systems Analysis and Simulation, QUALUS (Quantitative Land Use Analysis) and Biometry will help improve the student's quantitative and analytical skills. A work-integrated learning opportunity where students are linked to organisations in the industry will give students real-life perspective and will make them more employable.

To be accepted into the programme, a student would normally be required to be in possession of an appropriate four year Bachelor's (Agric) degree (NQF-level 8), or a three year Bachelor's degree (NQF-level 7) and a relevant postgraduate qualification (e.g. BScHons or postgraduate diploma) in any of the major disciplines related to Agriculture with a pass mark of at least 60%. English proficiency is a requirement. Students will be asked to submit a written motivation for acceptance into the programme.

13341 : Introduction to systems thinking	870(6): Introduction to systems thinking
13340 : Sustainable soil management	871(8): Sustainable soil management
13342 : Plant production and plant protection	872(8): Plant production and plant protection
13343 : Sustainable animal production	873(8): Sustainable animal production
11490 : Biodiversity and Ecosystem Services	874(6): Biodiversity and ecosystem services
13344 : Sociology of sustainable agriculture	875(6): Sociology of sustainable agriculture
13345 : Economics of sustainable agriculture	876(8): Economics of sustainable agriculture (including farm management)
13346 : Systems analysis and simulation	880(6): Systems analysis and simulation
13347 : Quantitative analysis of land use systems	881(8): Quantitative Analysis of Land Use Systems
13348 : Work-integrated learning	882(20): Work-integrated learning
13349 : Research thesis (Sustainable Agriculture)	883(90): Research thesis

Doctoral programmes

Plant and Soil Sciences

More information is available on the following websites:

<http://www.sun.ac.za/english/faculty/agri/genetics/> (Department of Genetics)

<http://www.sun.ac.za/agron/> (Department of Agronomy)

<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/english/faculty/agri/soil-science/> (Department of Soil Science)

Doctoral programmes in Plant and Soil Sciences

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): Doctoral dissertation
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 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 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 research collection
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 Production Systems

More information is available on the following website:

<http://www.sun.ac.za/foodsci>

Doctoral programmes in Food Production Systems

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

Programme Description

The doctoral programme is at least two years, but depending on the field of study could take longer to complete. For each field of study a relevant research project is chosen in consultation with the supervisor. The programme contributes at a high level to the Faculty of AgriSciences' research profile and delivers professional individuals who can play an important role in teams with regards to research, teaching and policy-making in the speciality areas of sustainable food and nutrition security in an environmentally-friendly manner.

21210 : Food Science	978(360): Doctoral dissertation
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Doctoral programmes in Food Production Systems (DSc programme)

Programme Description

The degree DSc is awarded to candidates who have held the PhD or PhD (Food Sc) degree of this University, or another equivalent (in the opinion of Senate) qualification for at least five years, or who have held the MSc Food Sc degree of this University, or another adequate (in the opinion of Senate) qualification for at least seven years, and who have produced advanced original research and/or creative work in Food Science, 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 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
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Wine Production Systems

More information is available on the following websites:

http://www.sun.ac.za/viti_oenol/ (Department of Viticulture and Oenology)

http://www.sun.ac.za/wine_biotechnology/ (Institute for Wine Biotechnology)

Doctoral programmes in Wine Production Systems [PhD]

Programme Description

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

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

Doctoral programmes in Wine Production Systems (DSc programme)

Programme Description

The degree DSc is awarded to candidates who have held the PhD or PhD (Agric) degree of this University, or some other equivalent (in the opinion of Senate) qualification for at least five years, or who have held the MSc or MScAgric degree of this University, or some other adequate (in the opinion of Senate) qualification for at least seven years, and who have produced advanced original research and/or creative work in Wine Production Systems 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 Wine Production Systems or the Agricultural Sciences and, if required by the examiners, has taken an oral examination to the satisfaction of the University.

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 website:

<http://www.sun.ac.za/animal> (Department of Animal Sciences)

Doctoral programmes in Animal Production Science

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 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 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 website:

http://www.sun.ac.za/agric_econ/ (Department of Agricultural Economics)

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 Senate) qualification for at least five years, or who have held the MScAgric or MAgricAdmin degree of this University, or some other adequate (in the opinion of 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 Wood Sciences

More information is available on the following website:

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

Doctoral programmes in Forestry and Wood Sciences

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 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 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 website:

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

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, individually or as member of a team, will play a meaningful research, teaching and/or policy-making role are delivered.

55638 : Conservation Ecology	978(360): Doctoral dissertation
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Subjects, Modules and Module Content

Abbreviation and numbering system

All subjects are represented by a subject number of five 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

Explanation

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 or 3: modules offered in the first semester;
 - 4, 5 or 6: modules offered in the second semester;
 - 7, 8 or 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 the square following the module subject.

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 hand-out.
- 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 hand-out, 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 lecturers from abroad.
- 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 hand-out.

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

Note: No qualification will be awarded unless the candidate has passed all the relevant prerequisite and co requisite 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	E+i
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+i
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</i>				
<i>C Agricultural Economics 234</i>				
Home department: AGRICULTURAL ECONOMICS				
262	8	The economics of agricultural resources	3L	A+i
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+i
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	E+i
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 in the South African context	3L	E+i
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	E+i
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	T
<p>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.</p> <p><i>P Biometry 212, 242 or</i> <i>P Statistics 186 or</i> <i>P Statistical Methods 176</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
424	16	Foundations of Agricultural Economics: an institutional approach	3L	T
<p>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.</p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
444	16	Environmental policy	3L	T
<p>Different standards of environmental protection; the use of market instruments vs. command and control policy instruments to limit environmental damage; support for environmentally friendly technology; cost benefit analysis; quantification of environmental impacts; international environmental treaties; the theory of environmental auditing.</p> <p><i>P Economics 114, 144</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
454	16	Agricultural policy analysis	3L	T
<p>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.</p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
478	32	Agricultural economics research project	1L	T
<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> <p>Home department: AGRICULTURAL ECONOMICS</p>				
780	20	Rural development		
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				

781	30	Research assignment: Agricultural economics		
<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>				
782	16	National and international market analysis		
<p>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.</p> <p><i>P Biometry 212, 242 or</i> <i>P Statistics 186 or</i> <i>P Statistical Methods 176</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
783	16	Foundations of Agricultural Economics: an institutional approach		
<p>This module is designed to introduce a range of problems, decision-making situations and institutional settings relevant to the study of agricultural and resource economics.</p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
784	16	Environmental policy		
<p>Different standards of environmental protection; the use of market instruments vs. command and control policy instruments to limit environmental damage; support for environmentally friendly technology; cost-benefit analysis; quantification of environmental impacts; international environmental treaties; the theory of environmental auditing.</p> <p><i>P Economics 114, 144</i></p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
785	16	Agricultural policy in the South African context		
<p>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.</p> <p>Home department: AGRICULTURAL ECONOMICS</p>				
871	20	Strategic farm management		
<p>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</p>				

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	International trade and marketing strategies	
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				
883	20	Applied SAM based modelling		
Introduction to input-output tables, social accounting matrices (SAMs), multiplier and computable general equilibrium models and their application in policy analysis. <i>Subject to continuous assessment.</i> <i>P Economics 318, 348 or 388</i> 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</i> <i>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	Management of veld and planted pastures	3L, 3P	T
Development and ecology of South African veld types; morphology and physiology of pasture plants and their reaction to defoliation; principles of grazing management in veld and planted pastures; methods to evaluate the condition of veld and planted pastures. Home department: AGRONOMY				

332	8	Cultivation of future crops	1.5L, 1.5P	T
<p>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.</p> <p>Home department: AGRONOMY</p>				
342	8	Weed management	1.5L, 1.5P	T
<p>Characteristics of weeds; methods of weed control; principles of weed management programmes; mechanisms of chemical herbicide action.</p> <p>Home department: AGRONOMY</p>				
362	8	Vegetable crops for intensive production systems	1.5L, 1.5P	T
<p>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.</p> <p>Home department: AGRONOMY</p>				
424	16	Physiological and ecological principles of natural pasture management	3L, 3P	T
<p>Development and ecology of South African veld types; morphology and physiology of pasture plants; physiology of defoliation and plant response; physiological principles of veld management; determination of veld condition, veld burning, bush encroachment, veld management on game farms; causes and control of erosion.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Agronomy 322 or</i> <i>P Conservation Ecology 314 or</i> <i>P Crop Production 214</i></p> <p>Home department: AGRONOMY</p>				
454	16	Production physiology and technology for annual agronomical crops	3L, 3P	T
<p>Physiological processes involved in yield increase in cool-weather crops; crop rotations and biological management for sustainable production; quality requirements and utilisation of crops.</p> <p><i>P Agronomy 322</i></p> <p>Home department: AGRONOMY</p>				

13335 Agronomy Science Project				
772	30	Agronomy Science Project	1L	T
Identification, planning, execution, evaluation and reporting of a selected appropriate research project.				
<i>Final report is assessed.</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
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 cross-breeding 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.				
<i>Subject to continuous assessment.</i>				
<i>P Genetics 354</i>				
Home department: ANIMAL SCIENCES				
741	16	Animal breeding and genetics		
Principles of animal genetics as they apply to livestock improvement and animal production. Development and evaluation of breeding programmes and familiarisation with the animal breeding industry.				
Home department: ANIMAL SCIENCES				

54801 Animal Management Science				
434	16	Intensive management systems	3L, 3P	T
<p>Development of modern lines of pigs and poultry for commercial production systems. Housing and ventilation requirements regarding pig and poultry production as influenced by the various growth and development phases. Health management programmes for pig and poultry.</p> <p>Pig production: management of breeding animals, weaners and growers.</p> <p>Poultry production: management of broiler breeders, layers, broilers and hatcheries.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Animal Science 244</i> <i>P Physiology 214</i> <i>C Animal Nutrition Science 344</i></p> <p>Home department: ANIMAL SCIENCES</p>				
464	16	Extensive management systems	3L, 3P	E
<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; principles of wool production.</p> <p><i>Practicals:</i> Assessment and handling of sheep and sheep management practices. Identification of animal diseases and herd health programmes. Students compile a complete herd management and fodder flow programme and visit relevant production facilities and farms. In addition, students also follow short courses in grading of animals presented by the industry.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Animal Nutrition Science 324</i></p> <p>Home department: ANIMAL SCIENCES</p>				
711	16	Intensive management systems		
<p>Biology, 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 growers; management of breeders, layers, broilers and hatcheries; biosecurity; recordkeeping.</p> <p>Home department: ANIMAL SCIENCES</p>				
712	16	Wildlife management		
<p>Wildlife management practices and production systems; interaction between animal husbandry and wildlife management; breeding and selection practices; nutritional requirements of browsers and grazers; principles of feed formulation suitable for game species; consumptive and non-consumptive usage of wildlife products.</p> <p><i>Practical:</i> Development of a complete management plan; feed formulation; excursions to wildlife ranches in the Western Cape.</p> <p>Home department: ANIMAL SCIENCES</p>				

741	16	Extensive management systems		
<p>Students will be trained in the management practices of sheep and beef cattle, with emphasis on production systems, mating systems, mating and lambing or calving seasons, the fattening and marketing of animals, flock and herd health and the relevant principles of wool production. Reference will also be made to Angora and Boergoat production.</p> <p>Practical experience will consist of the submission of a complete herd management and fodder flow programme as well as visits to relevant production facilities and farms.</p> <p>Home department: ANIMAL SCIENCES</p>				

56898 Animal Nutrition Science				
324	16	Introduction to ruminant nutrition	3L, 3P	A+i or E+i
<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><i>Practicals:</i> 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> <p><i>C Animal Science 244</i> <i>C Biochemistry 214, 244</i> <i>P Physiology 214</i></p> <p>Home department: ANIMAL SCIENCES</p>				
344	16	Introduction to monogastric nutrition	3L, 3P	T
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Biochemistry 214, 244</i> <i>C Animal Science 244</i> <i>P Physiology 214</i></p> <p>Home department: ANIMAL SCIENCES</p>				

414	16	Advanced ruminant nutrition	3L, 3P	A+i
<p>Applied nutrition of sheep, goats, dairy cattle, beef cattle and game. Metabolic disorders; processing of raw materials and feeds.</p> <p><i>Practicals:</i> Ration formulation with the aid of microcomputers. Visits to feedstuff manufacturers and farms.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Animal Nutrition Science 324</i></p> <p>Home department: ANIMAL SCIENCES</p>				
444	16	Advanced monogastric nutrition	3L, 3P	T
<p>Energy systems; Protein and amino acids; Anti-nutrients and toxins in feed; Species specific nutrition – poultry and pig nutrition; The use of non-nutritive feed additives; Nutritional pathology.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Animal Nutrition Science 344</i></p> <p>Home department: ANIMAL SCIENCES</p>				
711	16	Advanced ruminant nutrition		
<p>Students will be trained in modern and advanced concepts of ruminant nutrition, focussing on sheep, beef and dairy cattle. Knowledge will be applied through training in the processing of raw materials and the formulation and manufacturing of complete feedstuffs and feed supplements (licks). Metabolic disorders will be discussed in detail. In addition to using modern software packages to formulate feed, visits to feed manufacturers and producers will also be incorporated.</p> <p>Home department: ANIMAL SCIENCES</p>				
741	16	Advanced monogastric nutrition		
<p>Energy systems; protein and amino acids; anti-nutrients and toxins in feed; species-specific nutrition – poultry and pig nutrition; the use of non-nutritive feed additives; nutritional pathology.</p> <p>Home department: ANIMAL SCIENCES</p>				

11851 Animal Physiology

324	16	Applied Physiology in Farm Animals	3L, 3P	T
<p>Endocrinology and cell communication; regulation of acid-base balance; applied digestive physiology and relevant intermediary metabolism; cardiovascular system and regulation of blood pressure; thermoregulation.</p> <p><i>PP Physiology 214</i></p> <p><i>C Biochemistry 214, 244</i></p> <p>Home department: ANIMAL SCIENCES</p>				

344	16	Advanced Animal Production Physiology	3L, 3P	T
<p>Immunology and disease resistance; principles and application of pharmaceuticals in animal health; species comparative reproduction physiology; introduction to assisted reproduction techniques.</p> <p><i>PP Physiology 214</i> <i>C Biochemistry 214, 244</i></p> <p>Home department: ANIMAL SCIENCES</p>				

11878 Animal Production				
214	16	Management technology: Production animals	3L, 3P	T
<p>Introduction to nutrients and their functions, classification and processing of raw materials for livestock feed.</p> <p>Sheep and goats: Supplementary nutrition of grazing sheep and feedlot finishing. Sheep management. Goat management.</p> <p>Beef cattle: Nutrition and husbandry of breeding herds produced under grazing and intensive systems; feedlot finishing.</p> <p>Dairy cattle: Nutrition and husbandry of non-lactating and lactating cows and dairy calves. Housing facilities and herd health.</p> <p>Poultry: Basic principles in poultry production. Broiler management.</p> <p>Pigs: Management of pigs in different production stages.</p> <p>The cost and return calculations of each of the above mentioned operations are discussed.</p> <p>Practical: Feeding practices, visits to farming units and experimental trials, visual evaluation of dairy and beef cattle, discussion of prepared assignments.</p> <p><i>C Animal Production Physiology 112 or</i> <i>C Biology 154</i></p> <p>Home department: ANIMAL SCIENCES</p>				

44733 Animal Production Physiology				
112	8	Animal production physiology	1.5L, 1.5P	T
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: ANIMAL SCIENCES</p>				

51004 Animal Product Science				
334	16	Meat science	3L, 3P	E
<p>Meat production and meat consumption in perspective; factors that influence carcass composition; slaughter and processing of animals; pre-slaughter and postslaughter effects on meat quality; storage and processing of meat products.</p> <p>Practicals: Visits to abattoirs, production of various meat products.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Animal Science 244</i></p> <p>Home department: ANIMAL SCIENCES</p>				
352	8	Dairy science and dairy cattle management	2L, 1.5P	T
<p>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.</p> <p>Practicals: Determination of milk quality. Operation of the milking machine.</p> <p>Layout of housing. Visits to commercial dairies. Production of soft cheese.</p> <p><i>C Animal Science 244</i></p> <p>Home department: ANIMAL SCIENCES</p>				

20826 Animal Science				
144	16	Introductory Animal Science	3L, 3P	T
<p>An introduction to Animal Sciences and important terminology in Animal Science. An overview of the livestock industry in South Africa and the world. Domestication of livestock and a general introduction to animal production systems, viz. large stock, small stock, poultry and pigs. Care and handling of sheep, cattle, pigs, poultry and horses. An introduction to animal behaviour and welfare.</p> <p>Home department: ANIMAL SCIENCES</p>				
244	16	Basic principles of animal production and management	3L, 3P	T
<p>A short introduction to Animal Science and Aquaculture. Overview of veld types and rainfall areas in South Africa. Management of sweet and sour veld. Adaptation of animals to changing environments Growth and development of chickens, cattle, sheep and pigs as influenced by age, breed and gender. Introduction to animal breeding and genetics including breed science: the study of a selection of livestock breeds with historical or economic importance in South Africa.</p> <p>Home department: ANIMAL SCIENCES</p>				

442	8	Practical training	1.5L, 1.5P	T
<p>Methods of gathering scientific literature; seminar preparation and presentation; training in writing and presentation skills and exposure to the industry where, inter alia, students partake in a tour of relevant industries. Practical work (one month) as prescribed in the “Compulsory practical 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 work: Report preparation and submission. Students also undertake a tour of the Western Cape livestock farms and related industries.</p> <p>Home department: ANIMAL SCIENCES</p>				
772	24	Scientific skills in Animal Science		
<p>Students will be trained in different manners of scientific method and design; literature review, evaluation and compilation into a seminar and the oral presentation of scientific findings; developing a critical way of thinking and interpreting scientific findings; reporting observations and findings in technical reports; ethics of Animal Science-based research; theoretical biometrical concepts and their practical application.</p> <p>Home department: ANIMAL SCIENCES</p>				

20753 Applied Mathematics B				
124	15	Statics	4L, 2T	A&E
<p>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.</p> <p><i>Flexible assessment</i></p> <p>Home department: APPLIED MATHEMATICS</p>				

12487 Applied Plant Physiology				
414	16	Ecophysiology of horticultural and agronomical crops	3L, 3P	T
<p>Advanced principles of stomatal conductance, transpiration, photosynthesis and respiration. Micro-climatological influences on gas exchange. Effects of excess energy – temperature and light. The use of chlorophyll fluorescence as stress indicator. Upscaling of gas exchange and carbon balance of crops. Water relations of cells, tissues and whole plant. Stress physiology and advantageous aspects of stress. Climate change and agriculture. Theory and application of ecophysiological measurement techniques.</p> <p><i>C Soil Science 344 and P Horticultural Science 314 or P Agronomy 322</i></p> <p>Home department: HORTICULTURAL SCIENCE</p>				

464	16	Nutrition of horticultural and agronomical crops	3L, 3P	T
<p>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.</p> <p><i>Practicals:</i> An orchard report, amongst others. Cultivation of alternative crops.</p> <p><i>P Soil Science 244 and</i> <i>P Horticultural Science 314 or</i> <i>P Agronomy 342</i></p> <p>Home department: HORTICULTURAL SCIENCE</p>				
714	16	Ecophysiology of horticultural and agronomical crops		
<p>Students will be trained in 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 as stress indicator. Upscaling of gas exchange and carbon balance in 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.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
734	16	Applied plant physiology and tree architecture		
<p><i>Lectures:</i> Underlying physiology of growth, development and production practices of horticultural crops. Correlative phenomena and the role of plant hormones supported by an overview of relevant cell, tissue and organ anatomy as well as basic genetic principles. Overview of environmental perception and acclimation/adaptation. Dormancy as morphogenetic and survival mechanism. Physiology of growth cessation, hardening, induction and progression of dormancy, rest breaking and branching. Tree architecture and training systems, principles and techniques of tree manipulation and the role of rootstocks. Integration of the above taking production practices into account.</p> <p><i>Practicals:</i> 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.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
744	16	Postharvest physiology and technology of horticultural and agronomical crops		
<p>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.</p> <p>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.</p>				

<p>Plant products that are discussed to illustrate principles include deciduous fruit (pome fruit, stone fruit and table grapes) as well as some tropical and subtropical crops and vegetables.</p> <p><i>Practicals:</i> 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, fresh-cut facilities and the Cape Town port for handling of export products.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
764	16	Nutrition of horticultural and agronomical crops		
<p>Phloem transport and carbohydrate partitioning. Root anatomy, mineral application, uptake and partitioning in deciduous fruit and proteas. Crop-based nutritional requirements and application strategies; management of vegetative and reproductive balances and the role of rootstocks. Factors affecting mineral uptake.</p> <p><i>Practicals:</i> An orchard report and cultivation of alternative crops.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
771	16	Advanced plant physiology		
<p>Study selected course material, which are relevant to the production of horticultural crops and to the deepening of basic physiological knowledge thereof. Subjects covered include: anatomy, biophysics, primary and secondary metabolism, growth and development, and plant-environment interaction.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
773	40	Research project		
<p>Research project and presentation. Literature review on selected research topics, drawing up a research plan, performing experiments, collection, processing and interpretation of data, writing a research report. Regular feedback on the above via oral presentations.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				

46213 Aquaculture

314	16	Introduction to aquaculture	3L, 3P	T
<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: ANIMAL SCIENCES</p>				
344	16	Aquaculture production and processing	3L, 3P	T
<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>				

<i>Subject to continuous assessment.</i>				
<i>P Aquaculture 314</i>				
Home department: ANIMAL SCIENCES				
414	16	Freshwater aquaculture	3L, 3P	T
Production and management of freshwater aquaculture species: trout, tilapia, catfish, ornamental species, crocodiles, freshwater crawfish and prawns. Management techniques: broodstock, eggs, incubation and hatching, fingerlings and grow-out stages. Production planning, management systems and computer usage.				
<i>Subject to continuous assessment.</i>				
<i>P Aquaculture 344</i>				
Home department: ANIMAL SCIENCES				
444	16	Marine aquaculture	3L, 3P	T
Production and management of marine aquaculture species: oysters, mussels, abalone, salmon, seaweed and prawns. Management techniques: brood stock, eggs, incubation and hatching, fingerlings and grow-out stages. Production planning, management systems and computer usage.				
<i>Subject to continuous assessment.</i>				
<i>P Aquaculture 414</i>				
Home department: ANIMAL SCIENCES				
478	32	Aquaculture research project	3L, 3P	T
Formulation of an applicable research project proposal, including liaison with the industry and drawing up a budget. Literature study, experimental design, planning and execution, including supervision of facilities and experimental material, usage of apparatus and utilisation of calibrators and calibration techniques. Data processing, analysis, interpretation and reporting.				
<i>P Aquaculture 314, 344</i>				
Home department: ANIMAL SCIENCES				
711	16	Aquaculture production and management systems I		
Management practice of aquaculture production in relation to production systems; production planning; production management: applied biology, nutrition, water quality; including intensive and extensive systems, with reference to marine and freshwater species.				
Home department: ANIMAL SCIENCES				
712	16	Aquaculture products		
Processing technology and management practices in aquaculture. Product quality, food and health standards. Product development.				
Home department: ANIMAL SCIENCES				

741	16	Aquaculture production and management systems II		
<p>Management practice of aquaculture production in relation to production systems; production planning; production management; fish health, quality, processing; including intensive and extensive systems, with reference to marine and freshwater species.</p> <p>Home department: ANIMAL SCIENCES</p>				
742	16	Aquaculture ecology		
<p>Water ecology and water quality parameters in aquaculture. Water quality management practices. Environmental impact. Recirculation systems and technology.</p> <p>Home department: ANIMAL SCIENCES</p>				
743	16	Aquaculture nutrition		
<p>Feeding behaviour of aquaculture species. Nutrition management practices of aquaculture species. Nutrition and food quality of aquaculture species.</p> <p>Home department: ANIMAL SCIENCES</p>				
771	36	Aquaculture management practice		
<p>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.</p> <p>Home department: ANIMAL SCIENCES</p>				
772	30	Aquaculture research practice		
<p>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.</p> <p>Home department: ANIMAL SCIENCES</p>				

12910 Aquaculture Management Science

724	16	Aquaculture review, assessment and project development I		
<p>Aquaculture species; species selection and biology; aquaculture management practices and production systems; site selection.</p> <p><i>Practical:</i> The development of a complete production and management plan; species review, species selection, applied biology and production systems; site selection, risk assessment, budget, marketing plan; excursions to aquaculture operations in the Western Cape.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: ANIMAL SCIENCES</p>				

754	16	Aquaculture review, assessment and project development II		
<p>Aquaculture risk assessment; aquaculture best management practices; production planning; financial planning.</p> <p><i>Practical:</i> The development of a complete production and management plan; risk assessment; EIA procedures; preparation of a project proposal for presentation; excursions to aquaculture operations in the Western Cape.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: ANIMAL SCIENCES</p>				

11053 Biochemistry				
214	16	Biomolecules: Structure-function Relationships	3L, 3P	A+i or E+i
<p><i>Please note:</i></p> <p><i>Students intending to take Biochemistry as a subject are required to take modules in Biology, Physics and Mathematics during their first year. Chemistry 124 plus Chemistry 144 are taken as the first-year equivalent of Biochemistry.</i></p> <p>Structures, characteristics and functions of bio-molecules (bio-elements, water, nucleic acids, proteins, enzymes, coenzymes, carbohydrates, lipids).</p> <p><i>Continuous assessment</i></p> <p><i>PP Chemistry 124 and 144</i></p> <p><i>PP Biology 124</i></p> <p>Home department: BIOCHEMISTRY</p>				
244	16	Intermediary Metabolism	3L, 3P	A+i or E+i
<p>Bioenergetics; metabolism of carbohydrates, lipids and nitrogenous compounds; integration of metabolism.</p> <p><i>Continuous assessment</i></p> <p><i>P Biochemistry 214</i></p> <p>Home department: BIOCHEMISTRY</p>				
315	16	Biophysical and Structural Protein Biochemistry	3L, 3T	A+i or E+i
<p>Advanced protein biochemistry: Protein structure/function relationships studied in the context of a number of specialized complex protein systems and enzymatic reaction mechanisms. Basic protein purification techniques and analysis of protein purity, composition and structure.</p> <p>Analysis of biological molecules and processes with light, fluorescence, infrared, Raman and nuclear magnetic resonance spectroscopy, mass spectrometry, circular dichroism, optical rotatory dispersion, isotope-dependent techniques, advanced gel electrophoresis and chromatographic techniques.</p>				

<i>Continuous assessment</i>				
<i>PP Biochemistry 214 and 244</i>				
<i>PP Physics 114 or</i>				
<i>PP Physics (Bio) 134</i>				
Home department: BIOCHEMISTRY				
345	16	Specialised Biochemical Topics	3L, 3T	A+i or E+i
Selected topics chosen from the following (three of the following four topics are selected for presentation every year):				
Antibiotics: The biochemistry of selected antibiotics and antimicrobial agents. Intracellular signal transduction pathways; receptors; hormones; cAMP; networks and cross talk; biochemistry of vision; biochemistry of smell.				
Immunology: Innate and specific acquired immunity; antibody structure and function; defence mechanisms against pathogenic organisms; vaccinations; allergies; immune disorders; AIDS.				
Eukaryotic gene expression: Transcription and control of gene expression, promoters and enhancers, and transcription factors.				
<i>Continuous assessment</i>				
<i>P Biochemistry 315 and 324</i>				
Home department: BIOCHEMISTRY				
365	16	Practical protein expression, purification and analysis techniques	3L, 3P	T
Recombinant protein expression and protein purification techniques. Analysis of protein purity and integrity. Techniques include: plasmid DNA isolation, PCR, restriction enzyme digests, agarose gel electrophoresis, preparation of competent cells, transformation, induction of protein expression, gel permeation chromatography, ion exchange chromatography, immobilized-metal affinity chromatography, protein concentration determinations, SDS-PAGE, western blot, activity assays and spectrophotometric analyses.				
Practicals will be presented during the recess periods, specifically during a) the week before the 2nd semester officially starts, and b) the recess between the 3rd and 4th terms. Students registering for this module declare that they are available during both these periods.				
<i>Continuous assessment</i>				
<i>P Biochemistry 315, 324</i>				
Home department: BIOCHEMISTRY				

53953 Biodiversity and Ecology				
212	16	Statistics and Other Tools for Biologists	3L, 3P	E+i
<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, PowerPoint and 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>C Computer Skills 171</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
214	16	Principles of Ecology	3L, 3P	E+i
<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 in which students will be taught how to analyse ecological data. There will be a three-day, compulsory field course in which students conduct their own research projects.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biology 144</i></p> <p><i>P Mathematics (Bio) 124 or</i></p> <p><i>P Mathematics 114 and 144</i></p> <p><i>C Biodiversity and Ecology 212 or</i></p> <p><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	A+i or E+i
<p>The focus of this module is invertebrate diversity and physiology. Major evolutionary changes in morphology (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 or 154 and a final mark of at least 40% in the remaining Biology module</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				

254	16	Vertebrate Life	3L, 3P	A+i or E+i
<p>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.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biology 124 or 154 and a final mark of at least 40% in the remaining Biology module</i></p> <p><i>P Chemistry 124, 144</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
264	16	Diversity of Plant Form and Function	3L, 3P	A+i or E+i
<p>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 complementary way that will include formal lectures, group discussions, laboratory and field experiments.</p> <p><i>PP Biology 144 or 154 and a final mark of at least 40% in the remaining Biology module</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
315	16	Ecology Field Course	3L, 3P	E
<p>This is a field-based module. The location of the module will change from year to year. The module will be timed to fall outside of the formal lecture periods – typically two weeks during January. The aim of the module is to bring ecological and evolutionary theory to life in the field. The main foci are biotic interactions (e.g. pollination, competition, facilitation), animal behaviour and ecosystem-level ecology. Lectures, assignments and discussion groups will be conducted in the field, as well as during the normal university term.</p> <p>This module is a restricted module and largely limited to students registered in the Biodiversity and Ecology programme. Participants maybe selected from other programmes based on past performance and available places.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biodiversity and Ecology 212, 214</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				

324	16	Angiosperm Diversity and Evolution	3L, 3P	E+i
<p>The theory investigates the origin and phylogenetic relationships among angiosperms, as determined through different classification systems. Angiosperm diversification and classification is studied through the use of morphological, anatomical, embryological, palynological and molecular characters. The role of hybridisation and polyploidy in the diversification of the angiosperm lineage is assessed. Specialised morphological and physiological adaptations to suboptimal environments and the effect of such adaptations on the diversification of angiosperms are discussed.</p> <p>The practical series focuses on Fynbos taxa and plant identification up to the family level.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biodiversity and Ecology 264</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
334	16	Global Change Biology	3L, 3P	E+i
<p>The study of global change with a biological perspective, which brings together historical and current evidence for such change and summarises its main drivers. Topics include global climate change, anthropogenic change such as pollution, and land use. Data at different spatial and temporal scales and at different levels of biological organisation are covered, highlighting the technologies and numerical techniques used to study these processes. Finally, ways of ameliorating the process are covered, as is communication about all of the above topics both between scientists, and between scientists and the public.</p> <p><i>Prerequisite pass: any 4 of the following 6 modules:</i> <i>PP Biodiversity and Ecology 212, 214, 224, 244, 254, 264</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				
345	16	Invasion Biology	3L, 3P	E
<p>Biological invasions provide fascinating opportunities to improve our understanding of how the world works (from genes to ecosystems), but invasions also represent a major challenge to our sustainable use of resources (from impacts on rural communities to effects on major shipping companies). As such invasion science involves a wide range of disciplines. Biological invasions are widely recognised as one of the main threats to both the conservation of biodiversity, and the maintenance of ecosystem services worldwide. In many parts of the world, the most challenging and time-consuming tasks of conservation biologists and managers are those relating to controlling alien species and preventing impacts, and, increasingly, repairing systems already damaged by aliens. The interaction between invasions and other drivers of global change creates fascinating areas for research.</p> <p>The aim of this module is to provide an introduction to the exciting and important field of “invasion science” – the full spectrum of fields of enquiry that address issues pertaining to alien species and biological invasions.</p> <p><i>Prerequisite pass: any 4 of the following 6 modules:</i> <i>PP Biodiversity and Ecology 212, 214, 224, 244, 254, 264</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				

364	16	Conservation Biology	3L, 3P	E+i
<p>This module will introduce the topic of conservation biology with a focus on the role that science plays in this field. It aims to equip young biologists and conservation managers with a working knowledge of modern conservation biology principles. On completion, students will have an understanding of biodiversity patterns, how conservation can be addressed at the molecular, population, ecosystem and landscape scales, and how resource management interfaces with conservation efforts and the relevant policy framework.</p> <p><i>Continuous assessment</i></p> <p><i>PP Biodiversity and Ecology 212 or</i></p> <p><i>PP Biomathematics 214</i></p> <p><i>PP Biodiversity and Ecology 214</i></p> <p>Home department: BOTANY AND ZOOLOGY</p>				

11490 Biodiversity and Ecosystem Services				
874	6	Biodiversity and ecosystem services		
<p>Students will be able to explore the diversity of plant species, vegetation types and habitats that exist in South Africa in general, and in the Fynbos biome in particular, by using a tool called SynBioSys Fynbos. This tool is a multi-media platform that includes a geographic information system (GIS), allowing the student to query various biodiversity databases to see how various land uses, e.g. farming, conservation, eco-tourism, impact on the extant biodiversity and ecosystem services. Ultimately, the student will be able to derive biodiversity and ecosystem services data as inputs for qualitative and quantitative land use analysis.</p> <p>Learning outcomes</p> <p>At the end of the module the student is expected to be able to:</p> <ul style="list-style-type: none"> • appreciate the existence value of biodiversity as well as the importance of the different types of ecosystem services • appreciate the complexity of impacts of agricultural practices, and benefits of sustainable farming within a given landscape and biome • analyse the biological values of land use systems at different levels (species, ecosystems and landscapes) by querying the information system SynBioSys Fynbos • use geographic information systems (GIS) to analyse biodiversity at both temporal and spatial scales • discuss the potential of databases to assess the impact of climate change, invasive species and land degradation on biodiversity • use the SynBioSys system to provide biodiversity data and proxies for ecosystem services, which can be used for quantitative and qualitative land use analysis (QUALUS) and thus farm planning and decision making. <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				

25046 Biology				
124	16	Cell Biology	3L, 3P	A&E
Origin and early history of life. Cytology. Cell chemistry, biological membranes and cellular respiration. Fixation, transfer and expression of genetic information. Evolution. [Responsible departments: Biochemistry, Botany and Zoology, and Genetics] Home department: BOTANY AND ZOOLOGY				
144	16	Biodiversity and Ecology	3L, 3P	A&E
Classification of organisms. Diversity of micro-organisms, plants and animals. Ecological principles and global changes. [Responsible departments: Botany and Zoology and Microbiology] <i>C Biology 124 and</i> <i>C Chemistry 124, 144</i> Home department: BOTANY AND ZOOLOGY				
154	16	Functional Biology	3L, 3P	A&E
Plant anatomy and morphology; photosynthesis; water relations; transport in plants; plant mineral nutrition; growth and development; responses to the environment. Functional biology of animals. Introduction to biotechnology. [Responsible departments: Botany and Zoology and Genetics] <i>C Biology 124 and</i> <i>C Chemistry 124, 144 (not applicable to the stream Biomathematics, option 2: Ecology)</i> Home department: BOTANY AND ZOOLOGY				

11061 Biometry				
211	8	Statistics in Biology	1L, 1P	A+i or E+i
Role of statistics in research; principles of estimation, sampling, randomization and unbiasedness; methods of tabulation and graphical representation of data; descriptive measures of locality, variance and association; probability distributions and hypothesis testing; tests for homoscedasticity and normality; analysis of variance; T tests; simple and multiple linear regression; contingency tables and chi-square tests; non-parametric tests. All data will be analysed using Excel. <i>Continuous assessment</i> Home department: GENETICS				

212	8	Introductory biometry	2L, 1T	A&E
<p>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> <p><i>P Mathematics (Bio) 124 or P Mathematics 114</i></p> <p>Home department: GENETICS</p>				
242	8	Applications in biometry	2L, 1T	A&E
<p>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.</p> <p><i>PP Biometry 212</i></p> <p>Home department: GENETICS</p>				
312	8	Biometrical inference	1L, 1P, 1T	T
<p>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> <p><i>P Biometry 242 or 274</i></p> <p>Home department: GENETICS</p>				
342	8	Linear models in biometry	1L, 1P, 1T	T
<p>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> <p><i>P Biometry 312</i></p> <p>Home department: GENETICS</p>				
881	6	Postgraduate biometry		
<p>Data processing with SAS Enterprise Guide (or alternatively: R). 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</p> <p><i>P Biometry 212 and 242, 211 or any other similar module</i></p> <p>Home department: GENETICS</p>				

48550 Business Management				
113	12	Business Management	3L, 1P	A&E
Procedures for the establishment of a new business, the business environment, business ethics, competition, idea generation and entrepreneurship, choice of form of business, determining break-even levels, resources and people involved in the business, management and managerial resources.				
Home department: BUSINESS MANAGEMENT				
142	6	The Investment Decision	1.5L, 1P	A&E
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.				
<i>Continuous assessment.</i>				
Home department: BUSINESS MANAGEMENT				

11479 Chemistry				
124	16	Fundamental Principles of Chemistry I	3L, 3P	A&E
Matter and its properties; chemical formulae; stoichiometry; solution stoichiometry and reactions in aqueous solution; thermodynamics: energy, enthalpy, entropy and Gibbs free energy; atomic structure and bonding; molecular geometry and structure according to Lewis and VSEPR; intermolecular forces; chemical kinetics.				
Home department: CHEMISTRY AND POLYMER SCIENCE				
144	16	Fundamental Principles of Chemistry II	3L, 3P	A&E
Chemical equilibrium (both quantitative and qualitative), with applications in acid-base and precipitation reactions of aqueous solutions; an introductory study of organic compounds with a variety of functional groups; reaction mechanisms; stereochemistry; polymerisation.				
<i>C Chemistry 124</i>				
Home department: CHEMISTRY AND POLYMER SCIENCE				
214	16	Organic Chemistry	3L, 3P	E+i
Reaction mechanisms, including nucleophilic addition and substitution, elimination, electrophilic addition, electrophilic aromatic substitution; organometallic reactions; stereochemistry.				
<i>PP Chemistry 124, 144</i>				
Home department: CHEMISTRY AND POLYMER SCIENCE				
234	16	Inorganic Chemistry	3L, 3P	E+i
Periodic trends; structure and bonding in molecules; structure and bonding in solids; acid-base chemistry; main group elements.				
Coordination chemistry: Introduction, types of ligands, nomenclature; isomerism in coordination compounds; different geometries; formation constants; crystal field theory.				
<i>PP Chemistry 124</i>				
Home department: CHEMISTRY AND POLYMER SCIENCE				

254	16	Physical Chemistry	3L, 3P	A+i
<p>Chemical thermodynamics; colligative properties; phase diagrams; reaction kinetics; electrochemistry.</p> <p><i>PP Chemistry 124</i> <i>P Mathematics 114, 144</i></p> <p>Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
264	16	Chemical analysis I	3L, 3P	A+i or E+i
<p>Introduction to chemical analysis; basic classical analytical chemistry; errors and uncertainty in analytical data; basic statistical methods; volumetric methods (acid-base, redox and complexometric analysis); solvent extraction; introduction to chromatographic separation; introduction to analytical molecular spectroscopy: fundamental principles and quantitative aspects of UV/visible spectrophotometry; introduction to infrared spectroscopy.</p> <p><i>PP Chemistry 124, 144 and</i> <i>P Mathematics 114, 144 or</i> <i>P Mathematics (Bio) 124 or</i> <i>P Engineering Mathematics 115, 145</i></p> <p>Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
314	16	Chemical Analysis II	3L, 3P	E
<p>Introduction to instrumental analysis. Error theory in quantitative chemical analysis, calibration in instrumental analysis and figures of merit. Introduction to atomic spectroscopy: atomic absorption and atomic emission spectroscopy for quantitative elemental analysis. Molecular spectroscopy: basic principles and application of ^1H and ^{13}C nuclear magnetic resonance spectroscopy (NMR); introduction to analytical mass spectrometry; instrumental chromatographic methods.</p> <p><i>PP Chemistry 264</i></p> <p>Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
324	16	Physical Chemistry	3L, 3P	A+i
<p>Quantum mechanical description of atoms and molecules; vibrational and rotational spectra; statistical thermodynamics.</p> <p><i>PP Chemistry 254</i> <i>PP Mathematics 114, 144</i></p> <p>Home department: CHEMISTRY AND POLYMER SCIENCE</p>				
344	16	Organic Chemistry	3L, 3P	T
<p>Reaction mechanisms, including those pertaining to enolate chemistry, chemo-, stereo- and diastereoselectivity, controlling geometry of double bonds, pericyclic reactions; stereochemistry; syntheses.</p> <p><i>PP Chemistry 214</i></p> <p>Home department: CHEMISTRY AND POLYMER SCIENCE</p>				

364	16	Inorganic Chemistry	3L, 3P	E
Stereochemical non-rigidity; structure and strength correlations for acids and bases; structure, bonding and reactivity of transition metal complexes; selective metal-complexation; kinetics and mechanisms of selected inorganic reactions; bio-inorganic chemistry and the role of metal complexes in biological systems; introduction to organometallic chemistry and catalysis; the synthesis and characterisation of inorganic compounds (practicals).				
<i>PP Chemistry 234</i>				
Home department: CHEMISTRY AND POLYMER SCIENCE				

30317 Computer Programming				
143	12	Computer Programming	3L, 2P	A&E
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 program design. Emphasis is placed on modular programming for engineering applications.				
[Presented by the Department of Electrical and Electronic Engineering (75%) and by the Department of Mechanical and Mechatronic Engineering (25%)]				
<i>Flexible Assessment</i>				
Home department: ELECTRICAL AND ELECTRONIC ENGINEERING				

50040 Computer Skills				
171	4	Computer Skills	1L	T
<i>Study load: 26 lectures in total, presented as 2L per week every second week.</i>				
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.				
<i>The class mark will serve as the final mark.</i>				
Home department: COMPUTER SCIENCE				
272	5	Computer Skills	2L	E+i
<i>Study load: 35 lectures in total</i>				
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.				
<i>Continuous assessment</i>				
<i>P Computer Skills 171</i>				
Home department: COMPUTER SCIENCE				

55638 Conservation Ecology				
212	8	Conserving nature	2L, 1P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Biology 144</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
244	16	Conservation censusing	3L, 3P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Conservation Ecology 212</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
314	16	Biome ecology	3L, 3P	E
<p>Introduction to biomes and ecosystem services; key drivers; social-ecological systems of dynamics and biome-level management issues; ecology of tropical and afro-montane forests, woodlands, savannahs, treeless vegetation types; wetlands; animal diversity-habitat interactions; patterns of endemism.</p> <p><i>Subject to flexible assessment.</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
344	16	Introduction to conservation management	3L, 3P	E
<p>The relationship between society and the natural environment; history and philosophy of conservation; environmental and research ethics; cultural conservation; government and community influences on conservation; environmental legislation; environmental impact assessment (EIA); challenges in community based natural resource management; human environmental stressors; public opinion on environmental issues; the meaning of “the environment” and “nature” to people of various cultural and social backgrounds; conservation management for ecotourism and recreation; management plans and research.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Conservation Ecology 314</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				

414	16	Advanced conservation management	3L, 3P	E
<p>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, ecosystem health and emerging diseases, climate change, genetically modified organisms, pollution. There is a compulsory field trip during the Easter vacation.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Conservation Ecology 344</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
424	16	Wildlife management in a changing environment	3L, 3P	E
<p>Decision-making in the face of uncertainty; sustainable harvesting – terrestrial and marine environments; wildlife management – principles, habitat and game assessment, grazing management, sustainable utilisation, game capture and translocation, wildlife diseases, nutrition and contraception methods; planning and executing conservation-based research; case studies in conservation research.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
448	32	Conservation research project	6L, 6P	E
<p>Students develop and undertake a research project with supervision from a staff member with appropriate expertise. Project ideas can be co-developed between the student, course co-ordinator and conservation agencies, such as CapeNature, South African National Parks, private reserves and conservation non-government organisations (NGOs). Research projects could be for government or private reserves, or be species or community specific, e.g. a species recovery plan for a threatened species or ecosystem. Research projects can be on any topic related to nature conservation generally and agreed on between the student, supervisor and the course co-ordinator.</p> <p><i>Assessment: Report / mini-thesis (due October)</i></p> <p><i>P Conservation Ecology 314 or 344</i></p> <p><i>C Conservation Ecology 414</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				

14052 Crop Production				
152	8	Introduction to applied plant science	1.5L, 1.5P	A+i
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>C Biology 124</i>				
<i>P Biology 144 or 154 or</i>				
<i>P Crop Production 152</i>				
Home department: HORTICULTURAL SCIENCE				

53961 Crop Protection				
244	16	Introductory Plant Pathology and Entomology	3L, 3P	A+i
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				

13327 Crops for extensive production systems				
711	18	Crops for extensive production systems	3L, 3P	T
Identification, morphology and growth requirements of existing and new potentially important food, fibre, medicinal and industrial crops for the winter rainfall area; management practices for sustainable maximum production of the particular crops.				
<i>Subject to continuous assessment.</i>				
Home department: AGRONOMY				

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&E
<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&E
<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	E+i
<p>Macroeconomics: economic growth, business cycle, monetary and fiscal policy. Quantitative economics: general data analysis, mathematical and econometric techniques, input/output analysis. 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	E+i
<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 the macroeconomic policy debate.</p> <p><i>PP Economics 214</i> <i>P Economics 244</i> <i>C Economics 318</i></p> <p>Home department: ECONOMICS</p>				
388	24	Economics	2L, 2T	E+i
<p>Introductory applied econometrics: statistical concepts, the classical linear model of regression, multicollinearity, autocorrelation, heteroscedasticity, dummy variables, estimation of regression models.</p> <p>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.</p> <p>South African economic issues</p> <p><i>Continuous assessment</i> <i>PP Economics 214</i> <i>P Economics 244</i> <i>C Economics 318</i></p> <p>Home department: ECONOMICS</p>				

13345 Economics of sustainable agriculture				
876	8	Economics of sustainable agriculture (including farm management)		
<p>The module provides an introduction to the economics of the major aspects of sustainable agriculture. These include market analysis, contractual arrangements, environmental dimension and farm-level decision making.</p> <p>Learning outcomes</p> <p>At the end of the module the student is expected to be able to:</p> <ul style="list-style-type: none"> • apply basic notions of environmental economics • appreciate the organisation of supply chains • explain the basics of price formation process • explain the basics of competitiveness 				

- apply the basics of economic multipliers
- appreciate the basics of typical farm modelling as a farming system planning tool
- critically assess the potential of certification to value environmental services
- recognise market forces governing credit and insurance
- evaluate contractual arrangements as to land and labour.

Home department: AGRICULTURAL 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.

Flexible Assessment

C Engineering Mathematics 115

Home department: PROCESS ENGINEERING

46825 Engineering Drawings

123	15	Orthographic Drawings	1L, 3P, 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.

Flexible Assessment

Home department: MECHANICAL AND MECHATRONIC ENGINEERING

18791 Engineering Economy

212	8	Engineering Economics	2L, 2T	A+i
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Introduction to accounting: financing, tax and growth of a business. Income, balance sheet and cash flow statements. Financial ratios.

Flexible Assessment

Home department: INDUSTRIAL ENGINEERING

38571 Engineering Mathematics				
115	15	Introductory Differential and Integral Calculus	5L, 2T	A&E
<p><i>Any student who wishes to take this module must have achieved a mark of at least 6 (or 70%) for Mathematics in the NSC or the IEB's school-leaving certificate or must have successfully completed the first year of a suitable extended degree programme.</i></p> <p>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.</p> <p><i>Flexible assessment</i></p> <p>Home department: MATHEMATICS</p>				
145	15	Further Differential and Integral Calculus	5L, 2T	A&E
<p>Complex numbers; transcendental functions; integration techniques; improper integrals; conic sections; polar coordinates; partial derivatives; introduction to matrices and determinants.</p> <p><i>Flexible assessment</i></p> <p><i>P Engineering Mathematics 115</i></p> <p>Home department: MATHEMATICS</p>				
214	15	Differential Equations and Linear Algebra	4L, 2T	A&E
<p>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.</p> <p><i>Flexible assessment</i></p> <p><i>PP Engineering Mathematics 115 or 145</i></p> <p><i>P Engineering Mathematics 145</i></p> <p>Home department: MATHEMATICS</p>				

59498 Engineering Statistics				
314	15	Engineering Statistics	3L, 2.5T	A+i
<p>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; μ2 and K-S goodness-of-fit testing; simple linear and non-linear regression and correlation analyses; introduction to multiple linear regression; introduction to analysis of variance and experimental design.</p> <p><i>Flexible Assessment</i></p> <p><i>PP Engineering Mathematics 115, 145</i></p> <p>Home department: Statistics and Actuarial Science</p>				

59501 Enterprise Design				
444	15	Enterprise Design	2L, 2T	A+i
<p>Systems engineering, approaches towards enterprise modelling and supply chain management. Concepts like knowledge management, innovation, and different life cycles will be applied through the complete design of an enterprise within formal information, manufacturing and organisational architectures.</p> <p><i>Flexible Assessment</i></p> <p><i>Final-year enrolment</i></p> <p>Home department: INDUSTRIAL ENGINEERING</p>				

34576 Entomology				
314	16	Insect pest management	3L, 3P	T
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				

418	32	Insect diversity	6L, 6P	T
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
454	16	Applied insect ecology	3L, 3P	E
<p>Economically important insects: management for abundance using ecologically sensitive techniques. This includes looking at their biology and population dynamics; application of integrated pest management (IPM) tactics; ecosystem services. Introduction to practical methods to reduce pesticides / human impacts across agricultural landscapes.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				
464	16	Insect conservation ecology	3L, 3P	E
<p>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.</p> <p><i>Subject to flexible assessment.</i></p> <p>Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY</p>				

58335 Entrepreneurship and Innovation Management

214	16	Introduction to Entrepreneurship	4L	A&E
<p>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.</p> <p><i>C Business Management 113, 142</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
244	16	Small Business Management	4L	A&E
<p>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</p>				

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.

C Business Management 113, 142

P Entrepreneurship and Innovation Management 214

Home department: BUSINESS MANAGEMENT

318	24	Creativity and Innovation Management	4L	E+i
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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.

P Entrepreneurship and Innovation Management 214 or 244

Home department: BUSINESS MANAGEMENT

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: SCHOOL OF ACCOUNTANCY

288	32	Financial Accounting	4L	A&E
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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: SCHOOL OF ACCOUNTANCY

389	48	Financial Accounting	4L	A&E
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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 (No third-year Logistic Management modules may be taken in combination with Financial Accounting 389.)

Home department: SCHOOL OF ACCOUNTANCY

51047 Financial Management				
214	16	Introduction to Financial Management	3L, 1P	A&E
<p>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.</p> <p><i>Subject to continuous assessment</i></p> <p><i>C Business Management 113, 142 or Mathematics 114 or Mathematics (Bio) 124</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
244	16	Corporate Financial Management	3L, 1P	A&E
<p>The evaluation and interpretation of corporate financial performance by means of detailed ratio analyses; extensive analysis of the statement of cash flows; basic share and bond valuation; discussion of the influence of dividend policy on corporate valuations; the influence of financing policy on a firm's value; evaluation of working capital management by means of the cash conversion cycle.</p> <p><i>Subject to continuous assessment</i></p> <p><i>C Financial Management 214</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
314	12	Financial Planning and Control	2L	A+i
<p>Standardisation of published financial statements; reclassifying items from financial statements for managerial decision-making; application of financial planning process by means of financial forecasting; calculation of the sustainable growth rate; estimation of an optimal capital structure; the application of free cash flow valuations; the influence of inflation on annual financial statements.</p> <p><i>C Financial Management 214, 244 or C Investment Management 254</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>				
332	12	Capital Investments	2L	A+i
<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, 244 or</i> <i>C Investment Management 254</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
352	12	Financial Management Research	2L	A+i
<p>Identification and formulation of financial management problems and/or opportunities; setting financial research objectives; identifying appropriate research designs; conducting secondary and/or primary research; conducting financial data analysis to achieve research objectives.</p> <p><i>C Financial Management 214, 244 or</i> <i>C Investment Management 254</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
354	12	Mergers and Acquisitions	2L	A+i
<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, 244 or</i> <i>C Investment Management 254</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

21180 Food Factory Machinery				
414	15	Engineering Fundamentals of Food Processing	3L, 1P, 2T	A+i
<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>Flexible Assessment</i></p> <p>Home department: MECHANICAL AND MECHATRONIC ENGINEERING</p>				
444	15	Food Process Engineering	3L, 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 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.</p> <p><i>Examination</i></p> <p><i>P Food Factory Machinery 414</i></p> <p>Home department: MECHANICAL AND MECHATRONIC ENGINEERING</p> <p>Formula for Final mark: $P=0,5K+0,5E$</p>				

21210 Food Science				
144	16	Introduction to food science	3L, 3P	A+i or E+i
<p>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.</p> <p>Home department: FOOD SCIENCE</p>				
214	16	Commercial food processing and preservation I	3L, 3P	A+i or E+i
<p>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.</p> <p>Home department: FOOD SCIENCE</p>				

244	16	Commercial food processing and preservation II	3L, 3P	A+i or E+i
<p>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> <p><i>P Food Science 214</i></p> <p>Home department: FOOD SCIENCE</p>				
314	16	Animal food products	3L, 3P	A+i or E+i
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Food Science 244</i></p> <p>Home department: FOOD SCIENCE</p>				
324	16	Nutrition for the food scientist	3L, 3P	T
<p>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.</p> <p><i>PP Food Science 244</i></p> <p>Home department: FOOD SCIENCE</p>				
333	16	Quality management systems	3L, 3P	A+i or E+i
<p>Principles and advantages of quality and food safety management systems; fundamental principles of food safety, hygiene and the impact of food processing on food safety; prerequisite programmes; definitions, twelve stages and seven principles of HACCP; construction of a process flow diagram; 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>				

344	16	Food of plant origin	3L, 3P	T
<p>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.</p> <p><i>PP Food Science 244</i></p> <p>Home department: FOOD SCIENCE</p>				
354	16	Sensory analysis and process control	3L, 3P	A+i or E+i
<p>Introduction to sensory science; consumer sensory analysis, statistical analysis of data; correlation of data obtained through physical measurement and sensory analysis; fundamental principles and implementation of statistical food processing control. Compulsory visits to industry.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Food Science 244</i></p> <p><i>PP Biometry 242</i></p> <p>Home department: FOOD SCIENCE</p>				
454	16	Food packaging	3L, 3P	T
<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+i or E+i
<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, 333, 344, 354</i></p> <p>Home department: FOOD SCIENCE</p>				

488	32	Food chemistry and analysis	3L, 3P	A+i or E+i
<p>Advanced analysis of foods. Chemistry of proteins, carbohydrates, fats, enzymes, water, food additives and complex food systems.</p> <p><i>P Food Science 344</i> <i>PP Biochemistry 244</i> <i>PP Chemistry 264</i></p> <p>Home department: FOOD SCIENCE</p>				

11290 Forest Science				
171	12	Introduction	1L, 1P	E
<p>Introduction to forest and wood products science, global forest resources, the forest and wood products industry locally and internationally, plantation systems; silvicultural systems and agroforestry; an introduction to, and terminology of, forestry engineering; forest management, forest economics and forest policy. Composition of wood, decay, preservation, processing, sawmill layout, wood defects, grading, wood products, pulp and paper. One week of practical work in September is to be completed satisfactorily as part of this module.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
212	8	Natural forest ecosystems	2L, 2P	E
<p>The importance of natural forests and their functions, including products for livelihoods and industry and the management of woodlands and savannahs 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 of non-timber forest products.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
254	16	Forest mensuration and inventory	3L, 3P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Mathematics (Bio) 124</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

274	16	Dendrology	1L, 2P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
314	16	Silviculture I	3L, 3P	E
<p>Silviculture systems; site preparation; plantation establishment and regeneration; vegetation management; integrated pest- and disease management; environmental factors that influence tree and stand growth; species-site-market matching.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
344	16	Forestry development	3L, 3P	E
<p>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; 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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
354	16	Forest growth and yield science	3L, 3P	E
<p>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.</p> <p>One week of practical work in September to be completed satisfactorily as part of this module.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

355	16	Forest finance, economics, policy and marketing	3L, 3P	E
<p>Background to the forestry business environment in South Africa; International forest policy and processes; 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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
364	16	Timber harvesting	3L, 3P	E
<p>Introduction to timber-harvesting techniques; timber-harvesting equipment and systems; evaluation and selection of timber-harvesting systems; operational and tactical harvest planning; 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.</p> <p>One week of practical work (power-saw course) in September of the second year to be completed satisfactorily as part of this module.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Forest Science 254</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
414	16	Silviculture II	3L, 3P	E
<p>The eco-physiological basis for forest production; effects of silvicultural practices (coppice management, pruning, thinning and fertilisation) and environmental factors on stand growth; environmental sustainability and timber and pulp quality; nutritional management and nutrient cycles in forests; integrated fire management.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
424	16	Forest management and planning	3L, 3P	E
<p>Principles of business management; peculiarities in forest production systems; decision-making and decision support in forest management; planning techniques; classification and subdivision of land; annual planning of operations; scheduling of logging operations.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Forest Science 254</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

434	16	Forest roads and transport	3L, 3P	E
<p>Introduction to access development; forest road network planning; sequence of access suitability; influencing factors and road placement techniques. Introduction to road surveying; road construction materials and materials testing. Road construction techniques; road maintenance and drainage; impacts of roads on the environment, forest certification and road network management systems. Introduction to secondary timber transport; transport terminology and legislation; transport systems; interactions between timber harvesting, the road and timber transport. Introduction to logistics.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Forest Science 364</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
435	8	Silviculture III	2L, 2P	E
<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; developing, monitoring and evaluating nursery and tree improvement experiments.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Genetics 214</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
442	1	Experiential Work	1P	E
<p>Three weeks of practical work during the four years of study. Two-week study tour during the winter recess of the fourth year.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
468	32	Management plan	3L, 3P	E
<p>A study of the total industry or of a chosen or allocated management unit in the 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.</p> <p>The data collected at the management unit are analysed, processed and used for yield forecasting, yield regulation and financial, silvicultural, harvesting, roads and human resources planning. It will then be used for the compilation of a comprehensive management plan on the basis of which the module will be assessed</p> <p><i>No examination is written; class mark serves as final mark.</i></p> <p><i>C Forest Science 414, 424, 434</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

724	32	Tree propagation		
<p>Plant propagation of forestry species; principles and practices of tree propagation and nursery management; principles of sexual and asexual tree propagation; seed management principles.</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, co-ordinate 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>				
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; tactical 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	Tree improvement		
<p>Genetic tree improvement of forestry species; principles and practices of tree improvement; management breeding and research programmes; population genetics, quantitative traits and continuous variation within forestry species; selective processes and testing.</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>				

13285 Genetics				
214	16	Introductory Genetics	3L, 3P	A&E
<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; quantitative genetics and heredity.</p>				

<i>PP Biology 124 or 144 or 154</i>				
<i>P Mathematics (Bio) 124 or</i>				
<i>P Mathematics 114 or 144</i>				
Home department: GENETICS				
244	16	Introductory Molecular Biology	3L, 3P	A&E
The biology of the molecule of life. The structure of double-stranded DNA; the processes of replication and recombination of DNA; the deciphering and nature of the genetic code; the processes of transcription and translation; protein structure and function; the regulation of gene expression in prokaryotes and eukaryotes; DNA mutations; DNA repair and transposable elements; the construction and analysis of DNA clones; applications and ethics of recombinant DNA technology; introduction to bio-informatics.				
<i>P Genetics 214</i>				
Home department: GENETICS				
245	16	Introductory Plant and Animal Biotechnology	3L, 3P	A+i or E+i
This module follows on from the Genetics 215 module and introduces the student to first- and second-generation biotechnology in eukaryotic systems, including plants, animals and humans. First-generation biotechnology entails the use of organisms/ biological systems as they are, e.g. extracting pharmaceutical products from plants. In contrast, second-generation biotechnology focuses on more specialised techniques, e.g. <i>in vitro</i> propagation, mutagenesis and breeding. Themes that will be discussed include aquaculture, aquatic bioremediation, aquatic bioprocessing, embryogeny, assisted reproduction and embryo manipulation, cell and tissue culture for both plant and animal systems, micropropagation, and the identification, characterization and production of valuable natural products and pharmaceuticals in plants.				
[Presented by Departments Genetics, Plant Pathology, and the Institute for Wine Biotechnology.]				
Home department: GENETICS				
314	16	Genomes and Genome Analysis	3L, 3P	A+i or E+i
The module focuses on the organisation, structure and functionality of genomes and covers the following aspects: genome structure, genome organisation, genome function and methods to study genomes. Chromosome structure and organisation are also studied. Other complementary topics include: Introductory Bioinformatics to study genomes; chloroplast and mitochondrial genomes; genome models; genetics of development.				
<i>Continuous assessment.</i>				
<i>PP Genetics 244</i>				
Home department: GENETICS				

324	16	Molecular 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).</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Genetics 214</i> <i>C Genetics 244</i></p> <p>Home department: GENETICS</p>				
344	16	Advanced Topics in Molecular Genetics	3L, 3P	A+i
<p>Various advanced topics are addressed in this module and include: 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; applications from genome projects; personalised medicine and pharmacogenetics; epigenomics; genetic modification; cancer and apoptosis; gene therapy; genetics of behavioural traits.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Genetics 244</i></p> <p>Home department: GENETICS</p>				
354	16	Quantitative genetics	3L, 3P	T
<p>Quantitative traits and continuous variation; components of phenotypic and genetic variances; resemblance between relatives; estimation of heritability and breeding value; selection methods and genetic improvement; correlated traits; multiple traits selection; principles of marker-based selection; mapping and characterising of quantitative trait loci.</p> <p><i>Continuous assessment.</i></p> <p><i>P Genetics 324</i> <i>P Biometry 211 or 212</i></p> <p>Home department: GENETICS</p>				
414	16	Plant breeding techniques	3L, 3P	A
<p>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 breeders' rights.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Genetics 344</i></p> <p>Home department: GENETICS</p>				

444	16	Quantitative traits and selection methods	3L, 3P	A
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>P Genetics 414</i></p> <p>Home department: GENETICS</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: GEOGRAPHY AND ENVIRONMENTAL STUDIES</p>				
154	16	Introduction to Earth Systems Science	3L, 3P	A+i
<p>Introduction to Earth Systems Science; 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; Geology of South Africa; Energy and mineral resources; Humans and tectonics: earthquakes and volcanoes; The hydrosphere; Surface-water processes; Groundwater processes; Theory of the origin and evolution of life.</p> <p>Home department: EARTH SCIENCES</p>				

12923 Geographical Information Technology				
241	16	Spatial Data Management	3L, 3P	E
<p>Map projections and coordinate systems; spatial data modelling (e.g. vector, raster, object-orientated); topology and topological dimensions; topological-dimension conversions; geodatabases; data model and format conversions; data generalisation and aggregation.</p> <p><i>Continuous assessment</i></p> <p><i>P Geography and Environmental Studies 214</i></p> <p>Home department: GEOGRAPHY AND ENVIRONMENTAL STUDIES</p>				

312	16	Spatial Analysis	3L, 3P	E
Query operations and query languages; Geometric measures; Spatial analytical operations; Surface analysis; Geostatistics; Network analysis; Analysis design; Fuzzy sets.				
<i>Continuous assessment</i>				
<i>P Geography and Environmental Studies 214</i>				
<i>P Geographical Information Technology 241</i>				
Home department: GEOGRAPHY AND ENVIRONMENTAL STUDIES				

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 cartographic visualisation with a GIS; GIS applications.				
<i>P Geo Environmental Science 124</i>				
<i>C Mathematics 114 OR</i>				
<i>C Mathematics (Bio) 124</i>				
Home department: GEOGRAPHY AND ENVIRONMENTAL STUDIES				
324	16	Introduction to Geographical Information Systems	3L, 3P	E
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.				
<i>Subject to continuous assessment</i>				
Home department: GEOGRAPHY AND ENVIRONMENT STUDY				
334	16	Spatial modelling	3L, 3P	E
Models in science; Spatial models: types, construction, design and development; Cartographic modelling: terminology, methodology, in- and outputs, functions.				
<i>Subject to continuous assessment</i>				
<i>P Geography and Environmental Studies 214</i>				
Home department: GEOGRAPHY AND ENVIRONMENT STUDY				

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>No examination, class mark serves as final mark.</i></p> <p><i>P Crop Production 152 or Biology 154</i></p> <p>Home department: HORTICULTURAL SCIENCE</p>				
314	16	Deciduous fruit production	3L, 3P	T
<p>Biology and technology of deciduous fruit production (pome fruit, stone fruit and table grapes). Bearing habits, rootstocks, nursery tree quality, vegetative development, shoot 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 ripening.</p> <p><i>C Crop Production 214</i></p> <p>Home department: HORTICULTURAL SCIENCE</p>				
342	8	Citrus production	1.5L, 1.5P	T
<p>Biology and technology of citrus production. Rootstocks, nursery tree quality, vegetative development, shoot and root growth. Reproductive development, fruit growth, external and internal fruit quality.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
352	8	Ornamental, foliage and aromatic plant production systems	1.5L, 1.5P	T
<p>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.</p> <p>Home department: HORTICULTURAL SCIENCE</p>				
434	16	Applied plant physiology and tree architecture	3L, 3P	T
<p>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</p>				

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.

P Horticultural Science 314

Home department: HORTICULTURAL SCIENCE

444	16	Postharvest physiology and technology	3L, 3P	T
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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.

P Biochemistry 244

Home department: HORTICULTURAL SCIENCE

44792 Industrial Ergonomics

414	15	Industrial Ergonomics	3L, 1.5T	A+i
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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.

Flexible Assessment

Home department: INDUSTRIAL ENGINEERING

53937 Industrial Management

354	15	Industrial Management	3L, 2T	A+i
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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.

Flexible Assessment

P Production Management 314

Home department: INDUSTRIAL ENGINEERING

47422 Industrial Programming				
244	15	Industrial programming	2L, 3T	A+i
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.				
<i>Flexible Assessment</i>				
<i>P Engineering Mathematics 145</i>				
Home department: INDUSTRIAL ENGINEERING				

44776 Industrial Psychology (Special)				
354	12	Industrial Psychology (Special)	2L, 1S	E+i
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				

13341 Introduction to systems thinking				
870	6	Introduction to systems thinking		
Analysis of an existing farm and its environment by using a problem tree. The concept of a transect walk will be introduced. The issue of food security is studied as an overarching issue.				
In the lectures, systems thinking and the associated terminology and concepts are introduced including system boundaries, system components, system structure, internal and external factors.				
Learning outcomes				
At the end of the module the student is able to:				
<ul style="list-style-type: none"> • distinguish the main components of farming systems and rural livelihoods • appreciate the complexity of the farming systems and their context • explain the basic concepts of systems analysis • describe the importance of the different disciplines for the multiple dimensions of sustainable agriculture with food security as an overarching issue • use a problem tree to assess sustainability of a farming system. 				
Home department: ANIMAL SCIENCES				

13334 Intensive crop production systems				
771	18	Intensive crop production systems	3L, 3P	T
Morphology and physiology of the most important vegetable crops for intensive production systems; soilless production techniques (hydroponics); effect of different growth mediums and climate control systems; and optimum concentrations of nutrient solutions for different crops.				
<i>Subject to continuous assessment.</i>				
Home department: AGRONOMY				

55344 Investment Management				
254	16	Introduction to Investment Theory	3L, 1P	A+i
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>C Business Management 113</i>				
<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+i
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>				
<i>PP Statistical Methods 176 with 65% or</i>				
<i>PP Statistics 186 or</i>				
<i>PP Probability Theory and Statistics 114 or 144</i>				
Home department: BUSINESS MANAGEMENT				
324	12	Fixed Income Securities	1.5L, 0.5P	A+i
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 pre-payment; active portfolio management; economic analysis and management of bond portfolios.				
<i>P Investment Management 254</i>				
<i>PP Statistical Methods 176 with 65% or</i>				

<i>PP Statistics 186 or PP Probability Theory and Statistics 114 or 144</i>				
Home department: BUSINESS MANAGEMENT				
344	12	Derived Financial Instruments and Alternative Investments	1.5L, 0.5P	A+i
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>				
<i>PP Statistical Methods 176 with 65% or</i>				
<i>PP Statistics 186 or</i>				
<i>PP Probability Theory and Statistics 114 or 144</i>				
Home department: BUSINESS MANAGEMENT				
348	12	Real Estate Investment and Financing	4L	A+i
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</i>				
<i>C Financial Accounting 178 or 188</i>				
<i>PP Statistical Methods 176 with 65% or</i>				
<i>PP Statistics 186 or</i>				
<i>PP Probability Theory and Statistics 114 or 144</i>				
Home department: BUSINESS MANAGEMENT				

50407 Logistics Management				
214	16	Logistics Management	3L, 1P	A&E
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.				
<i>P Business Management 113</i>				
Home department: LOGISTICS				

244	16	Logistics Management	3L, 1P	A&E
<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>				
314	12	Logistics Management	2L	E+i
<p>Functional excellence: Major logistics activities related to transport, storage, packaging and handling covered in more detail than introduced in Logistics Management 214 and 244. Topics to cover: sourcing strategies and plans, total cost analysis, supplier selection and development, supplier collaboration, relationship management, negotiation and contracting, warehousing and materials handling, materials management, master production scheduling, product conversion, production and inventory control, process control & quality management, delivery management, warehousing layout and flow optimization, inventory control, international logistics (global), reverse logistics and its impact, waste management, maritime management, customer service, relationship management.</p> <p><i>PP Logistics Management 214, 244</i> <i>P 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 (No third-year Logistic Management modules may be taken in combination with Financial Accounting 389.)</i></p> <p>Home department: LOGISTICS</p>				
324	12	Logistics Management	2L	E+i
<p>Integrative excellence: Internal/functional integration as well as external integration with supply chain partners has become a business imperative. Business process integration is a critical enabler. Topics to cover: logistics planning and control, inventory planning and management, coordination of supply chains. Monitoring and control of logistics performance, measurement and standards, efficiency and effectiveness and financial performance indicators, client/customer requirements versus achievable logistics performance, review of logistics goals and objectives, risk management, sustainable logistics, logistics and the environment, closed-loop supply chains.</p> <p><i>PP Logistics Management 214, 244</i> <i>P 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 (No third-year Logistic Management modules may be taken in combination with Financial Accounting 389.)</i></p> <p>Home department: LOGISTICS</p>				

344	12	Logistics Management	2L, 1P	A+i
<p>Logistics analysis: For both functional excellence and integrative excellence, a variety of analytical techniques and enabling technology can be employed to support decisions on the short, medium and longer timeframes. Analytical techniques (descriptive and normative) and enabling technology (transactional vs. analytical information technology) form an integral part of the support decision makers require.</p> <p><i>PP Logistics Management 314, 324 (No third-year Logistic Management modules may be taken in combination with Financial Accounting 389.)</i></p> <p>Home department: LOGISTICS</p>				
354	12	Logistics Management	2L	A+i
<p>Logistics research:</p> <p>Defining the logistics 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 (if required) and basic statistical tests.</p> <p><i>PP Logistics Management 314, 324 (No third-year Logistic Management modules may be taken in combination with Financial Accounting 389.)</i></p> <p>Home department: LOGISTICS</p>				

23795 Marketing Management				
214	16	Marketing Management	3L, 1P	A&E
<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 Business Management 113, 142</i> <i>C Financial Management 214 or</i> <i>C Financial Accounting 278 or 288 or</i> <i>C Biometry 212</i> <i>C Mathematics (Bio) 124 (Only for BScAgric students) and</i> <i>C Statistical Methods 176 (Only for BScAgric students)</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

244	16	Advertising and Sales Promotion	3L, 1P	A&E
<p>Marketing communication, advertising and the marketing process; the consumer audience; marketing communication research; functioning of marketing communication; marketing communication planning and strategy in traditional and digital environments; media; media planning and buying; traditional, new and digital media; planning and execution of creative advertising aspects; 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&E
<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&E
<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 its measurement; 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&E
<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 or</i> <i>P Statistical Methods 176 or</i> <i>P Statistics 186</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				
354	12	Strategic Marketing	2L	A&E
<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><i>Any student who wishes to take this module must have achieved a mark of at least 6 (or 70%) for Mathematics in the NSC or the IEB's school-leaving certificate.</i></p> <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; polar co-ordinates; 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	A+i or E+i
<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.</p> <p><i>PP Biology 124 or 144</i> <i>PP Chemistry 124 and 144</i></p> <p>Home department: MICROBIOLOGY</p>				

244	16	Microbial Diversity	3L, 3P	E+i
<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> <i>PP Chemistry 124 and 144</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</i> <i>Chemistry 124</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 South African wine trade; industry structure in South Africa; legal issues and licensing. Understanding South African consumer preferences. Labelling legislation. Devising and using component Sensory evaluation of wine cultivars.</p> <p><i>P Chemistry 124</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. Permissible additives in wine.</p> <p><i>P Crop Production 152</i> <i>P Oenology 142, 214</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 124, 144</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
342	8	Postfermentation 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/visible 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</i></p> <p><i>P Oenology 342, 344</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

59528 Operations Research (Eng)				
345	15	Operations Research (Deterministic Models)	3L, 3T	A+i
<p>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> <p><i>Flexible Assessment</i></p> <p><i>P Engineering Mathematics 214</i></p> <p>Home department: INDUSTRIAL ENGINEERING</p>				

415	15	Operations Research (Stochastic Models)	3L, 3T	A+i
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. <i>Flexible Assessment</i> <i>P Engineering Statistics 314</i> Home department: INDUSTRIAL ENGINEERING				

13005 Physics (Bio)				
134	16	Introductory Physics for Biological Sciences A	3L, 3P	A&E
Selected topics, relevant to the biological sciences, from introductory mechanics, hydro-statics and optics. <i>Continuous assessment</i> <i>C Mathematics (Bio) 124 or</i> <i>C Mathematics 114</i> Home department: PHYSICS				
154	16	Introductory Physics for Biological Sciences B	3L, 3P	A&E
Selected topics, relevant to the biological sciences, from introductory electricity, magnetism, thermodynamics, gas laws, atomic physics, radioactivity, oscillations and waves. <i>Continuous assessment</i> <i>P Physics (Bio) 134</i> Home department: PHYSICS				

13328 Physiological and ecological principles of natural pasture management				
712	18	Physiological and ecological principles of natural pasture management		
Development and ecology of South African veld types; morphology and physiology of pasture plants; physiology of defoliation and plant response to it; 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> Home department: AGRONOMY				

13080 Physiology				
214	16	Physiological Principles and Systems	3L, 3P	A+i or E+i
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.				
<i>PP Biology 124, 154 or</i>				
<i>PP Biology (OCC) 111 or</i>				
<i>PP Physiology 114, 144</i>				
<i>C Biochemistry 214</i>				
Home department: PHYSIOLOGICAL SCIENCES				
244	16	Systems in Physiology	3L, 3P	A+i or E+i
Textbook-based overview of the following physiological systems of the body: Special sense organs, acid/base balance, blood, cardiovascular, renal and reproductive systems.				
<i>P Physiology 214</i>				
<i>C Biochemistry 244</i>				
Home department: PHYSIOLOGICAL SCIENCES				

32891 Plant Pathology				
314	16	Plant disease dynamics	3L, 3P	T
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
The underlying principles and methods used for plant disease control from pre-planting to postharvest. 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.				
<i>PP Plant Pathology 314</i>				
Home department: PLANT PATHOLOGY				

414	16	Taxonomy and biology of plant pathogens	3L, 3P	T
<p>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.</p> <p><i>PP Plant Pathology 314, 344</i></p> <p>Home department: PLANT PATHOLOGY</p>				
444	16	Plant-microbe interactions	3L, 3P	T
<p>The dynamic interaction between plants and micro-organisms, 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.</p> <p><i>PP Plant Pathology 314, 344</i></p> <p>Home department: PLANT PATHOLOGY</p>				
478	32	Advanced plant pathology	3L, 3P	T
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Plant Pathology 314, 344</i></p> <p>Home department: PLANT PATHOLOGY</p>				
771	16	Advanced plant disease dynamics		
<p>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.</p> <p>Home department: PLANT PATHOLOGY</p>				
772	16	Advanced disease management		
<p>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</p>				

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.

Home department: PLANT PATHOLOGY

773	10	Research methodology		
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Relevant and current experimental approaches and methods of analysis used in plant pathology. Experimental design and statistical analysis, molecular methods, phylogenetic analysis, paper reviews.

Continuous assessment.

Home department: PLANT PATHOLOGY

774	60	Project management and presentation		
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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.

Continuous assessment.

Home department: PLANT PATHOLOGY

775	18	Advanced topics in plant pathology		
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Topical issues in plant pathology will be discussed in this module. These include aspects such as climate change, food security and genetic modification. Students are expected to prepare properly for these discussions by doing internet searches and reading research papers and books on the individual topics. The topic will be introduced by an expert, after which a class discussion will follow. Students will be expected to prepare a one-page document of their views on the topic and list the literature sources that they have accessed.

Subject to continuous assessment.

Home department: PLANT PATHOLOGY

13342 Plant production and plant protection

872	8	Plant production and plant protection		
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This module focuses on integrated crop management and integrated pest management (IPM) within farming systems. It covers the complex relationships between soil, plants, microbes, growing practices and nutrient kinetics. This module provides knowledge and tools to understand the interactions between the biotic and abiotic factors in agrosystems in order to facilitate agricultural demands.

The module uses a systems approach to integrate disciplinary knowledge of plant production at various integration levels (plant, crop, farm) taking farming externalities, such as effluent and off-farm nutrients, into account. Attention will be paid to conservation agriculture including aspects such as no- and minimum till, rotational and intercropping, precision

agriculture, cover crops, green manuring and alternative crops.

Learning outcomes

At the end of this module the student is expected to be able to:

- describe the agro-ecological determinants of cropping systems
- use a systems approach to farms using basic knowledge of plant production
- recognise the influence of diverse farming methods on natural resources and on the environment
- explain insect and pathogen ecology as related to integrated pest management in diverse agricultural systems
- evaluate the dynamics of biological control of pests and diseases
- explain the processes related to the influence of climate change on crop production and crop protection.

Home department: AGRONOMY

23256 Production Management

212	8	Production and Operational Management	2L, 2T	A+i
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Introduction to operations management; strategy and sustainability; process analysis and manufacturing processes; lean supply chains; facility location; sales and operations planning; materials requirements planning (dependent inventory).

Flexible Assessment

Home department: INDUSTRIAL ENGINEERING

13336 Production physiology and technology for annual agronomical crops

742	18	Production physiology and technology for annual agronomical crops	3L, 3P	T
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Physiological processes involved in yield increases of temperate crops, crop rotations, soil tillage and biological management for sustainable production, quality improvement and utilization of crops.

Subject to continuous assessment.

Home department: AGRONOMY

59447 Professional Communication				
113	8	Professional Communication	2L, 1T	A&E
<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>Introduction to the engineering profession.</p> <p><i>Project</i></p> <p>Home department: ENGINEERING (ADMIN)</p>				

51993 Project Management				
412	12	Project Management	3L, 1T	A+i
<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 (25%) and the Department of Industrial Engineering (75%)]</p> <p><i>Flexible Assessment</i></p> <p>Home department: INDUSTRIAL ENGINEERING</p>				

46167 Quality Assurance				
344	15	Quality Assurance	3L, 3T	A+i
<p>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.</p> <p><i>Flexible Assessment</i></p> <p><i>P Engineering Statistics 314</i></p> <p>Home department: INDUSTRIAL ENGINEERING</p>				

59471 Quality Management				
444	15	Quality Management	2L, 3T	E+i
<p>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.</p> <p><i>Flexible Assessment</i></p> <p><i>P Engineering Statistics 314</i></p> <p>Home department: INDUSTRIAL ENGINEERING</p>				

13347 Quantitative analysis of land use systems				
881	8	Quantitative Analysis of Land Use Systems		
<p>The module deals with qualitative land evaluation and presents an overview of quantitative methods for regional land use analysis and design. The methods identify options for sustainable systems and land use and provide trade-offs among objectives. Disciplinary knowledge about economics, soil, water, climate, animals and plants is integrated at different levels. Important aspects of the various methods treated are their aim, spatial and temporal scale under different climate regimes and the use of biological information systems. The module will be illustrated primarily with a case study on fynbos, but other cases will also be used.</p> <p>Learning outcomes</p> <p>At the end of the module the student is expected to be able to:</p> <ul style="list-style-type: none"> • give an overview of the qualitative and quantitative methods for (sustainable) regional land use analysis; • give an overview and explain the role of models within land use design and planning; • explain competing claims between various types of land use, such as agriculture and nature conservation; • carry out a qualitative evaluation of sustainable land use using QUALUS; • understand the influence of temporal and spatial scales on the methodology and the results of land use analysis; • carry out data collection (mainly literature) on different aspects of sustainable land use. <p>Home department: AGRICULTURAL ECONOMICS</p>				

13349 Research thesis (Sustainable Agriculture)				
883	90	Research thesis		
Conduct a literature review on selected research topics, drawing up a research proposal, performing experiments, collection, processing and interpretation of data, writing a research report. Regular feedback on the above via oral presentations.				
Learning outcomes				
At the end of the module the student is expected to be able to				
<ul style="list-style-type: none"> • prepare a research proposal • conduct a literature review on selected research topics • perform experiments according to statistical designs • collect relevant data • process and interpret data • write a research report • provide feedback on the above via oral presentations to peers, academic staff and relevant industry partners 				
Home department: ANIMAL SCIENCES				

19003 Sociology				
334	12	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.				
A system of continuous assessment is used in module 334 (Environmental Sociology).				
Home department: SOCIOLOGY AND SOCIAL ANTHROPOLOGY				

13344 Sociology of sustainable agriculture				
875	6	Sociology of sustainable agriculture		
An introduction to sociological perspectives on social relationships (including gender), sustainability, land and the environment. Topics covered include the sociological imagination; introduction to the sociology of the environment; sociological debates on sustainability, development, and livelihoods; social stratification, gender and diversity; sociological perspectives on land and conservation issues in South African society and participatory research methodologies.				
Learning outcomes				
At the end of the module the student is expected to be able to:				
<ul style="list-style-type: none"> • appreciate the value of 'the sociological imagination' for understanding human action and social relationships in agricultural contexts 				

- explain key sociological concepts, e.g. social structure, human agency, modernisation, power, social stratification, gender, social identity
- join key sociological debates on sustainability, livelihoods and the sociology of the environment
- describe the social dynamics in the South African countryside, including in relation to land and conservation
- be able to apply the concepts and principles of social analysis presented in this module to the broader social context in which sustainable agriculture is defined and practised
- apply participatory research methodologies useful for research and practice in the management of natural and agricultural resources.

Home department: CONSERVATION ECOLOGY AND ENTOMOLOGY

14176 Soil Science

114	16	Principles of soil science	3L, 1.5P	T
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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.

Subject to continuous assessment.

Home department: SOIL SCIENCE

142	8	Applications of soil science	1.5L, 1.5P	T
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Principles of plant nutrition and fertilisation; ground water and irrigation; salinity and drainage; soil management.

Subject to continuous assessment.

P Soil Science 114

Home department: SOIL SCIENCE

214	16	Introduction to Soil Science	3L, 3P	A+i or E+i
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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.

P Chemistry 144

Home department: SOIL SCIENCE

244	16	Plant nutrition and fertilisation	3L, 3P	T
<p>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.</p> <p><i>P Soil Science 214</i> <i>P Chemistry 124, 144</i></p> <p>Home department: SOIL SCIENCE</p>				
314	16	Genesis, morphology, classification and uses of soil	3L, 3P	T
<p>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.</p> <p><i>P Soil Science 214</i> <i>P Chemistry 124 and 144</i></p> <p>Home department: SOIL SCIENCE</p>				
344	16	Soil and water management	3L, 3P	T
<p>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.</p> <p><i>P Soil Science 214, 244, 314</i> <i>P Mathematics (Bio) 124</i></p> <p>Home department: SOIL SCIENCE</p>				
414	16	Advanced soil physics	3L, 3P	T
<p>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).</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Soil Science 214, 244</i> <i>P Soil Science 314, 344</i></p> <p>Home department: SOIL SCIENCE</p>				

424	16	Advanced soil chemistry	3L, 3P	T
<p>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).</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Soil Science 214, 244</i> <i>P Soil Science 314, 344</i></p> <p>Home department: SOIL SCIENCE</p>				
444	16	Advanced pedology	3L, 3P	T
<p>Weathering of minerals and rocks: important crystalline layer silicate clay minerals and amorphous weathering products in soils; techniques of mineral identification; advanced soil genesis; development and nature of the South African soil landscape; age of soils; international soil classification systems. (Laboratory and practical fieldwork.)</p> <p><i>Subject to continuous assessment.</i></p> <p><i>PP Soil Science 214, 244</i> <i>P Soil Science 314, 344</i></p> <p>Home department: SOIL SCIENCE</p>				
454	16	Advanced resource management	3L, 3P	T
<p>Practically orientated chemical, physical and pedological field and laboratory investigations, with a theoretical foundation; technical report and recommendations; evaluation of the literature; writing and presentation of articles and seminars on subjects related to soil science.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Soil Science 414, 424, 444</i></p> <p>Home department: SOIL SCIENCE</p>				

19690 Statistical Methods

176	18	Statistical Methods with Computer Implementation	3L, 2T	A&E
<p><i>* First semester: 3L, 1½T; Second semester: 2L, 1½T</i></p> <p><i>Sampling techniques:</i> Simple random; Stratified; Systematic; Cluster; Probability proportional to size.</p> <p><i>Descriptive Statistics:</i> Various data types; Stem-and-leaf display; Frequency distributions; Graphical representation of data (histogram, polygons, bar and pie charts);</p> <p>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).</p> <p><i>Probability theory:</i> Basic probability concepts (sample spaces, events, addition and</p>				

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%.

Differences between Statistics 186 and Statistical Methods 176:

In Statistics 186 and Statistical Methods 176 similar statistical techniques are covered. However, in Statistics 186 basic mathematical techniques are revised and expanded, which are not covered in Statistical Methods 176. The Statistics 186 module is a normal exam written module with three tests that are written during the year and a final examination written at the end of the year. The Statistical Methods 176 module is a more practical module that focuses on applications in Excel and computer assignments. These assignments form an important component (40%) of this continuously assessed module.

Continuous assessment.

Home department: STATISTICS AND ACTUARIAL SCIENCE

19658 Statistics				
186	18	Introduction to Statistics	4L	A&E
<p><i>Linear programming:</i> Graphical techniques to solve problems with two variables; Shadow prices; Sensitivity analyses.</p> <p><i>Sampling techniques:</i> Simple random; Stratified; Systematic; Cluster; Probability proportional to size.</p> <p><i>Descriptive Statistics:</i> Various data types; Stem-and-leaf representations; Frequency distributions; Graphical representation of data (histograms, polygons, bar and pie charts); Descriptive measures of location, spread and association (mean, median, mode, percentiles, variance, standard deviation, coefficient of correlation); Box plots.</p> <p><i>Probability theory:</i> Basic probability concepts (sample spaces, events, addition and multiplication rules, conditional probabilities, probability trees, contingency tables); Bayes' theorem; Counting rules.</p> <p><i>Discrete random variables and probability distributions:</i> Expected value, variance and standard deviation of a discrete random variable; Covariance between discrete random variables; Portfolio management; Binomial and hypergeometric distributions.</p> <p><i>Basic calculus:</i> Introduction to differentiation and integration with simple applications.</p> <p>Continuous random variables and probability distributions: Expected value, variance and standard deviation of a continuous random variable; Normal distribution.</p> <p><i>Sampling distributions:</i> Central limit theorem; Sampling distributions of the mean, a proportion and the variance; Sampling distribution of the difference between two means.</p> <p>Inferential Statistics: Interval estimation and hypothesis testing for the mean, a proportion, the variance and the standard deviation; Interval estimation and hypothesis testing for the difference between two means and the ratio of two variances; Applications of interval estimation in auditing.</p> <p><i>Regression analysis:</i> The simple linear regression model; The method of least squares estimation; Inference on the model parameters and coefficient of correlation; Residual analysis.</p> <p><i>Time series analysis:</i> Components of a time series; Smoothing; Least squares trend fitting and forecasting; Index numbers.</p> <p><i>Differences between Statistics 186 and Statistical Methods 176:</i></p> <p>In Statistics 186 and Statistical Methods 176 similar statistical techniques are covered. However, in Statistics 186 basic mathematical techniques are revised and expanded, which are not covered in Statistical Methods 176. The Statistics 186 module is a normal exam written module with three tests that are written during the year and a final examination written at the end of the year. The Statistical Methods 176 module is a more practical module that focuses on applications in Excel and computer assignments. These assignments form an important component, 40% of the module, of this continuously assessed module.</p> <p>Home department: STATISTICS AND ACTUARIAL SCIENCE</p>				

214	16	Applied Statistics	3L, 2T	A+i
<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 deviation, coefficient of variation, percentiles); Approximate measures for grouped data; Box plots; Measure of association (coefficient of correlation); Determining the regression line.</p>				
<p><i>Probability theory:</i> Basic probability concepts (sample spaces, events, addition rules, multiplication rules, conditional probabilities, contingency tables); Bayes' theorem; Counting rules.</p>				
<p><i>Discrete random variables and probability distributions:</i> 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.</p>				
<p><i>Continuous random variables and probability distributions:</i> Expected value, variance and standard deviation of a continuous random variable; Uniform, normal and exponential distributions.</p>				
<p><i>Sampling distributions:</i> 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.</p>				
<p><i>Inferential statistics:</i> 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.</p>				
<p><i>Note</i></p>				
<p>Application of statistical techniques using Microsoft® Excel is emphasised throughout.</p>				
<p><i>Continuous assessment.</i></p>				
<p><i>PP Statistical Methods 176 with a final mark of at least 60 or</i></p>				
<p><i>PP Statistics 186 or</i></p>				
<p><i>PP Probability Theory and Statistics 114 or 144</i></p>				
<p><i>C Statistics 224 (Students who have passed Mathematics 114 or 144 are exempt from this.)</i></p>				
<p>Home department: STATISTICS AND ACTUARIAL SCIENCE</p>				

244	16	Statistical Inference	3L, 2T	A+i
<p><i>Sampling techniques:</i> Simple random sampling; Stratified sampling; Systematic sampling; Cluster sampling; Probability proportional to size sampling.</p> <p><i>Properties of estimators:</i> Unbiasedness; Efficiency; Consistency; Sufficiency; Robustness.</p> <p><i>Estimation methods:</i> Maximum likelihood; Method of moments.</p> <p><i>Simple linear regression analysis:</i> The simple linear regression model; Method of least squares estimation; Inference on the model parameters and the correlation coefficient; Residual analysis; Prediction intervals and confidence intervals.</p> <p><i>Multiple linear regression analysis:</i> The multiple linear regression model; Residual analysis; Inference on the parameters of the model; Regression models with dummy variables and interaction terms; Polynomial regression; Transformations; Collinearity; Variable selection.</p> <p><i>Analysis of variance:</i> Completely randomized factorial designs; Block designs.</p> <p><i>Non-parametric techniques for analysis of variance:</i> Wilcoxon's rank sum test; The sign test; Wilcoxon's signed-rank test; Kruskal-Wallis test; Friedman's test.</p> <p><i>Note</i></p> <p>Application of statistical techniques using Microsoft® Excel and STATISTICA is emphasised throughout.</p> <p><i>Continuous assessment.</i></p> <p><i>PP Statistics 214 and</i> <i>P Statistics 224</i></p> <p>Home department: STATISTICS AND ACTUARIAL SCIENCE</p>				

59587 Strategic Management				
344	12	Strategic Management	1.5L, 0.5P	A+i
<p>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.</p> <p><i>C Business Management 113 **Not applicable for students in Forest Science.</i></p> <p>Home department: BUSINESS MANAGEMENT</p>				

19712 Strength of Materials				
143	12	Introduction: Mechanics of Deformable Bodies	3L, 2T	A&E
Introduction to mechanics, internal forces and stresses, deformations and strain, material response: material law, axially loaded elements, torsion elements with circular cross section, symmetrical bending of beams, thin walled pressure vessels.				
<i>Flexible Assessment</i>				
<i>C Engineering Mathematics 115</i>				
<i>C Applied Mathematics B 124</i>				
Home department: CIVIL ENGINEERING				

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>P Business Management 113</i>				
Home department: LOGISTICS				

13343 Sustainable animal production				
873	8	Sustainable animal production		
This module will focus on livestock production both as an activity on its own, and as an integral part of a mixed system, together with crop production. Emphasis will be on cattle, pigs, small ruminants, poultry and wildlife. Topics to be taught in this module will be advanced principles of nutrition, breeding and genetics, physiology and how they relate to sustainable animal production, the environmental impact of different rangeland production systems, perception of welfare of the animals in view of markets and social acceptance.				
Furthermore, the module addresses various approaches that can be used to analyse problems with respect to sustainable development of livestock-related production. Students will learn how to tackle problems related to ecological, societal and economic sustainability. The course will also include a sustainability assessment of innovations in farming systems.				
Learning outcomes				
At the end of the module the student is expected to be able to:				
<ul style="list-style-type: none"> • explain advanced principles of animal production and how they relate to intensive and extensive animal production systems (small and large scale) in different biomes • calculate environmental indicators of animal production systems and their innovations 				

- explain the potential use of environmental indicators from a farm and life cycle perspective
- make a stakeholder analysis making use of a power analysis
- interview farmers and other stakeholders to obtain data on e.g. social sustainability issues such as animal welfare, power relations and gender and analyse it statistically
- evaluate the sustainability of innovations in farming systems using a round table discussion and a decision matrix.

Home department: ANIMAL SCIENCES

13340 Sustainable soil management

871	8	Sustainable soil management		
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This module covers Integrated Soil Fertility Management (ISFM) within crop production systems. As part of crop and soil fertility management, a systems approach is taken that analyses yield efficiencies, integrating disciplinary knowledge of crop production at various levels (plant, crop, farm). Insight is gained into agro-ecological determinants of soil that would influence cropping systems. The course addresses various methods/approaches that can be used to analyse problems with respect to sustainable development of crop related production. The macro and micro-organisms present in soils will be covered with specific reference to organisms that are pests or pathogens. Indicators of system performance are assessed and related to certification opportunities of sustainable agriculture.

Learning outcomes

At the end of this module the student is expected to be able to:

- explain production and ecological principles of crop production
- recognise and understand the importance of soil characteristics for crop production and select relevant nutrient and soil management solutions
- appreciate the complexity in the relationship between soil, including soil organisms, plant and cultivation practices
- interpret long-term carbon and nutrient balances of cropping systems
- evaluate cropping systems with respect to sustainability indices (e.g. soil quality, water and nutrient productivity, input-output ratios, biodiversity, landscape).

Home department: SOIL SCIENCE

13346 Systems analysis and simulation				
880	6	Systems analysis and simulation		
<p>This module introduces the student to complex agro-ecosystems. It will address system dynamics and simulation of simple systems in practical work. Model development, evaluation and exploration of management options will be illustrated by case studies. Specifically systems approaches will be applied to crop sciences, soil sciences and animal sciences to evaluate options for improved management.</p>				
<p>Learning outcomes</p>				
<p>At the end of the module the student is expected to be able to</p>				
<ul style="list-style-type: none"> • apply elementary concepts such as feedback, time coefficient, relational diagram, analysis of units and numerical integration methods, following the conventions of the systems analysis approach • analyse systems in terms of states, rates and driving variables • discuss the outcome of basic simulation models • explain how systems approaches can be applied in crop science, soil science and animal science and what their usefulness is for evaluating options for improved systems management • write simple simulation models. 				
<p>Home department: ANIMAL SCIENCES</p>				

38784 Theory of Interest				
152	6	Theory of Interest	2L, 1T	A&E
<p>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.</p>				
<p>Home department: STATISTICS AND ACTUARIAL SCIENCE</p>				

21008 Transport Economics				
214	16	Transport Economics	3L	A+i
<p>Introduction to Transport Economics: Role and functions of transport. Nature of the transport demand. Economic, physical and service characteristics of air, road rail, sea and pipeline 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 in South Africa.</p>				
<p><i>PP Economics 114, 144</i></p>				
<p>Home department: LOGISTICS</p>				

33081 Viticulture				
214	16	Wine grape cultivars and their establishment and maintenance; grapevine abnormalities	3L, 3P	T
<p>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.</p> <p><i>C Crop Production 152</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
244	16	Grape production	3L, 3P	T
<p>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.</p> <p><i>P Crop Production 152 or</i> <i>Biology 154</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
314	16	Table and raisin grape production, packaging and storage	3L, 3P	T
<p>Table and raisin grape production: the global industries, cultivars, production practices, spring/summer manipulations, pre-harvest physiology. Harvest and packaging, cooling and storage, postharvest quality factors.</p> <p><i>P Crop Production 152</i> <i>C Viticulture 214</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
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 space above and below ground). 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></p> <p><i>C Viticulture 454, 478</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				
454	16	Advanced vineyard management	3L, 3P	T
<p>Human resources 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 pests and diseases.</p> <p><i>PP Viticulture 314, 322, 344</i></p> <p><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></p> <p><i>C Viticulture 322, 444, 454</i></p> <p>Home department: VITICULTURE AND OENOLOGY</p>				

13329 Weed Management				
741	18	Weed management	3L, 3P	T
Characteristics of weeds; methods of weed control; principles of weed management programmes; mechanisms of chemical herbicide action; herbicide resistance. <i>Subject to continuous assessment.</i> Home department: AGRONOMY				

50997 Wine Biotechnology				
714	5	Chemical components of grapes and wine		
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. Home department: VITICULTURE AND OENOLOGY				
771	40	Research methodology for grapevine and wine biotechnology		
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. <i>Subject to continuous assessment.</i> Home department: VITICULTURE AND OENOLOGY				
772	25	Techniques in grapevine and wine biotechnology		
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. <i>Subject to continuous assessment.</i> Home department: VITICULTURE AND OENOLOGY				

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

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; wood quality.</p> <p><i>Subject to continuous assessment.</i></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 of moisture, long-term load, pressure treatment, load sharing. Strength grading of timber. The SABS timber design code.</p> <p><i>P Strength of Materials 143</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
244	16	Wood chemistry	3L, 3P	E
<p>Introduction to the chemistry relating to wood and wood products. Chemical composition (lignin, cellulose, hemicelluloses, extractives) and chemical utilisation of wood. Biological degradation of lignocellulosics.</p> <p><i>Subject to continuous assessment.</i></p> <p><i>C Engineering Chemistry 123 or Chemistry 144</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

264	16	Wood physics and drying	3L, 3P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
314	12	Surface finishing and wood preservation	2L, 3P	E
<p>Composition and properties of various surface finishes, including preservatives, surface preparation and coating application. Surface characterisation and performance testing, environmental aspects.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
335	16	Wood adhesives and composite products	3L, 3P	E
<p>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.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
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. 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><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
444	12	Bio-energy	2L, 2P	E
<p>Renewable energy sources, conversion of biomass into energy, biorefinery, processing methods, determination of calorific values and other properties, comparison of different biofuels, environmental aspects, emissions and emissions reduction, introduction to life cycle analysis for biofuels and bio-energy.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
468	32	Research project	3L, 3P	E
<p>Independent execution of a theoretical and/or practical investigation in any wood science related field, and the submission of a comprehensive research report.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				

754	16	Wood quality		
<p>Testing and analysis to evaluate wood quality: including wood and wood based products, durability, dimensional stability, hygroscopic and mechanical properties. Physical/chemical and biological degradation of wood; wood-protecting chemicals and treatment methods; environmental aspects of treatments, preservatives and preservative treated products.</p> <p><i>Subject to continuous assessment.</i></p> <p>Home department: FOREST AND WOOD SCIENCE</p>				
781	32	Wood properties		
<p>Tree growth; bulk, macroscopic, cellular, cell wall, ultra-structural and molecular properties of wood; variability between trees and within a tree 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>				
782	32	Primary wood processing		
<p>Theory of wood drying; drying technology: drying methods, kiln types and schedules; drying defects. 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	Bio-energy		
<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>				
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>				

13348 Work-integrated learning			
882	20	Work-integrated learning	
<p>Teams of students with a different disciplinary and preferably cultural background will carry out a design type project for a client. This client may be a company with activities related to agriculture in its widest sense (e.g. seed, fertilizer, machinery, food processing), a (research) institute, an NGO, or a consultancy firm. The project must have a direct relationship with the theme “sustainable agriculture”, the suitability of projects to be determined by the SU course coordinator. It could be design of new technologies, but it could also be a policy paper, a business plan, a communication plan or the draft of a plan for an integrated research programme. These project plans must address a realistic, existing problem or area of interest for the commissioner; plans should not be developed as a teaching exercise.</p> <p>The ultimate goal is for teams to reach an interdisciplinary synthesis of the information they have compiled and translate this into an advice on future actions for their client.</p> <p>Learning outcomes</p> <p>At the end of the module the student is expected to be able to:</p> <ul style="list-style-type: none"> • determine, with a team and in close interaction with a client, the goals of a project and formulate tasks and a project plan on the basis of their disciplinary knowledge and general academic skills and attitude • defend and sell their viewpoints and conclusions in a professional and representative way and academically correct • contribute at an academic level to the execution of an interdisciplinary project both in terms of process and content related to their own disciplinary training by gathering, selecting and analysing information and integrating this into project deliverables • implement reflective learning by an assessment of their personal functioning in and contribution to a professional team and reflection on this in writing and during an assessment interview • assess the contribution of other team members and other stakeholders on team functioning and execution of project tasks and appropriately reflect on these and give feedback in writing and verbally. <p>Home department: ANIMAL SCIENCES</p>			

Research and Service Bodies

Institute for Wine Biotechnology (IWBT)

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 cutting-edge 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 to 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 cross-breeding programme. The latter programme focuses on producing species hybrids and secondary hybrid derivatives in an attempt to transfer disease and salt tolerance genes from the wild species to the cultivated cereals. Even departments from other faculties, such as the Department of Botany and Zoology, make use of the facilities on the farm.

Mariendahl

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

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

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