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2025

AgriSciences

Academic programmes and faculty information

Yearbook, Part 7

forward together · sonke siya phambili · saam vorentoe

Please note that the University officially changed the English name "Calendar" to "Yearbook" in August 2023. The new name immediately came into effect in documents and communication of the University and will also be used in all Yearbook parts from the 2024 Yearbook onwards.

Accuracy, liability and changes

- Stellenbosch University has taken reasonable care to ensure that the information provided in the Yearbook parts is as accurate and complete as possible.
- Please note, however, that the University's Council and Senate accept no liability for any incorrect information in the Yearbook parts.
- The University reserves the right to change the Yearbook parts at any time when necessary.

The division of the Yearbook

- The Yearbook is divided into 13 parts.
- Part 1, 2 and 3 of the Yearbook contain general information applicable to all students. Make sure that you understand all provisions in Part 1 (General Rules) of the Yearbook that are applicable to you.
- Part 4 to 13 of the Yearbook are the Faculty Yearbook parts.

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

Availability of the Yearbook parts

- The electronic versions of the Yearbook parts are available at www.sun.ac.za/Yearbook.
- Part 1 to 12 are available in both English and Afrikaans. Military Science (Part 13) is only available in English.

Table of Contents

How to use this Yearbook part

This section gives you guidelines for finding particular information in the different chapters in this Yearbook part. Consult the table of contents for the page numbers of the chapters referred to below.

1. Where to find information

1.1 Prospective undergraduate students

- General Information chapter contains information about:
  - Communication with the Faculty and the University, which includes an explanation of the concepts "application number" and "student number" as well as relevant contact details where you can refer important enquiries to;
  - The University's Language Policy and Plan; and
  - The degree programmes that you can enrol for and the qualifications that you can obtain.
- Undergraduate Programmes chapter contains information about:
  - The Faculty's undergraduate study programmes;
  - The process of enrolment management, which entails selection for admission to programmes of study;
  - The minimum admission requirements for the various study programmes; and
  - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Subjects, Modules and Module Contents chapter contains:
  - An explanation of subjects as opposed to modules;
  - An explanation of the different digits used for the numbering of modules in the Undergraduate Programmes chapter; and
  - Definitions of prerequisite pass, prerequisite and corequisite modules.
- Alphabetical list of subjects is available in the back of this Yearbook part.

1.2 Prospective postgraduate students

- General Information chapter contains information about:
  - Communication with the Faculty and the University, which includes an explanation of the concept "student number" as well as relevant contact details where you can refer important enquiries to; and
  - The University's Language Policy and Plan.
- Postgraduate Programmes chapter contains information about:
  - The Faculty's postgraduate study programmes;
  - The minimum admission requirements for the various study programmes;
  - Specific closing dates for applications, and other relevant information, for example selection for admission; and
  - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Subjects, Modules and Module Contents chapter contains:
  - An explanation of subjects as opposed to modules; and
  - An explanation of the different digits used for the numbering of modules in the Postgraduate Programmes chapter.
- Alphabetical list of subjects is available in the back of this Yearbook part.

1.3 Registered undergraduate students

- General Information chapter contains information about;
  - Communication with the Faculty and the University with relevant contact details where you can refer important enquiries to;
  - The University's Language Policy and Plan; and
  - The granting of Dean's Concession Examinations to final-year students.
- Undergraduate Programmes chapter contains information about:
  - The Faculty's undergraduate study programmes; and

    - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Subjects, Modules and Module Contents chapter contains:
    - An explanation of subjects as opposed to 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 prerequisite pass, prerequisite and corequisite modules, as well as an indication at each module which of the requisites apply to it, if any; and
    - How individual modules are assessed.
- Alphabetical list of subjects is available in the back of this Yearbook part.

1.4 Registered postgraduate students

- Postgraduate Programmes chapter contains information about:
    - The Faculty's postgraduate study programmes; and
    - The subjects and modules that must be taken per academic year for the different study programmes, with choices where applicable.
- Subjects, Modules and Module Contents chapter contains:
    - An explanation of subjects as opposed to modules; and
    - An explanation of the different digits used for the numbering of modules in the Postgraduate Programmes chapter.
- Alphabetical list of subjects is available in the back of this Yearbook part.

General information

1. History, structure and mission of the Faculty of AgriSciences

1.1 History

When SU was officially established in 1918, Agriculture was one of the first four faculties and right from the outset it made an indelible contribution to agricultural education and research in South Africa. In 2006 the Faculties of Agriculture and Forestry merged to become the Faculty of AgriSciences. The Faculty of AgriSciences at Stellenbosch University is held in high esteem at national and international levels for the quality of our training and research and also as consultant in the agricultural and forestry industry.

1.2 Functions

Some of the challenges facing the present-day agricultural and forestry industries are the creation of employment and entrepreneurial opportunities, the provision of sufficient high-quality food, and sufficient plant and animal fibre at affordable prices. 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. Furthermore, we have to practice agriculture and forestry in harmony with nature to without exploiting natural resources. Our country has a large variety of animal and plant life that, while agricultural and forestry activities are being carried out, must be respected, protected and conserved to ensure that the quality of life of all South Africans is improved.

1.3 Structure

The Faculty consists of 11 departments, which are:

- Agricultural Economics;
- Agronomy;
- Animal Sciences;
- Conservation Ecology and Entomology;
- Food Science;
- Forest and Wood Science;
- Genetics;
- Horticultural Science;
- Plant Pathology;
- Soil Science; and
- Viticulture and Oenology.

The Faculty has two institutes, which are:

- South African Grape and Wine Research Institute
- The Institute of Plant Biotechnology

The Faculty has two experimental farms, Welgevallen and Mariendahl. The farms managed by the Faculty of AgriSciences, are mainly utilised for training at undergraduate level as well as for postgraduate projects by postgraduates and staff members.

1.4 Vision and mission

The vision of the Faculty of AgriSciences is 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.

Our mission 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.

To this end:

- our research forms a seamless continuum, from pioneering fundamental investigations, through market-driven applied research, to relevant 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; and
- every staff member is multi-skilled and of world-class standard.

2. Teaching, research and social impact

The Faculty of AgriSciences plays an important role in continuously advancing and improving agricultural and forestry productivity in South Africa while ensuring that natural resources are protected and used sustainably. We strive to supply the agricultural and forestry sectors with excellent research, top tuition and world class service. Consequently, the Faculty is one of the most important institutions which addresses the growing challenges to agriculture and forestry in its fields of study and research, and tries to find solutions.

South Africa has an exceptional variety of fauna and flora which is respected, protected and conserved in all agricultural and forestry practises. Therefore, it is also the Faculty's purpose to ethically and scientifically align the application and management of living organisms by means of training, research and community involvement. In doing so the quality of life of everyone in the country is improved.

2.1 Teaching

Our undergraduate and postgraduate programmes prepare students to act as competitive leaders and managers in the various sectors of both agriculture and forestry. The Faculty focuses on creating opportunities where all students can develop their full potential. This is done by researching and using the most suitable methods of teaching to encourage students to obtain all facets of the graduate qualities. The Faculty works closely with other support divisions to ensure success on undergraduate level, including additional tutor support, integration of information and communication technologies in the teaching and learning process. Interpreting services are also offered in certain areas.

2.2 Research

Agriculture and forestry are faced with many challenges to supply the increasing world population with sufficient quality, safe food and fibre and to manage these industries in a meaningful way. The Faculty of AgriSciences is fully aware of this responsibility and enthusiastically accepts these challenges. Accordingly, we aspire to provide excellent research in each of our departments to ensure the agricultural industry's progress and success.

The Faculty now has four government-funded South African Research Chairs Initiative chairs (the purpose of which is to boost research and innovation capacity of universities), in post-harvest technology, plant biotechnology, meat science and wine biotechnology. In addition, the accelerated outputs achieved in conservation ecology, food science, animal sciences and plant pathology are testimony to the Faculty's advances in both traditional and emerging fields of study.

This increased postgraduate emphasis has resulted in unprecedented numbers of master's and PhD graduates.

2.3 Social impact

The Faculty of AgriSciences is committed to the burning questions and development challenges of the present time and pays much attention to community interaction initiatives. These initiatives relate to poverty alleviation, food security, biodiversity, sustainability, the rural economy, postharvest technology, pests and diseases, water management, food processing, rural development and agribusiness.

We continuously extend our global network of collaboration to more universities and research institutes in various African countries and the East, where our academic interests continue to grow.

3. How to communicate with the Faculty

3.1 Contact details of the Faculty of AgriSciences

Direct specific enquiries related to the Faculty to the following address:

The Dean

Faculty of AgriSciences

Stellenbosch University

Private Bag X1

MATIELAND

7602

3.2 Physical address and contact details of the Dean's Office

Dean's physical address

Room 1027

JS Marais building

Victoria Street

Stellenbosch

Contact persons and details

Staff	Telephone number	E-mail address
Dean Prof D Brink	021 808 4737	db@sun.ac.za
Vice-Dean: Learning and Teaching Prof M du Toit	021 808 3772	mdt@sun.ac.za
Vice-Dean: Research, Innovation and Postgraduate Studies Prof K Dzama	021 808 4740	kdzama@sun.ac.za
Personal Assistant Ms K Vergeer	021 808 4792	ccav@sun.ac.za
Director: Faculty Management Dr M-J Freeborough	021 808 4802	mfree@sun.ac.za
Coordinator: Academic and Student Affairs Dr N Brown	021 808 2015	nbro@sun.ac.za
Undergraduate Recruitment and Marketing Mrs M Basson	021 808 2978	mh@sun.ac.za
Digital Marketing and Communications Officer Ms P Canham	021 808 9047	pcanham@sun.ac.za
Academic Coordinator Ms K Wirth	021 808 3550	wirthk@sun.ac.za
Faculty Administrator Mr E van Zyl	021 808 9305	erik@sun.ac.za

For more information on the Faculty of AgriSciences, visit us at http://agric.sun.ac.za.

3.3 Contact details of departments

Department	Telephone number	E-mail address	Web page
Agricultural Economics Prof A Jooste	021 808 4899	joostea@sun.ac.za	www.sun.ac.za/english/faculty/agri/agricultural-economics/Pages/default.aspx
Agronomy Prof PA Swanepoel	021 808 4668	pieterswanepoel@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/agronomy
Animal Sciences Dr JHC van Zyl	021 808 4746	brinkvz@sun.ac.za	www.sun.ac.za/english/faculty/agri/animal-science
Conservation Ecology and Entomology Prof F Roets	021 808 2635	fr@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/conservation-ecology
Food Science Prof GO Sigge	021 808 3581	gos@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/food-science/

Department	Telephone number	E-mail address	Web page
Forest and Wood Science Prof B Talbot	021 808 3293	bruce@sun.ac.za	www.sun.ac.za/english/faculty/agri/forestry
Genetics Prof C Rhode	021 808 5834	clintr@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/genetics
Horticultural Science Dr EM Crouch	021 808 4763	elke@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/horticulture
Plant Pathology Dr C Lennox	021 808 4796	clennox@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/plant-pathology/Pages/default.aspx
Soil Science Prof C Clarke	021 808 3659	cdowding@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/soil-science
Viticulture and Oenology Dr AE Strever	021 808 4545	aestr@sun.ac.za	https://www.sun.ac.za/english/faculty/agri/viticulture-oenology
Institute for Plant Biotechnology (part of Dept of Genetics) Dr S Peters	021 808 3836	swpeters@sun.ac.za	www.sun.ac.za/english/faculty/agri/plant-biotech
South African Grape and Wine Research Institute (part of Dept of Viticulture & Oenology) Prof MA Vivier	021 808 3773	mav@sun.ac.za	http://sagwri.sun.ac.za/

3.4 Contact details of the AgriSciences Student Association

The AgriSciences Students Association (ASA) is an association for students in agricultural or forestry sciences of Stellenbosch University. The association strives to promote both your academic and social interests. It achieves these goals by representing you on faculty and other academic bodies and committees within the University.

The ASA welcomes you to the Faculty of AgriSciences. Contact us at asa@sun.ac.za.

4. How to communicate with the University

4.1 Prospective students

- The University allocates an application number to you (for example APP/1234567) when you apply to study at the University.
- The application number is a unique number to identify you and to simplify future communication with the University regarding all your programme applications in a given year.
- Use your application number every time you communicate with the University.

4.2 Current or former Stellenbosch University students

- The University allocates a student number to you when you apply to study at the University.
- The student number is a unique number to identify you and to simplify future communication with the University.
- Use your student number every time you communicate with the University.

4.3 Contact details of the University

You can send enquiries regarding your studies, bursaries and loans, and residence placements to the following address:

The Registrar

Stellenbosch University

Private Bag X1

MATIELAND

7602

You can send enquiries regarding finances and services, including services at University residences, to the following address:

The Chief Operating Officer

Stellenbosch University

Private Bag X1

MATIELAND

7602

Visit the University's website at http://www.sun.ac.za.

5. Language at the University

Stellenbosch University (SU) is committed to engagement with knowledge in a diverse society and through the Language Policy aims to increase equitable access to SU for all students and staff. Multilingualism is promoted as an important differentiating characteristic of SU. Afrikaans, English and isiXhosa are used in academic, administrative, professional and social contexts. Pedagogically sound teaching and learning are facilitated by means of Afrikaans and English.

More information concerning language at SU is available on the website www.sun.ac.za/language.

6. Qualifications offered in the Faculty of AgriSciences

You can obtain the following qualifications in the Faculty of AgriSciences. Consult the chapters "Undergraduate Programmes" and "Postgraduate Programmes" for more information regarding your specific programme.

6.1 Plant and Soil Sciences

Programme	Qualification
Bachelor's programme in Plant and Soil Sciences	BScAgric
Postgraduate Diploma in Agronomy	PgDip (Agronomy)
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 or PhD (Agric)
DSc programme in Agronomy, Entomology, Genetics, Horticultural Science, Nematology, Plant Pathology, Soil Science or Viticulture	DSc

6.2 Food Production Systems

Programmes	Qualifications
Bachelor's programme in Food Production Systems	BSc Food Sc
Master's programme in Food Production Systems	MSc Food Sc
MSc in Food and Nutrition Security	MSc (Food and Nutrition Security)
PhD programme in Food Production Systems	PhD
DSc programme in Food Production Systems	DSc

6.3 Wine Production Systems

Programmes	Qualifications
Bachelor's programme in Grapevine and Wine Sciences	BScAgric
Honours programme in Wine Production Systems	BScHons (Wine Biotechnology)
Master's programme in Wine Production Systems	MSc or MScAgric (Wine Biotechnology) or MScAgric (Oenology or Viticulture) or MSc (Agric)
PhD programme in Wine Production Systems	PhD (Oenology, Viticulture or Wine Biotechnology) or PhD (Agric)
DSc programme in Wine Production Systems	DSc (Oenology, Viticulture or Wine Biotechnology)

6.4 Animal Production Systems

Programmes	Qualifications
Bachelor's programme in Animal Production Systems	BScAgric
Postgraduate Diploma in Aquaculture	PgDip (Aquaculture)
Master's programme in Animal Production Systems	MScAgric
PhD programme in Animal Production Systems	PhD or PhD (Agric)
DSc programme in Animal Production Systems	DSc

6.5 Agricultural Economics and Management

Programmes	Qualifications
Bachelor's programme in Agricultural Economics and Management	BScAgric or BAgric (Agri-business Management)
Honours programme in Agri-business Management	BAgricHons
Master's programme in Agricultural Economics and Management	MScAgric or MAgric
PhD programme in Agricultural Economics and Management	PhD or PhD (Agric)
DSc programme in Agricultural Economics and Management	DSc

6.6 Forestry and Wood Sciences

Programmes	Qualifications
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) or PhD (Agric)

DSc programme in Forestry and Wood Sciences	DSc (For)

6.7 Conservation Ecology

Programmes	Qualifications
Bachelor's programme in Conservation Ecology	BScConsEcol
Master's programme in Conservation Ecology	MScConsEcol
PhD programme in Conservation Ecology	PhD (ConsEcol) or PhD (Agric)
Master's programme in Entomology	MSc or MScAgric
PhD programme in Entomology	PhD or PhD (Agric)
DSc programme in Entomology	DSc
Master's programme in Nematology	MSc or MScAgric
PhD programme in Nematology	PhD or PhD(Agric)
DSc programme in Nematology	DSc

6.8 Agricultural Production and Management

Programme	Qualification
Bachelor's programme in Agricultural Production and Management	BAgric

On the basis 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 Elsenburg Agricultural Training Institute on the Elsenburg Campus. For all information about this programme contact the Institute directly at 021 808 5451 or visit their website at www.elsenburg.com.

*Please note: The BAgric (Agri-business Management) programme is offered at Stellenbosch University.

6.9 Interdisciplinary BDatSci programme

Programme	Qualification
Bachelor's programme in Data Science	BDatSci

6.10 Multidisciplinary MSc (Sustainable Agriculture) programme

Programme	Qualification
Master's programme in Sustainable Agriculture	MSc (Sustainable Agriculture)

6.11 Bioinformatics and Computational Biology

Programme	Qualification
Master's programme in Bioinformatics and Computational Biology	MSc
PhD programme in Bioinformatics and Computational Biology	PhD
Master's programme in Bioinformatics of Infectious Diseases and Pathogen Genomics	MSc

7. Profile of the graduates of the Faculty of AgriSciences

As one of our graduates you are a scientist who has the necessary knowledge, skills and disposition to function optimally, whether independently or in team context, in a scientific agricultural or agriculturally related environment. This means that you will be able to implement the relevant sciences sensibly in the 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, you will display the below-mentioned professional characteristics as a graduate. It means that you:

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.

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.

Attitude and disposition

- Show respect for the environment and those who use it.
- Acknowledge the limitations of your own knowledge and skills.
- Have a positive disposition to continuous professional development.
- Are involved in and provide a 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.

8. Standing rules for Dean's Concession Assessments (DCAs)

Please refer to the Part 1 (General Rules) of the Yearbook, Section 7, for the rules pertaining to the Dean's Concession Assessments (DCAs).

9. Assessment

9.1 The general assessment provisions that apply to modules and programmes are available in Yearbook Part 1 (General Rules). Please take note of these important provisions.

9.2 You can find the test and/or assessment dates in the module guides available on SunLearn.

9.3 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 A2 period).

9.4 Tests are scheduled so that they do not coincide with the mid-semester tests of other faculties.

10. Information on admission, registration, accommodation and regulations

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

11. Agriculture and Forestry in South Africa

11.1 Agriculture

In South Africa agriculture provides in people's basic needs for food and fibre. Agriculture contributes about 2% to the gross domestic product and it is an important earner of foreign exchange. Furthermore, it is a large employer; 5% of formal job opportunities. 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. 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 1,3 million ha are planted with trees. 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 still 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.

11.2 Forestry

South Africa has beautiful forests and 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 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, 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 aesthetic 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 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. Our graduates enjoy high regard in the domestic and international labour market.

Undergraduate programmes

1. Instructional programmes and fields of study

The Faculty's instructional programmes train you in one of seven industry sectors, namely:

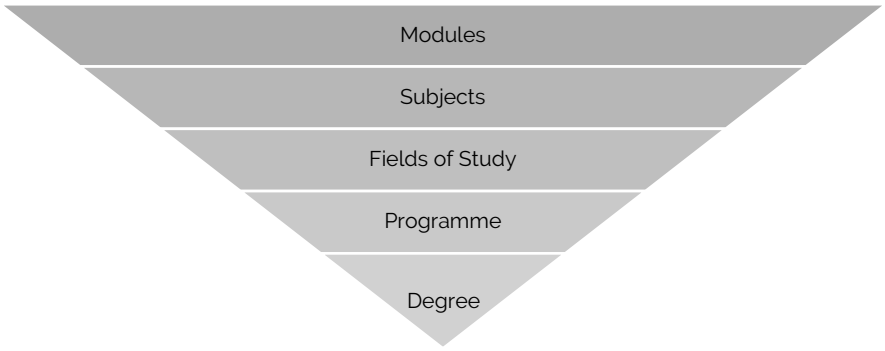
- Plant and Soil Sciences;
- Animal Production Systems;
- Food Production Systems;
- Wine Production Systems;
- Agricultural Economics and Management;
- Forestry and Wood Sciences; and
- Conservation Ecology.

You must first select one of the seven abovementioned instructional programmes. Each instructional programme consists of various fields of study from which you must make a choice. Each field of study consist of a number of specific modules; a module is a predetermined study unit.

The modules in each of the instructional programmes are grouped in such a way that they contain all the information needed to ensure comprehensive training within a particular field of the selected programme. Each instructional programme consists of various fields of study which give you the opportunity to make a refined choice within the broader programme. These fields of study are related but each one forms a specialisation within the training programme as a whole.

The field of specialisation is determined by the combination of major subjects selected for each field of study. You will study basic scientific principles ever more deeply from the first year of the programme, to culminate in the final year of study into two major subjects. This provides you 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, when you obtain a bachelor's degree you are equipped to achieve success in any career relating to agriculture or forestry. The following scheme represents the hierarchy from modules to a degree:



After obtaining your bachelor's degree you can proceed with an honours, master's or doctoral degree in one of the specialisation fields of the broader instructional programmes. After obtaining these qualifications you are able to enter the labour market as a specialist in your field.

The first year of all study fields (with the exception of the BAgric (Agri-business Management) and BScAgric (Agricultural Economic Analysis and Management) programmes) 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. Your specific combination is given in your specific study programme later in this chapter.

From the second year of study, you join your selected study programme offered mainly in the Faculty of AgriSciences.

In the case of the BAgric (Agri-business Management) and BScAgric (Agricultural Economic Analysis and Management) programmes, you join the programme in the first year which is mainly offered in the Faculty of AgriSciences.

2. Undergraduate enrolment management

In order to meet the targets of Council with regard to the total number of students and the fields of study and diversity profile of the student body of Stellenbosch University, it is necessary to manage the undergraduate enrolments at Stellenbosch University. The University's total number of enrolments is not

only managed to accommodate its available capacity, but we are committed to the advancement of diversity.

The University's undergraduate enrolment is managed within the framework of the national higher-education system. We strive toward a well-grounded cohesion between national and institutional goals, respecting important principles such as institutional autonomy, academic freedom and public responsibility. The following points of departure apply:

- High academic standards are maintained for the expansion of academic excellence
- The University attempts to maintain and continuously improve high success rates.
- The University is committed to rectification, social responsibility and training future role models from all population groups.
- The University strives to expand access to higher education especially for students from educationally disadvantaged and economically needy backgrounds who possess the academic potential to successfully study at the University.

Please note that, due to the limited availability of places and the strategic and purposeful management of enrolments, you will not be automatically admitted to Stellenbosch University even if you meet the minimum requirements of your chosen programme. You can find more details about the selection procedures and admission requirements for undergraduate programmes in this chapter, on the Faculty's website at https://agric.sun.ac.za/ and at www.maties.com.

As a prospective undergraduate student, you must write the National Benchmark Tests (NBT). Consult the NBT website at www.nbt.ac.za or the University's website at www.maties.com for more information on the National Benchmark Tests. The University can use the results of the National Benchmark Tests for the following purposes:

- To help determine whether you must be placed in an extended curriculum programme;
- For selection in a specific programme; and
- Curriculum development.

3. Admission requirements

3.1 School-leaving qualifications

- For admission to the University you need:
  - A National Senior Certificate (NSC) or school-leaving certificate from the Independent Examination Board as certified by Umalusi with admission to bachelor's (which requires that you obtain a mark of at least 4 (50-59%) in each of four designated university admission subjects); or
  - A university exemption certificate issued by the South African Matriculation Board to students with other school qualifications.

3.2 Minimum admission requirements for the Faculty's degree programmes

- In addition to the school-leaving qualifications in 3.1, the admission requirements for the programmes **BScAgric, BScFor (field of study Forestry and Natural Resources Sciences), BScConsEcol, BSc Food Sc and BAgric (Agri-business Management)** are as follows**:**
  - An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
  - English or Afrikaans (Home Language or First Additional Language) – 4 (50%);
  - Mathematics – 5 (60%); and
  - Physical Sciences (Physics and Chemistry) – 4 (50%).
- In addition to the school-leaving qualifications in 3.1, the admission requirements for the field of study **BScFor (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;
  - English or Afrikaans (Home Language or First Additional Language) – 4 (50%);
  - Mathematics – 6 (70%); and
  - Physical Sciences (Physics and Chemistry) – 5 (60%).
- In addition to the school-leaving qualifications in 3.1, the admission requirements for the field of study **BAgric (Agricultural Production and Management)** are:
  - English or Afrikaans (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%).

3.3 Admission to the extended curriculum programme (ECP)

Background

The extended curriculum programme (ECP) 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 ECP. During this extra year you will receive additional academic support as preparation for specific mainstream subjects and for university studies in general.

In all fields of study in the Faculty of AgriSciences except *Agri-business Management* and *Agricultural Economic Analysis and Management*, the ECP includes an additional year of study before you start the first year of study of your chosen mainstream degree programme. The curriculum of this additional year is specifically designed to provide you with additional academic support and to facilitate the transition between school and university. You must pass all the modules of this year to gain admission to the first year of the mainstream programme.

For the ECP in the fields of study *Agri-business Management* and *Agricultural Economic Analysis and Management* the first year of the mainstream degree programme is spread over two years, with the addition of the following compulsory modules: Introduction to Economics 141; Financial Accounting 179 and Mathematics for Economic and Management Sciences 171. You must pass all prescribed modules for these two years to gain admission to the second year of the mainstream programme.

Even if you have been admitted to a mainstream programme you can apply for admission to your programme's ECP. Based on your school results and/or the results of any assessment or test, including the NBTs, prescribed by the University, you may be advised or compelled by the Faculty to follow the ECP route.

Minimum admission requirements for the ECP in BScAgric, BScFor, BScConsEcol and BAgric (Agri-business Management)

- The minimum admission requirements for the ECP in the programmes BScAgric, BScFor (Forestry and Natural Resource Management), BScConsEcol and BAgric (Agri-business Management):
  - An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
  - English or Afrikaans (Home Language or First Additional Language) – 4 (50%);
  - Mathematics – 4 (between 55% and 59,9%) **AND** Physical Sciences (Physics and Chemistry) – 4 (50%)
    OR
  - Mathematics – 5 (60%) **AND** Physical Sciences (Physics and Chemistry) – 3 (between 45% and 49,5%).
- The minimum admission requirements for the ECP in BScFor (Wood and Wood Products Sciences):
  - An average performance level of 60% in the NSC or the IEB's school-leaving certificate (excluding Life Orientation), or other school qualification;
  - English or Afrikaans (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

All necessary information on the structure and curriculum of the ECP will be supplied to you if you want to or are required to register for the ECP. You can also obtain the information from Client Services at 021 808 9111.

First-year curriculum for the ECP in BScAgric, BScFor and BScConsEcol

FIRST YEAR (146 CREDITS)

Compulsory modules

Biology	146(16)
Chemistry	176(32)
Computer Skills	176(8)
Physics	176(32)
Scientific Communication Skills	116(12), 146(6)
University Practice in the Natural Sciences	176(8)

and

Mathematics (Bio)	176(32) **OR**
Mathematics	186(32)

First-year curriculum for the ECP in BScFor with focus area: Wood and Wood Products Sciences

First Year (146 credits)

Compulsory modules

Chemistry	176(32)
Computer Skills	176(8)
Mathematics	186(32)
Physics	176(32)
Scientific Communication Skills	116(12), 146(6)
Preparatory Technical Drawings	146(16)
University Practice in the Natural Sciences	176(8)

Take note of the following:

- During the first year of the programme your knowledge base will be strengthened, and your skills will be developed to prepare you to enter the mainstream modules from your second year of study.
- Class attendance is compulsory, and you must pass all modules in Year 1 to proceed to the next year of study.
- You cannot repeat modules from the first year in your second year of study. This means that poor class attendance or failing one or more modules in Year 1 will result in you not being readmitted to the extended curriculum programme.
- If you complete this degree programme successfully, you will receive a degree certificate from the University that is exactly the same as those received by mainstream students.

First-year curriculum for the ECP in BScAgric (Agricultural Economic Analysis and Management)

First Year (82 credits)

Compulsory modules

Animal Production Physiology	112(8)
Computer Skills	171(4)
Crop Production	152(8)
Introduction to Economics	141(12)
Financial Accounting	179(26)
Mathematics for EMS	171(18)
Theory of Interest	152(6)

Second Year (100 credits)

Compulsory modules

Business Management	113(12), 142(6)
Economics	114(12), 144(12)
Mathematics (Bio)	124(16)
Soil Science	114(16), 142(8)
Statistics and Data Science	188(18)

Take note of the following.

- You must pass all prescribed modules for these two years to gain admission to the second year of the mainstream programme.

First-year curriculum for the ECP in BAgric (Agri-business Management)

First Year (82 credits)

Compulsory modules

Animal Production Physiology	112(8)
Computer Skills	171(4)
Crop Production	152(8)
Introduction to Economics	141(12)
Financial Accounting	179(26)
Mathematics for EMS	171(18)
Theory of Interest	152(6)

Second Year (96 credits)

Compulsory modules

Business Management	113(12), 142(6)
Economics	114(12), 144(12)
Introduction to Transport and Logistics Systems	144(12)
Soil Science	114(16), 142(8)
Statistics and Data Science	188(18)

Take note of the following.

- You must pass all prescribed modules for these two years to gain admission to the second year of the mainstream programme.

4. Compulsory practical work

If you are taking the BScAgric degree programme with one or more majors in Animal Science, Soil Science or Grapevine and Wine Sciences you must, before completion of the fourth year of study of the programme, undertake practical work to the satisfaction of the Department during your summer and/or winter vacation at an approved agricultural institution (the period for Soil Science and Animal Science is two months and for Grapevine and Wine Sciences a minimum of six months):

- You must choose the institution where you will do the practical work in consultation with the department(s) of your major(s). Your chosen institution must be approved by the chair(s) of the departments(s) concerned before you start with the practical work.
- You must write a satisfactory report on your practical work and it must be submitted on the dates specified by the department(s) concerned.
- Partial or full exemption from the abovementioned rules may be granted at the discretion of the department concerned if your circumstances justify such exemption.
- If you have Animal Science as a major and you are planning to submit a report on your practical work to the Department of Animal Sciences, you must spend a minimum of four weeks of your two-month practical working at the University's experimental farms. You must do the practical work during the vacations of the second year of study. You will not be paid for this work. You must also undertake the compulsory Southern Cape tour in the beginning of your final year, which forms part of Animal Science 474.

Consult your specific programme to see if you must do any practical work in addition to your modules.

5. Compulsory module for first-year students

As first-year student you must register for the ReadTheory short course and complete it to the satisfaction of the Faculty before your degree can be awarded.

6. Bachelor's programmes

6.1 Plant and Soil Sciences

More information is available on the following websites:

- https://www.sun.ac.za/english/faculty/agri/agronomy
  (Department of Agronomy)
- https://www.sun.ac.za/english/faculty/agri/horticulture
  (Department of Horticultural Science)
- https://www.sun.ac.za/english/faculty/agri/plant-pathology/Pages/default.aspx
  (Department of Plant Pathology)
- https://www.sun.ac.za/english/faculty/agri/soil-science
  (Department of Soil Science)

Programme description and outcomes

The bachelor's programme in Plant and Soil Sciences leads to the qualification BScAgric. 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, you 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. These fields of study with the applicable majors are:

- **Crop Production Systems:**
  - Agronomy, Horticultural Science or Grapevine Sciences in combination with Entomology, Plant Pathology or Agricultural Economics; or
  - Agricultural Economics in combination with Animal Science and Agronomy;
- **Crop Protection and Breeding:** Plant Pathology and Entomology or Genetics; and
- **Soil and Water Management:** Soil Science and one of Agronomy, Horticultural Science, Plant Pathology, or Grapevine Sciences.

In Crop Production Systems you will be trained as a crop production manager for, amongst others, agronomy, deciduous fruit, citrus and vines. In Crop Protection and Breeding you will be 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 you will be trained to become a specialist who understand the nature, importance and management of soil, soil fertility and water in crop production.

After successful completion of this programme you 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 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 grape 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 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 Contents" of this Yearbook part. For compulsory practical work in Soil Science and Grapevine Sciences see section 4 in this chapter. You can find information on practical training in Soil Science and Grapevine Sciences at the relevant field of study.

6.1.1 Bachelor's programme in Plant and Soil Sciences (BScAgric): Crop Production Systems with Agronomy, Horticultural Science or Grapevine Sciences in combination with Entomology, Genetics, Plant Pathology or Agricultural Economics

Specific Admission Requirements

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

FIRST YEAR (122, 124, 130 OR 132 CREDITS)

Compulsory Modules

Biology	124(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Crop Production	151(8), 152(8)
Crop Protection	152(8)
Mathematics (Bio)	124(16)
AND	
If Agronomy or Horticultural Science is the chosen major where Agricultural Economics is not the second major	
Physics (Bio)	134(16), 154(16)
OR	
If Grapevine Sciences is the chosen major where Agricultural Economics is not the second major	
Grapevine and Wine Sciences	142(8)
Physics (Bio)	134(16), 154(16)
OR	
If Agricultural Economics is taken as a major with Agronomy or Horticultural Science as the second major	
Economics	114(12), 144(12)
Theory of Interest	152(6)
OR	
If Agricultural Economics is taken as a major with Grapevine Sciences as the second major	
Economics	114(12), 144(12)
Theory of Interest	152(6)
Grapevine and Wine Sciences	142(8)

Second Year (124 or 144 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Crop Protection	244(16)
Soil Science	214(16), 244(16)
AND	
If Agronomy or Horticultural Science is the chosen major where Agricultural Economics is not the second major	
Crop Production	214(16)
Genetics	214(16), 244(16)
OR	
If Grapevine Sciences is the chosen major where Agricultural Economics is not the second major	
Grapevine Sciences	214(12), 244(16)
OR	
If Agricultural Economics is taken as a major with Agronomy or Horticultural Science as the second major	
Crop Production	214(16)
Agricultural Economics	234(16), 242(8), 262(8)
OR	
If Agricultural Economics is taken as a major with Grapevine Sciences as the second major	
Grapevine Sciences	214(12), 244(16)
Agricultural Economics	234(16), 242(8), 262(8)

Third Year (120, 136 or 144 credits)

Compulsory Modules

The compulsory modules are combined with a crop of choice option and additional elective modules.

Soil Science	314(16), 344(16)

Crop of Choice as first major

Crop of choice 1: Agronomy

Agronomy	312(8), 322(8), 332(8), 342(8), 362(8)
Horticultural Science	352(8)

Crop of choice 2: Grapevine Sciences

Grapevine Sciences	314(12), 344(12)

Crop choice 3: Horticultural Science

Horticultural Science	314(16), 342(8), 352(8)
WITH EITHER	
Agronomy	312(8)
OR	
Grapevine Sciences	312(8)
AND	

Agronomy	362(8)
OR	
Horticultural Science	362(8)

Additional elective modules as second major

Choose two from the following four choices. Entomology 314(16) and Nematology 344(16) cannot be taken in combination with Agricultural Economics 314(16) and 364(16). If Grapevine Sciences is your first major, you cannot take Genetics as second major.

Agricultural Economics	314(16), 364(16)
OR	
Entomology	314(16)
Nematology	344(16)
OR	
Genetics	314(16), 344(16)
Data Science and Computational Thinking	314(8) *(This module is taken instead of Agronomy 312 or Grapevine Sciences 312)*
OR	
Plant Pathology	314(16), 344(16)

Fourth Year (120, 128, 136, 144 credits)

Compulsory Modules for all combinations

Crop Production	478(16)

Crop of choice as first major:

Crop choice 1: Agronomy

Agronomy	424(16), 454(16)
Applied Plant Physiology	414(16)
AND	
Applied Plant Physiology	464(16)
OR	
Agronomy	444(16)

Crop choice 2: Grapevine Sciences

Grapevine Sciences	444(16), 452(8)
Grapevine and Wine Sciences	444(8), 454(8)
Applied Plant Physiology	414(16)

Crop choice 3: Horticultural Science

Horticultural Science	434(16), 444(16)
Applied Plant Physiology	414(16), 464(16)

Choose one of the following as second major

(If Grapevine Sciences is your first major, you cannot take Genetics as second major.)

Agricultural Economics

Agricultural Economics	414(16), 434(16), 444(16), 454(16)

Entomology

Entomology	418(32), 464(16)
Plant Pathology	414(16)

Plant Pathology

Plant Pathology	414(16), 444(16), 474(16)

Genetics

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

6.1.2 Bachelor's programme in Plant and Soil Sciences (BScAgric): Crop Production Systems with Agronomy, Agricultural Economics and Animal Science

If you follow this programme successfully you will be able to register as an agricultural scientist with The South African Council for Natural Scientific Professions (SACNASP). You will, however, not be able to register as an animal scientist.

Specific Admission Requirements

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

First Year (126 credits)

Compulsory Modules

Animal Science	144(20)
Biology	124(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Crop Production	151(8)
Economics	114(12), 144(12)
Mathematics (Bio)	124(16)
Theory of Interest	152(6)

Second Year (120 credits)

Compulsory Modules

Agricultural Economics	242(8)
Animal Anatomy and Physiology	214(16)
Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Introduction to Animal Nutrition	244(16)
Soil Science	214(16), 244(16)

Third Year (136 credits)

Compulsory Modules

Agricultural Economics	314(16), 364(16)
Agronomy	322(8), 342(8)

Animal Nutrition Science	324(16), 344(16)
Animal Physiology	324(12), 344(12)
Soil Science	314(16), 344(16)

FOURTH YEAR (136 CREDITS)

Compulsory Modules

Agricultural Economics	334(16), 478(32)
Agronomy	424(16), 454(16)
Animal Nutrition Science	414(12), 444(12)
Animal Management Science	434(16), 464(16)

6.1.3 Bachelor's programme in Plant and Soil Sciences (BScAgric): Crop Protection and Breeding with Plant Pathology and Entomology or Genetics

Specific Admission Requirements

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

FIRST YEAR (124 CREDITS)

Compulsory Modules

Biology	124(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Crop Production	151(8), 152(8)
Crop Protection	152(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

SECOND YEAR (144 CREDITS)

Compulsory Modules

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

THIRD YEAR (136 OR 144 CREDITS)

With Genetics and Plant Pathology as majors, taking Agronomy as the crop of choice in the 3rd year

Data Science and Computational Thinking	314(8) *(This module is taken instead of Agronomy 312 or Grapevine Sciences 312)*
Genetics	314(16), 344(16)
Plant Pathology	314(16), 344(16)
Entomology	314(16)
Nematology	344(16)
Agronomy	322(8), 332(8), 342(8), 362(8)

With Genetics and Plant Pathology as majors, taking Horticultural Science as crop of choice in the 3rd year

Data Science and Computational Thinking	314(8) *(This module is taken instead of Agronomy 312 or Grapevine Sciences 312)*
Genetics	314(16), 344(16)
Plant Pathology	314(16), 344(16)
Entomology	314(16)
Nematology	344(16)
Horticultural Science	314(16), 342(8), 352(8)
AND	
Agronomy	362(8)
OR	
Horticultural Science	362(8)

Entomology and Plant Pathology as majors must be combined with a crop of choice, as indicated in the tables below.

Compulsory modules

Entomology	314(16)
Nematology	344(16)
Plant Pathology	314(16), 344(16)
Soil Science	314(16), 344(16)

Crop of Choice

Crop of Choice 1: Agronomy

Agronomy	312(8), 322(8), 332(8), 342(8), 362(8)
Horticultural Science	352(8)

Crop of Choice 2: Horticultural Science

Horticultural Science	314(16), 342(8), 352(8)
WITH EITHER	
Agronomy	312(8)
OR	
Grapevine Sciences	312(8)
AND	

Agronomy	362(8)
OR	
Horticultural Science	362(8)

FOURTH YEAR (128 CREDITS)

Compulsory Modules

Crop Production	478(16)
Applied Plant Physiology	414(16)

With Genetics and Plant Pathology as majors and either Agronomy or Horticultural Science as crop of choice in the 3rd year

Plant Pathology	414(16), 444(16), 474(16)
Genetics	324(16), 354(16), 414(16)

With Plant Pathology and Entomology as majors

Plant Pathology	414(16), 444(16), 474(16)
Entomology	418(32), 464(16)

6.1.4 Bachelor's programme in Plant and Soil Sciences (BScAgric): Soil and Water Management with Soil Science and one of Agronomy, Horticultural Science or Grapevine Sciences

Specific Admission Requirements

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

FIRST YEAR (124 OR 132 CREDITS)

Compulsory Modules

Biology	124(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Crop Production	151(8), 152(8)
Crop Protection	152(8)
Physics (Bio)	134(16), 154(16)
Mathematics (Bio)	124(16)
Grapevine and Wine Sciences	142(8) *(For students with Soil Science and Grapevine Science as second major, Grapevine and Wine Sciences 142 is compulsory)*

Second Year (124 or 128 credits)

Compulsory Modules

Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8) *(Students with Grapevine Sciences only take Biometry 212 and 242 in their third year)*
Crop Protection	244(16)
Soil Science	214(16), 244(16), 222(16)
If Agronomy or Horticultural Science is the crop of choice	
Crop Production	214(16)
OR	
If Grapevine Sciences is the crop of choice	
Grapevine Sciences	214(12), 244(16)

Third Year (120, 128, 136 or 144 credits)

Compulsory Modules

Chemistry	234(16), 254(16) *(Chemistry 254 is compulsory only if you take Chemistry and Soil Science as majors)*
Plant Pathology	314(16), 344(16)
Soil Science	314(16), 344(16)

Crop of Choice as second major

Crop of Choice 1: Agronomy

Agronomy	312(8), 322(8), 332(8), 342(8), 362(8)
Horticultural Science	352(8)

Crop of Choice 2: Grapevine Sciences

Grapevine Sciences	314(12), 344(12) *(Students with Soil Science and Chemistry as majors cannot take Grapevine Sciences as a crop of choice)*
Biometry	212 (8), 242 (8) *(Students with Grapevine Sciences as crop of choice must now take Biometry 212 and 242 in their third year)*

Crop of Choice 3: Horticultural Science

Horticultural Science	314(16), 342(8), 352(8)
WITH EITHER	
Agronomy	312(8)
OR	
Grapevine Sciences	312(8)
AND	
Agronomy	362(8)
OR	
Horticultural Science	362(8)

FOURTH YEAR (120, 128 CREDITS)

Organised excursion and/or practical assignment

Please note that you must undertake an organised excursion and/or do a practical assignment during short vacation(s) and/or weekends for the modules Soil Science 414, 424 and 444. Such organised excursion and/or assignment takes place under the guidance of lecturers from the Department of Soil Science in collaboration with lecturers from the departments of Agronomy, Horticultural Science or Viticulture and Oenology. This necessary practical experience must be done during the relevant semesters of the abovementioned modules.

Compulsory Modules

Crop Production	478(16)
Soil Science	414(16), 424(16), 444(16)

Elective modules

Choose one of the four options in the table below.

Chemistry	314(16), 324(16), 344(16), 364(16)
OR	
Agronomy	424(16), 454(16) *(These modules are followed with Agronomy as major)*
Applied Plant Physiology	414(16)
AND	
Applied Plant Physiology	464(16)
OR	
Agronomy	444(16)
OR	
Grapevine Sciences	444(16), 452(8)
Grapevine and Wine Sciences	444 (8), 454 (8)
Applied Plant Physiology	414(16)
OR	
Horticultural Science	434(16), 444(16) *(These modules are followed with Horticultural Science as major)*
Applied Plant Physiology	414(16), 464(16)

6.2 Food Production Systems

More information is available on the following website:

- https://www.sun.ac.za/english/faculty/agri/food-science/ (Department of Food Science)

Programme description and outcomes

The 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.

After successful completion of this programme you 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.

Industry training in Food Production Systems

If you are following the programme BSc Food Sc you must carry out practical work to the satisfaction of the University in approved food installations or food research institutions for at least six weeks of your summer and/or winter vacations. You must submit a satisfactory report in your final year to the Department before the degree can be awarded. This report must be according to the instructions of the Department of Food Science.

Please note: The University is not liable for any injury that you may sustain during industry training or for any claims that may result from such injury.

The prescribed modules of the various years of study of this programme are set out below. The module contents are given in the chapter "Subjects, Modules and Module Contents" of this Yearbook part.

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

Specific Admission Requirements

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

First Year (132 credits)

Compulsory Modules

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

Applied Chemistry	334(16)
Food Science	314(16), 324(16), 333(16), 344(16), 353(16), 354(16)
Microbiology	244(16)

FOURTH YEAR (126 CREDITS)

Compulsory Modules

Food Process Engineering	414(15), 444(15)
Food Science	414(16), 478(48), 488(32)

6.3 Wine Production Systems

More information is available on the following websites:

- https://www.sun.ac.za/english/faculty/agri/viticulture-oenology (Department of Viticulture and Oenology)

Programme description and outcomes

The bachelor's programme in Grapevine and Wine Sciences leads to the qualification BScAgric.

Grapevine and Wine Sciences 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. In this field you will be prepared for a career in the grape and wine industries.

After successful completion of this programme you will be able to:

- understand the terms, concepts, principles and theories within the fields of wine sciences, grapevine sciences 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.

Industry training in Wine Production Systems

If you are following the BScAgric programme with Grapevine and Wine Sciences as majors, you must complete a compulsory internship as determined by the Department. The internship is from the end of the third year to the middle of the fourth year in table or wine grape vineyards and pertains to pruning during winter, canopy management during summer and working in a commercial wine cellar. The Department of Viticulture and Oenology will provide specific minimum requirements pertaining to the number of weeks you must spent on these aspects. These work programmes are cleared in consultation with lecturers in the Department of Viticulture and Oenology and you must pass Grapevine and Wine Sciences 478 associated with the internship in order to qualify for the degree BScAgric.

To enable you to perform practical work during the harvest season, as a final-year student, you will be excused from lectures until the second semester.

Please note: The University is not liable for any injury that you may sustain during industry training or for any claims that may result from such injury.

The prescribed 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" of this Yearbook part.

6.3.1 Bachelor's programme in Grapevine and Wine Sciences

Specific Admission Requirements

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

First Year (132 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Crop Production	152(8)
Grapevine and Wine Sciences	142(8)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16), 154(16)

Second Year (140 credits)

Compulsory Modules

Biochemistry	214(16)
Chemistry	264(16)
Grapevine Sciences	214(12), 244(16)
Grapevine and Wine Sciences	212(8), 278(8)
Soil Science	214(16), 244(16)
Wine Sciences	214(16), 244(16)

Third Year (120 credits)

Compulsory Modules

Grapevine Sciences	314(12), 344(12)
Grapevine and Wine Sciences	378(16)
Wine Sciences	314(16), 344(16)

plus

Elective Modules

Choose (with consideration of prerequisites and the time table) modules to the credit value of 48.

Chemistry	314(16)
Data Science and Computational Thinking	314(8), 344(8)
Entomology	314(16)
Plant Pathology	314(16), 344(16)
Soil Science	314(16), 344(16)

FOURTH YEAR (124 CREDITS)

Compulsory Modules

Grapevine Sciences	444 (16), 452 (8)
Grapevine and Wine Sciences	444 (8), 454 (8), 478 (60)
Wine Sciences	446 (24)

6.4 Animal Production Systems

More information is available on the following website:

- www.sun.ac.za/english/faculty/agri/animal-science
- (Department of Animal Sciences)

Programme description and outcomes

The bachelor's programme in Animal Production Systems leads to the qualification BScAgric. 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.

The programme makes provision for one field of study only, namely Animal Science.

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

- know and understand terminology, concepts, theory and principles of animal physiology, animal breeding and animal nutrition;
- create 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;
- apply analytical thinking and practical skills in extensive and intensive animal production environments, laboratories, in the field and through the use of computers;
- identify, analyse and propose solutions to industry-related problems;
- make responsible decisions using critical and creative thought processes;
- function in an interdisciplinary environment;
- register as a Candidate Natural Scientist, qualified as an animal scientist, with the South African Council of Natural Scientific Professions;
- demonstrate a positive attitude, not only towards the animal industry, but also towards the broader community by means of continuous service and professional development; and
- study towards obtaining postgraduate qualifications at national and international bodies.

Practical training in Animal Science (Performance testing of sheep and wool classing)

All third-year students who are taking Animal Science as a major must attend a course on wool classing. The course is presented during the week before the start of the academic year. If you are taking Animal Science as a major, then you must also attend training in performance testing of sheep in your final year. It is a five-day course that is presented during the June vacation.

The prescribed 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 Contents" of this Yearbook part. For compulsory practical work for Animal Science also see section 4 of this chapter.

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

Specific Admission Requirements

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

First Year (120 credits)

Compulsory Modules

Animal Science	144(20)
Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Mathematics (Bio)	124(16)
Physics (Bio)	134(16)

Second Year (128 credits)

Compulsory Modules

Animal Anatomy and Physiology	214(16)
Biochemistry	214(16), 244(16)
Biometry	212(8), 242(8)
Genetics	214(16), 244(16)
Introduction to Animal Nutrition	244(16)
Microbiology	214(16)

Third Year (128 credits)

Compulsory Modules

Animal Health	342(8)
Animal Nutrition Science	324(12), 344(12)
Animal Physiology	324(16), 344(16)
Data Science and Computational Thinking	314(8), 344(8)
Genetics	324(16), 354(16)
Agronomy	324(16)

Fourth Year (128 credits)

Compulsory Modules

Animal Breeding and Genetics I	424(16)
Animal Breeding and Genetics II	452(8)
Animal Nutrition Science	414(12), 444(12)
Animal Product Science	334(16)
Animal Science	474(32)
Animal Management Science	434(16), 464(16)

6.5 Agricultural Economics

More information is available on the following website:

- www.sun.ac.za/english/faculty/agri/agricultural-economics/Pages/default.aspx (Department of Agricultural Economics)

Programme description and outcomes

The bachelor's programme in Agricultural Economics leads to one of the following qualifications: BScAgric or BAgric (Agri-business Management). The aim of the programme is to develop skilled agricultural economists and agricultural managers for the public and private sectors 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
- Agri-business Management (BAgric).

After successful completion of the programme you 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 the 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 contents are given in the chapter "Subjects, Modules and Module Contents" of this Yearbook part.

For the degree BCom with Agricultural Economics see the Faculty of Economic and Management Sciences' Yearbook Part, Part 10.

6.5.1 Bachelor's programme in Agricultural Economics BAgric (Agri-business Management)

Specific Admission Requirements

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

First Year (122 credits)

Compulsory Modules

Animal Production Physiology	112(8)
Business Management	113(12), 142(6)
Computer Skills	171(4)
Crop Production	152(8)
Economics	114(12), 144(12)
Introduction to Transport and Logistics Systems	144(12)
Soil Science	114(16), 142(8)
Statistics and Data Science	188(18)
Theory of Interest	152(6)

Second Year (120 or 136 credits)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Financial Accounting	188(24)
and one of the following two groups with the value of 48 credits	
Financial Management	214(16) Δ
Marketing Management	214(16) Δ
Financial Management	244(16) # or
Investment Management	254(16) # or
Marketing Management	244(16) Δ
OR	
Financial Management	214(16)
Logistics and Supply Chain Management	214(16), 244(16)
and one of the following two groups with the value of 16 or 32 credits	
Agronomy	212(8)
Horticultural Science	222(8)
OR	
Animal Production	214(16)
Introduction to Animal Nutrition	244(16)

Δ If you take Marketing Management 214 and 244, you must take Financial Management 214 (all three marked with a Δ). Also see the prerequisites for Marketing Management 214 and 244 in the module contents chapter of this Yearbook part.

These two modules cannot be taken together.

Third Year (128 credits)

Compulsory Modules

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

plus

Elective Modules

Choose modules to the value of 48 credits from the table below as allowed by the timetable.

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

6.5.2 Bachelor's programme in Agricultural Economics (BScAgric) Agricultural Economic Analysis

Specific Admission Requirements

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

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)
Financial Accounting	188(24)
Soil Science	214(16), 244(16)
Statistics and Data Science	188(18)
Theory of Interest	152(6)

Third Year (128 credits)

Compulsory Modules

Agricultural Economics	314(16), 364(16)
Economics	214(16), 244(16)
AND	
Financial Accounting	288(32)
OR	
Statistics	214(16), 244(16)

plus

Elective Modules

Choose one of the groups to the value of 16 or 32 credits from the table below.

(*Students who choose the electives Agronomy 212(8) and Horticultural Science 222(8), have to take both Financial Accounting 288(32) and Statistics 214(16) in order to comply with the minimum credit requirement.)

Agronomy*	212(8)
Horticultural Science*	222(8)
OR	
Animal Production	214(16)
Introduction to Animal Nutrition	244(16)

FOURTH YEAR (144 CREDITS)

Compulsory Modules

Agricultural Economics	414(16), 434(16), 444(16), 454(16), 478(32), 479(24)
Economics	318(24) or 348(24) or 388(24)

6.5.3 Bachelor's programme in Agricultural Economics (BScAgric) Agricultural Economic Analysis and Management

Specific Admission Requirements

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

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)
Statistics and Data Science	188(18)
Theory of Interest	152(6)

SECOND YEAR (120 OR 136 CREDITS)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Financial Accounting	188(24)
AND	
Agronomy	212(8)
Horticultural Science	222(8)

OR	
Animal Production	214(16) and
Introduction to Animal Nutrition	244(16)

plus

Elective Modules

Choose modules to value of 48 credits from one of the groups below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

Financial Management	214(16)Δ, 244(16)#
Investment Management	254(16)#
Marketing Management	214(16)Δ, 244(16)Δ
OR	
Entrepreneurship and Innovation Management	214(16), 244(16)
Financial Management	214(16)Δ, 244(16)#
Investment Management	254(16)#
OR	
Financial Management	214(16)Δ, 244(16)#
Investment Management	254(16)#
Logistics and Supply Chain Management	214(16), 244(16)
OR	
Logistics and Supply Chain Management	214(16), 244(16)
Marketing Management	214(16)Δ, 244(16)Δ
OR	
Entrepreneurship and Innovation Management	214(16), 244(16)
Logistics and Supply Chain Management	214(16), 244(16)

Δ If you take Marketing Management 214 and 244, you must take Financial Management 214 (all three marked with a Δ). Also see the prerequisites for Marketing Management 214 and 244 in the module contents chapter of this Yearbook part.

These two modules cannot be taken together.

Third Year (136 credits)

Compulsory Modules

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

plus

Elective Modules

Choose modules to a minimum value of 88 credits from one of the groups below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

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 and Supply Chain Management	314(12), 324(12), 344(12), 354(12)
Statistics	214(16), 244(16)

Strategic Management	344(12)
Management Accounting	288(24)
OR	
Economics	214(16), 244(16)
Entrepreneurship and Innovation Management	318(24)
Financial Accounting	288(32)
Logistics and Supply Chain Management	314(12), 324(12), 344(12), 354(12)
Marketing Management	314(12), 324(12), 344(12)
Statistics	214(16), 244(16)
Strategic Management	344(12)
Management Accounting	288(24)
OR	
Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	314(12), 332(12), 352(12), 354(12)
Logistics and Supply Chain Management	314(12), 324(12), 344(12), 354(12)
Statistics	214(16), 244(16)
Strategic Management	344(12)
Transport Economics	214(16)
Management Accounting	288(24)
OR	
Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	314(12), 332(12), 352(12), 354(12)
Logistics and Supply Chain Management	314(12), 324(12), 344(12), 354(12)
Marketing Management	314(12), 324(12), 344(12)
Statistics	214(16), 244(16)
Strategic Management	344(12)
Management Accounting	288(24)

Fourth Year (144 credits)

Compulsory Modules

Agricultural Economics	414(16), 434(16), 444(16), 454(16), 478(32), 479(24)

plus

Elective Modules

Choose modules to a minimum value of 24 credits from one of the groups below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

Economics	318(24), 348(24), 388(24)
Financial Management	314(12), 332(12), 352(12), 354(12)
Investment Management	314(12), 324(12), 344(12), 349(12)
Strategic Management	344(12)
OR	

Economics	318(24), 348(24), 388(24)
Investment Management	314(12), 324(12), 344(12), 349(12)
Logistics and Supply Chain Management	314(12), 324(12), 344(12), 354(12)
Strategic Management	344(12)

6.5.4 Bachelor's programme in Agricultural Economics (BScAgric) Agricultural Economic Analysis and Management with Food Science

Specific Admission Requirements

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

First Year (142 credits)

Compulsory Modules

Animal Production Physiology	112(8)
Business Management	113(12), 142(6)
Computer Skills	171(4)
Crop Production	152(8)
Economics	114(12), 144(12)
Food Science	144(16)
Mathematics (Bio)	124(16)
Soil Science	114(16), 142(8)
Statistics and Data Science	188(18)
Theory of Interest	152(6)

Second Year (120 or 136 credits)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Financial Accounting	188(24)
Food Science	214(16), 244(16)
AND	
Agronomy	212(8) and
Horticultural Science	222(8)
OR	
Animal Production	214(16) and
Introduction to Animal Nutrition	244(16)

plus

Elective Modules

Choose one module from the table below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

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

Δ If you take Marketing Management 214 and 244, you must take Financial Management 214 in your third year (all three marked with a Δ). Also see the prerequisites for Marketing Management 214 and 244 in the module contents chapter of this Yearbook part.

Third Year (128 credits)

Compulsory Modules

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

plus

Elective Modules

Choose modules to a minimum value of 32 credits from the table below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

Economics	214(16), 244(16)
Financial Accounting	288(32)
Financial Management	244(16) #
Investment Management	254(16) #
Logistics and Supply Chain Management	214(16), 244(16)
Marketing Management	314(12), 324(12), 344(12)
Strategic Management	344(12)
Management Accounting	288(24)

If you take Marketing Management 214 and 244, you must take Financial Management 214 (marked with a Δ). Also see the prerequisites for Marketing Management 214 and 244 in the module contents chapter of this book.

These two modules cannot be taken together.

Fourth Year (144 credits)

Compulsory Modules

Agricultural Economics	414(16), 434(16), 444(16), 454(16), 479(24)
Food Science	333(16), 414(16)

plus

Elective Modules

Choose modules to a minimum value of 24 credits from the table below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

Economics	318(24), 348(24), 388(24)
Financial Management	314(12), 332(12), 352(12), 354(12)
Food Process Engineering	414(15), 444(15)
Logistics and Supply Chain Management	314(12), 324(12), 344(12), 354(12)

6.5.5 Bachelor's programme in Agricultural Economics (BScAgric) Agricultural Economics with Food Science

Specific Admission Requirements

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

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 (120 or 136 credits)

Compulsory Modules

Agricultural Economics	234(16), 242(8), 262(8)
Financial Accounting	188(24)
Food Science	214(16), 244(16)
Microbiology	214(16)
AND	
Agronomy	212(8)
Horticultural Science	222(8)
OR	
Animal Production	214(16) and
Introduction to Animal Nutrition	244(16)

Third Year (128 credits)

Compulsory Modules

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

plus

Elective Modules

Choose modules to a minimum value of 48 credits from the table below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

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

FOURTH YEAR (144 CREDITS)

Compulsory Modules

Agricultural Economics	414(16), 434(16), 444(16), 454(16), 479(24)
Food Science	333(16), 414(16)

plus

Elective Modules

Choose modules to a minimum value of 24 credits from the table below. You can only take your chosen group of modules if the class, test and exam timetables allow the specific combination of modules.

Financial Management	314(12), 332(12), 352(12), 354(12)
Food Process Engineering	414(15), 444(15)
Logistics and Supply Chain Management	314(12), 324(12), 344(12), 354(12)

6.6 Forestry and Wood Sciences

More information is available on the following website:

- www.sun.ac.za/english/faculty/agri/forestry (Department of Forest and Wood Science)

Programme description and outcomes

This 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.

A brief description of the two fields of study including the required practical work is given below.

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. You have to participate in practical work during vacations from your first to your final year of study.

After successful completion of the programme in *Forestry and Natural Resource Sciences* you 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 managed timber 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

For the field of study in Wood and Wood Products Sciences you take modules 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 and Quality Assurance. You have to participate in practical work during vacations from your first to your final year of study.

After successful completion of the field of study in *Wood and Wood Products Sciences* you 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, board mills, 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.

Practical work in Forest and Wood Sciences

- You must do compulsory practical work in your first three years of study:
  - In your first year, this practical work can take place during either the June or September vacation. If you have completed your first year of study at another university and you are enrolling in the second year, you are still required to complete this practical.
  - During your second and third years of study, you will be required to complete a one-week period of prescribed practical work for each year. This one week of practical work can also be done before the beginning of the academic year.
- You must submit reports of all your practical work to the satisfaction of your lecturers.
- You are responsible for all costs regarding demonstrations and practical work.
- It can be expected of you to do practical work during other vacations in addition to the ones already mentioned.
- In your final year you will:
  - undertake a study tour of approximately two weeks during the winter vacation to the forest regions of South Africa.
  - submit a complete report at the beginning of the second semester as prescribed by the tour

leader.

- collect data during vacations for your management plan or project.
- complete a comprehensive management plan or project during the second semester that is based on the data you collected during the winter vacation (or an earlier extended vacation).
- hand in the completed project or management plan before 1 November of the year in which you intend to graduate.
- obtain a final mark of at least 50 to pass the project or management plan.
    - If you obtain a final mark of 40 to 49 in November, you can submit a modified project or management plan before the January examinations of the following year. That will allow you to receive your degree during the supplementary graduation ceremony in March.
    - If you obtain a final mark of less than 40 in November or you fail to obtain a final mark of at least 50 in January, you must repeat the practical work for the project or management plan.
    - Please note: The University is not liable for any injury that you may sustain during practical work or tours or for any claims that may result from such injury.

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 Contents" of this Yearbook part.

6.6.1 Bachelor's programme in Forestry and Wood Sciences (BScFor): Forestry and Natural Resources Sciences

Specific Admission Requirements

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

First Year (124 credits)

Compulsory Modules

Biology	124(16), 154(16)
Chemistry	124(16), 144(16)
Computer Skills	171(4)
Forest Science	171(24)
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)
Geographical Information Technology	214(16)
Soil Science	214(16)
Wood Product Science	224(16), 244(16), 264(16)

THIRD YEAR (120 CREDITS)

Compulsory Modules

Data Science and Computational Thinking	314(8)
Forest Science	334(16), 355(16), 356(16), 364(16)
Genetics	214(16)
Soil Science	314(16)
Wood Product Science	335(16)

FOURTH YEAR (121 CREDITS)

Compulsory Modules

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

6.6.2 Bachelor's programme in Forestry and Wood Sciences (BScFor): Wood and Wood Products Sciences

Specific Admission Requirements

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

FIRST YEAR (123 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(24)
Strength of Materials	143(12)

SECOND YEAR (130 CREDITS)

Compulsory Modules

Engineering Mathematics	214(15)
Forest Science	254(16)
Industrial Programming	244(15)
Production Management	212(8)
Intercultural Communication	113(8)
Wood Product Science	224(16), 234(16), 244(16), 255(4), 264(16)

THIRD YEAR (128 CREDITS)

Compulsory Modules

Engineering Statistics	314(15)
Forest Science	334(16), 355(16), 356(16)
Operations Research (Eng)	345(15)
Production Management	314(15)
Quality Assurance	344(15)
Wood Product Science	335(16), 346(4)

FOURTH YEAR (126 CREDITS)

Compulsory Modules

Forest Science	442(1), 468(32)
Industrial Ergonomics	414(15)
Operations Research (Eng)	415(15)
Quality Management	444(15)
Wood Product Science	414(16), 426(4), 434(16), 444(12)

6.7 Conservation Ecology

More information is available on the following website:

- www.sun.ac.za/english/faculty/agri/departments1/conservation-ecology (Department of Conservation Ecology and Entomology)

Programme description and outcomes

This 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 you to choose from a broad range of careers in conservation ecology. Some of the most popular careers in this field of study are:

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 nature reserve management.
5. Ecotourism (you can follow careers 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).

Practical work

You must take part in practicals in each of the four years of study. Additionally, you must attend a one-week field trip in your fourth year. An integral part of this programme is a comprehensive research project that you must complete and submit in your fourth year.

The prescribed modules of the various years of study in this programme are set out below. The module contents are given in the chapter "Subjects, Modules and Module Contents" of this Yearbook part.

6.7.1 Bachelor's programme (BSc) in Conservation Ecology

Specific Admission Requirements

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

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 (125 credits)

Compulsory Modules

Biodiversity and Ecology	212(16), 214(16), 224(16), 254(16), 264(16)
Computer Skills	272(5)
Conservation Ecology	212(8), 244(16)
Geographical Information Technology	214(16)

Third Year (128 credits)

Compulsory Modules

Agricultural Economics	262(8)
Biodiversity and Ecology	311(16), 324(16)
Biometry	212(8), 242(8)
Conservation Ecology	314(16), 344(16)
Forest Science	212(8)

plus

Elective Modules

Choose two of the six modules below that fit into your class, test and examination timetables. Acceptance to the module Biodiversity and Ecology 315 is limited and you have to apply for acceptance. The module Biodiversity and Ecology 315 is presented outside formal semester times.

Biodiversity and Ecology	315(16)
Biodiversity and Ecology	341(16)
Biodiversity and Ecology	342(16)
Genetics	214(16)
Geographical Information Technology	241(16)
Soil Science	214(16)

FOURTH YEAR (120 CREDITS)

Compulsory Modules

Conservation Ecology	414(16), 424(16), 478(40)
Entomology	464(16)

plus

Elective Modules

Choose module(s) to the value of 32 credits from the modules below that fit into your class, test and examination timetables.

Entomology	418(32)
Agronomy	424(16)
Conservation Ecology	444(16)
Sustainability Transitions	478(16)

plus

Additional Elective Modules (not compulsory)

You may choose one of the two modules below that fit into your class, test, and examination timetables. Your total credits will then be 136.

Geographical Information Technology	312(16)
Soil Science	314(16)

6.8 Agricultural Production and Management (Elsenburg)

6.8.1 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 Elsenburg Agricultural Training Institute on the Elsenburg Campus.

*Please note: The BAgric (Agri-business Management) programme is offered at Stellenbosch University.

Specific Admission Requirements

- A National Senior Certificate with admission for bachelor's degree studies and an average of at least 55% (excluding Life Orientation)

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

- English or Afrikaans (Home Language or First Additional Language) – 4 (50%); and
- Mathematics – 4 (50%) or Mathematical Literacy – 5 (60%); and
- Physical Sciences – 4 (50%); or
- Life Sciences – 4 (50%) or
- Agricultural Sciences – 4 (50%).

You specialise in one of the fields of study below by choosing two subjects.

Field of Study	Major Subjects
Plant Production	Agronomy, Vegetable Production, Horticultural Science, Viticulture
Animal Production	Large Stock, Small Stock
Plant and Animal Production	Agronomy, Large Stock OR Small Stock
Cellar Technology	Viticulture, Oenology
Cellar Management	Viticulture, Cellar Management
Extension & Plant Production	Extension, Vegetable Production, Horticulture, Viticulture

Extension & Animal Production	Extension, Large Stock, Small Stock

Consult the website at www.elsenburg.com or contact us at 021 808 5451 for more information about this programme.

6.9 Interdisciplinary BDatSci programme

6.9.1 BDatSci: General Information

Interdepartmental and interfaculty collaboration

This programme is presented in four faculties, namely Economic and Management Sciences, Science, AgriSciences and Arts and Social Sciences. The faculty where you are registered awards the degree.

Specific Admission requirements

- Overall NSC average of at least 80%, excluding Life Orientation
- Mathematics 80%
- One of the following:
    - Afrikaans Home Language 60%; *or*
    - English Home Language 60%; *or*
    - Afrikaans First Additional Language 75%; *or*
    - English First Additional Language 75%

Selection

The number of students selected is determined by the Faculty's enrolment plan and may differ from year to year.

If there are more applicants who meet the admission requirements than the capacity of the Faculty's enrolment plan allows, further selection criteria and processes will be applied.

Application procedure and closing date

Apply electronically at www.maties.com by 31 July of the year before your intended studies.

Duration of programme

Four years, full-time.

Programme structure

The data science programme, BDatSci, comprises several focal areas each of which spans four years. For each year, there is a set of compulsory modules shared by all the focal areas. There may also be further compulsory and/or elective modules in each year which are specific to the individual focal area. You will register for BDatSci in the faculty that offers your chosen focal area. After completing your BDatSci degree programme, you will be able to apply for a master's programme, since BDatSci is a four-year qualification at honours level (NQF level 8).

Focal areas

The objective of the focal areas is to help you choose a specific career focus within the BDatSci programme. The focal area is not a programme, and the module combinations are only recommendations so you can make more focussed module choices. Nevertheless, there are a several compulsory modules that must be taken within each focal area. The module choices in the tables describing each focal area fit in with the lecture and assessment timetables.

There are eight focal areas within the BDatSci programme, of which one is offered in the Faculty of AgriSciences. The specific focal area residing within the Faculty of AgriSciences is described below under "Focal areas within the BDatSci programme". For the sake of completeness, however, all eight focal areas in the BDatSci programme are listed below. An indication of the faculty where the programme is offered is given in brackets, and you will find the description of the focal area in that faculty's Yearbook part.

- Statistical Learning (Economic and Management Sciences)
- Analytics and Optimisation (Economic and Management Sciences)
- Behavioural Economics (Economic and Management Sciences)
- Computer Science (Science)

- Applied Mathematics (Science)
- Statistical Physics (Science)
- Geoinformatics (Arts and Social Sciences)
- Statistical Genetics (AgriSciences)

Changing focal areas in the BDatSci programme

For information on changing focal areas within the BDatSci programme, refer to the relevant appendix in the latest version of the Faculty of Economic and Management Sciences' Yearbook part (Part 10).

Enquiries

For further information about the BDatSci programme, visit www.sun.ac.za/datascience, email datascience@sun.ac.za or use the contact details below.

Programme leader

Prof Paul Mostert

Department of Statistics and Actuarial Science

Focal areas within the BDatSci programme

Statistical Genetics

Home Department: Genetics, Faculty of AgriSciences

Description of focal area

Statistical genetics is the field of study where statistical methods are used to make inferences of genetic data. It is used in fields such as population and quantitative genetics by for example plant breeders and conservation geneticists and in genetic epidemiology where the effects of genes on diseases are studied.

First Year (128 credits)

Compulsory Modules

Computer Science	113(16), 144(16)
Data Science	141(16)
Mathematics	114(16), 144(16)
Probability Theory and Statistics	114(16)

plus

Biology	124(16)
Applied Mathematics	144(16)

Second year (128 credits)

Compulsory Modules

Data Science	241(16)
Computer Science	214(16), 244(16)
Mathematics	214(16)
Mathematical Statistics	214(16), 245(8), 246(8)
Genetics	214(16), 244(16)

Third Year (128 credits)

Compulsory Modules

Mathematical Statistics	312(16)
Computer Science	315(16), 343(16)
Data Science	316(16), 346(16)
Genetics	314(16), 344(16)
Biotechnology	315(16)

Fourth Year (124 credits)

Compulsory Modules

Introduction to Statistical Learning	441(12)
Data Science Research in Statistical Genetics	471(40)
Genetic Data Analysis	413(8)
Bioinformatics	414(8)
Scientific and Proposal Writing	421(8)
Genetics: Molecular Techniques	411(16)
Genomics	416(8)
Machine Learning	441(16)
Human and Animal Genetics	412(8)
OR	
Plant Genetics and Crop Improvement	422(8)

Postgraduate programmes

For more information on the Faculty's postgraduate programmes, consult the University's Postgraduate Prospectus or the departmental websites.

1. Summary of postgraduate programmes

The undergraduate programmes offered in the Faculty of AgriSciences lead to the following postgraduate programmes:

Broad Instructional Programmes	Postgraduate Programmes
Plant and Soil Sciences	PgDip (Agronomy); BScHons in Plant Pathology (BSc degree with Biotechnology, Botany, Genetics or Microbiology as major is a requirement); BScHons in Applied Plant Physiology (BSc degree with Biochemistry, Biotechnology, Botany, Genetics or Plant Biotechnology as major is a requirement); MSc; MScAgric; MSc (Agric) for Agronomy or Soil Science; PhD (Agric); PhD; DSc
Animal Production Systems	PgDip (Aquaculture); MScAgric; PhD (Agric); PhD; DSc
Food Production Systems	MSc Food Sc; MSc in Food and Nutrition Security; PhD; DSc
Wine Production Systems	BScHons (Wine Biotechnology); MSc (Agric); MSc or MScAgric (Wine Biotechnology); MScAgric (Viticulture or Oenology); PhD (Agric); PhD (Oenology, Viticulture or Wine Biotechnology); DSc (Oenology, Viticulture or Wine Biotechnology)
Agricultural Economics and Management	BAgricHons (Agri-business Management); MScAgric; MAgric (Agri-business Management); PhD (Agric); PhD; DSc
Forestry and Wood Sciences	PgDip (Forestry and Wood Sciences); MScFor; PhD (Agric); PhD; DSc
Conservation Ecology	MScConsEcol; PhD (Agric); PhD
Multidisciplinary Programme in Sustainable Agriculture	MSc (Sustainable Agriculture)

2. General information on the postgraduate programmes

2.1 Postgraduate diploma programmes

a) You follow a prescribed course for at least a year after obtaining an applicable bachelor's degree or an equivalent qualification that Senate has approved for this purpose.

b) Admission requirements are determined according to your specific programme.

c) Consult the rest of this chapter for more information regarding the admission requirements and programme content of your specific postgraduate diploma.

d) Consult the section "Postgraduate Qualifications" in Part 1 (General Rules) of the University's Yearbook for other regulations.

2.2 Honours programmes

a) You follow a prescribed course for at least a year after obtaining an applicable bachelor's degree.

b) You must follow the honours degree programme in one of the majors of your bachelor's degree.

c) You will be admitted to the honours degree programme if –

- you are in possession of a bachelor's degree that Senate has approved for this purpose;
- the subject of your honours programme was passed as a major in the preceding bachelor's degree; and
- you obtained an average final mark of at least 60 – 65% in the major.

d) To pass the honours degree programme you must obtain a final mark of at least 50 (out of 100) for each module.

e) Consult the rest of this chapter for more information regarding the admission requirements and programme content of your specific honours degree programme.

f) Consult the section "Postgraduate Qualifications" in Part 1 (General Rules) of the University's Yearbook for other regulations.

2.3 Master's programmes

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

b) The MSc, MSc (Agric), MScAgric, MScFor, MSc Food Sc, MScConsEcol or MAgric (Agri-business Management) can be awarded to you if you –

- have an applicable bachelor's degree of this University or a bachelor's degree approved for this purpose by Senate, and on written application have been admitted by Senate to the particular programme with a minimum study period of one year, or hold an applicable honours degree of this University or a similar honours degree approved for this purpose by Senate, and on written application have been admitted by Senate to the particular programme with a minimum study period of one year;
- 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;
- have passed the prescribed examination(s);
- have submitted a complete and well-written thesis or assignment which shows that you have performed independent scientific and technical investigations and interpreted the results satisfactorily;
- 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 your own work; and
- have satisfactorily taken an oral examination. In certain instances, supplementary study may be required of you.

c) You must also satisfy all other regulations regarding theses or assignments for master's degrees. See Postgraduate qualifications in Part 1 (General Rules) of the University's Yearbook.

2.4 PhD or PhD (Agric) degree programmes

a) The degree PhD or PhD (Agric) can be awarded to you if you –

- have the degree MSc, MSc (Agric), MScAgric, MScConsEcol, MScFor, MSc Food Sc, MAgric (Agri-business Management) or MPhil of this University, or another university's degree approved by Senate for this purpose;
- after Senate's approval of your proposed research project, have carried out and completed, 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;
- have completed any supplementary study as may be required by Senate to the satisfaction of the University;
- have submitted a complete and well-written dissertation which shows that you have 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 your own work; and
- 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.
- In addition, examiners may require a written examination.

b) As a candidate for the PhD or PhD (Agric) degree you must be enrolled for at least two academic years before the degree can be awarded to you.

c) Your application for admission must include 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.

d) The supervisor will be appointed once your application has been approved.

Please note: 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 section Postgraduate Qualifications in Part 1 (General Rules) of the University's Yearbook apply.

2.5 DSc degree programme

a) The degree DSc can be awarded to you if you –

- have held, for at least five years, a PhD of this University or another qualification considered suitable in the opinion of Senate; or
- have held, for at least seven years, the MAgric (Agri-business Management), MSc, MScAgric, MScConsEcol, MScFor, or MSc Food Sc degree of this University or another 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(s)* that convinces Senate that you have 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.

b) As a candidate for the DSc degree you must –

- have been enrolled for at least one academic year at this University before the degree can be awarded;
- give the Registrar written notice of at least one year of your intention to present yourself as a candidate for the degree and include in the notification the title(s) and extent of the proposed work(s). If Senate accepts the application, a supervisor and examiners will be appointed.

c) You must provide before 1 September, for graduation in December, or before 1 December of the previous year, for graduation in March, four copies of the work(s) which you want to submit to the University, accompanied by a declaration that it is your 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 your name, you must provide satisfactory evidence that shows which part of the work is your own. Furthermore, you must state who conceived the work, under whose guidance it took place and who executed, processed and put it in writing. You must also indicate which part of the work, if any, you, or a co-author, have already submitted to this or any other university in order to obtain a degree.

d) The general rules for doctoral degrees concerning the appointment of examiners, as given under Postgraduate Qualifications in Part 1 (General Rules) of the University's Yearbook, also apply to the DSc degree.

* The term 'published work' refers to 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
- submitted for the degree too soon after publication.

You may also submit your other publications with little or no connection with the particular subject in which the main study has been performed in support of your application.

3. Provisions regarding enrolment for programmes

3.1 Periods of enrolment for master's and doctoral studies

Table

Programme	The year of enrolment					
	1	2	3	4	5	6
MSc full-time	M	N	F	X	-	-
PhD full-time	M	M	N	F	X	-

The Faculty does not offer part-time postgraduate studies, but in exceptional cases, students can motivate for extension of their studies based on personal circumstances. If approval is granted in your case, you will only be allowed to extend the studies to N+2 years (X). See table above.

Legend

M	Minimum enrolment period
N	Normal maximum enrolment period
F	Final concessional year (May register without having to apply for readmission)
X	Enrolment only if readmission has been approved by the Faculty Board or, for PhDs, Senate (Allowed in exceptional circumstances)
-	Further registration not allowed

Please note: In the case of a conversion from master's to doctoral studies, the first registration for the PhD is considered the start of the enrolment.

3.2 Continued enrolment during the maximum period of enrolment

You must register as a student every year for the full duration of your studies, until you are awarded the degree, except if the Faculty Board approves an interruption of your studies (see section "Interruption of master's and doctoral studies" in Part 1 (General Rules) of Yearbook). You must make sufficient progress in your studies each year to be permitted to register again. If your progress is insufficient, the relevant departmental chairperson may recommend to the Faculty Board that the Board prevent you from continuing your postgraduate studies.

3.3 Continued enrolment after the maximum period of enrolment

After the normal maximum enrolment period (status F), you may only re-register as a postgraduate student if a departmental panel recommends approving your application to continue (status X). Such approval will only be granted more than once in exceptional circumstances.

4. Postgraduate programmes per department

4.1 Department of Agricultural Economics

Closing dates for all postgraduate applications in the Department

International students: Apply by 14 September of the previous year.

South African students: Apply by 31 October of the previous year.

4.1.1 BAgricHons (Agri-business Management)

Programme Code

2771001

Specific Admission Requirements

- The three-year BAgric (Agri-business Management) degree, an applicable three-year degree, as well as other qualifications that Senate has approved for this purpose.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over one year.

Programme Content

The programme is designed to equip prospective expert agricultural managers and agricultural economists 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. After the successful completion of the programme you 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. This expertise is 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.

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

plus

Elective Modules

Choose modules to the value of at least 90 credits from the table below. You can choose from the honours modules following the 300-level of your other major subject(s) up to a maximum of 32 credits, subject to the approval of the relevant department, to contribute to a minimum of 120 credits.

15504: Agricultural Economics	750(20): Institutional economics
15504: Agricultural Economics	770(20): Food and fibre value chain management
15504: Agricultural Economics	771(20): Farm management
15504: Agricultural Economics	772(20): Topical issues in agricultural policy
15504: Agricultural Economics	773(20): Wine marketing
15504: Agricultural Economics	774(20): General equilibrium models for policy analysis
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	784(16): Environmental policy
15504: Agricultural Economics	785(16): Agricultural policy in the South African context
15504: Agricultural Economics	786(16): Farm investment and finance management

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations in June and November.

Enquiries

Prof A Jooste

Tel: 021 808 4899

E-mail: joostea@sun.ac.za

Master's programme in Agricultural Economics and Management

The master's programme in Agricultural Economics and Management leads to one of the following qualifications: *MScAgric (Agricultural Economics and Management)* or *MAgric (Agricultural Economics)*.

4.1.2 MAgric (Agri-business Management)

Programme Code

2781011

Specific Admission Requirements

- The one-year BAgricHons degree, as well as other qualifications that Senate has approved for this purpose.
- An average final mark of 60% for the major subject.

Programme Description

After completion of the degree BAgricHons you can apply for admission to the degree MAgric (Agricultural Economics). The programme consists of a research component and is designed to develop your ability to undertake independent research in terms of problem-solving, multidisciplinary approaches and scientific scholarship. After completion of the programme you will be 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. 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.

Programme Content

Compulsory Module

15504: Agricultural Economics	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof A Jooste

Tel: 021 808 4899

E-mail: joostea@sun.ac.za

4.1.3 MScAgric in Agricultural Economics and Management

Programme Code

2731011

Specific Admission Requirements

- An applicable BScAgric degree.
- An average final mark of 60% for the major subject.

Programme Description

After completion of the BScAgric degree in Agricultural Economics and Management you will be able to apply for admission to the degree MScAgric (Agricultural Economics and Management). The programme consists of a research component and is designed to develop your ability to undertake independent research in terms of problem-solving, multidisciplinary approaches and scientific scholarship. After completion of the programme you will be 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. You must carry out independent research 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.

Programme Content

Compulsory Module

15504: Agricultural Economics	873(120): MScAgric (Agricultural Economics and Management)

First Year (60 credits)

Elective Modules

Choose modules to the value of at least 60 credits from the table below.

15504: Agricultural Economics	850(15): Institutional economics
15504: Agricultural Economics	880(15): Analysis of food and fibre value chains
15504: Agricultural Economics	884(15): Rural development
15504: Agricultural Economics	885(15): Applied SAM based modelling
15504: Agricultural Economics	891(15): Strategic farm management
15504: Agricultural Economics	892(15): Agricultural policy analysis
15504: Agricultural Economics	893(15): Strategic marketing of wine
15504: Agricultural Economics	894(15): Topical issues in agricultural resource use
15504: Agricultural Economics	895(15): Agricultural production economics and decision analysis
15504: Agricultural Economics	896(15): International trade and marketing strategies

Second Year (120 credits)

Compulsory Module

15504: Agricultural Economics	873(120): Master's thesis

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations in June and November.

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof A Jooste

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4.1.4 PhD in Agricultural Economics and Management or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

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 expertise 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. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

15504: Agricultural Economics	978(360): Doctoral dissertation

Assessment and Examination

Note that the programme has a substantial residential requirement. After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof A Jooste

Tel: 021 808 4899

E-mail: joostea@sun.ac.za

4.1.5 DSc in Agricultural Economics and Management

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Agricultural Economics and Management is required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Agricultural Economics and Management. An oral examination may be required of you. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

15504: Agricultural Economics	998(360): DSc research collection

4.2 Department of Agronomy

4.2.1 Postgraduate Diploma in Agronomy

Programme Code

6431001

Specific Admission Requirements

- Three-year BSc degree, pre-HEQSF BTech degrees or Advanced Diplomas at NQF level 7 in a relevant field of study, and other qualifications deemed equivalent as approved by Senate

Closing Date for Applications

Apply by 14 September of the previous year.

Programme Structure

The primary purpose of a Postgraduate Diploma is to strengthen and deepen students' knowledge in a particular domain of practice with a specific focus on equipping working professionals with the knowledge, skills and attributes to solve workplace-based problems.

If you have obtained this qualification, you may apply for entry to the MScAgric in Agronomy. However, admission is not guaranteed since the purpose of the Postgraduate Diploma differs from research-based qualifications such as an Honours degree or Master's degree. Postgraduate Diploma graduates will be screened using the admission requirements for the MScAgric in Agronomy.

Duration of Programme

This programme extends over one year full-time, or two years part-time.

Programme Content

Full-time offering:

All modules are compulsory. If you are completing the programme in one year full-time, you must take all modules together.

13327: Crops for extensive production systems	711(18): Crops for extensive production systems
13328: Physiological and ecological principles of natural pasture management	712(18): Physiological and ecological principles of natural pasture management
13329: Weed Management	741(18): Weed management
13336: Production physiology and technology for annual agronomical 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

Part-time offering:

All modules are compulsory. If you are completing the programme in two years part-time, you must take the following modules each year, as indicated below:

YEAR 1

13327: Crops for extensive production systems	711(18): Crops for extensive production systems
13329: Weed Management	741(18): Weed management
13336: Production physiology and technology for annual agronomical crops	742(18): Production physiology and technology for annual agronomical crops
13335: Agronomy Science Project	772(30): Agronomy Science Project

YEAR 2

13334: Intensive crop production systems	771(18): Intensive crop production systems
13328: Physiological and ecological principles of natural pasture management	712(18): Physiological and ecological principles of natural pasture management
13335: Agronomy Science Project	772(30): Agronomy Science Project

Assessment and Examination

Modules are assessed by means of practical and written assignments and tests.

Enquiries

Prof PA Swanepoel

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E-mail: pieterswanepoel@sun.ac.za

4.2.2 MScAgric in Agronomy

Programme Code

2731011

Specific Admission Requirements

- An applicable four-year BScAgric degree (NQF level 8).
- An average final mark of 60% for all final year subjects.
- A mark of more than 60% for the scientific aptitude test.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

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.

Compulsory Modules

55565: Agronomy	828(172): Master's thesis
11061: Biometry	821(8): Biometrical applications

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof PA Swanepoel

Tel: 021 808 4668

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4.2.3 MSc (Agric)

Programme Code

5981001

Specific Admission Requirements

- A suitable four-year Bachelor's (Agric) degree (NQF level 8), or a three-year bachelor's degree (NQF level 7) and an applicable postgraduate qualification (BScHons) in any of the major subjects that are accompanied by agriculture.
- An average final mark of 60% for all final-year subjects.
- A mark of more than 60% for the scientific aptitude test.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

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.

Compulsory Modules

14015: Agriculture	818(172): Master's thesis
11061: Biometry	821(8): Biometrical applications

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof PA Swanepoel

Tel: 021 808 4668

E-mail: pieterswanepoel@sun.ac.za

4.2.4 PhD in Agronomy or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Agronomy, leading to innovation or problem-solving through high-level research in Agronomy and in the industry concerned. This will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

55565: Agronomy	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof PA Swanepoel

Tel: 021 808 4668

E-mail: pieterswanepoel@sun.ac.za

4.2.5 DSc in Agronomy

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Agronomy is required. Additionally original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Agronomy. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

55565: Agronomy	998(360): DSc research collection

4.3 Department of Animal Sciences

4.3.1 Postgraduate Diploma in Aquaculture

Programme Code

6021001

Specific Admission Requirements

- An applicable three-year BSc degree.
- An average final mark of 60% for the major subject.
- A high level of theoretical engagement will be expected of you to increase your competency to the level of a four-year bachelor's degree in Agriculture at NQF level 8.

Closing Date for Applications

Apply by 14 September of the previous year.

Duration of Programme

This programme extends over one year.

Programme Content

The postgraduate diploma in Aquaculture is designed to expand and strengthen your knowledge in the discipline of Aquaculture. In addition, you will be introduced to research methodology and your writing and presentation skills will be developed.

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

plus

Elective Modules

Choose two of the modules below.

46213: Aquaculture	712(16): Aquaculture products
46213: Aquaculture	713(16): Introduction to aquaponics production systems
46213: Aquaculture	742(16): Aquaculture ecology
46213: Aquaculture	743(16): Aquaculture nutrition
46213: Aquaculture	745(16): Advanced aquaponics technologies

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations in June and November.

Enquiries

Dr JHC van Zyl

Tel: 021 808 4746

E-mail: brinkvz@sun.ac.za

4.3.2 MScAgric in Animal Science

Programme Code

2731011

Specific Admission Requirements

- The BScAgric degree with an average final mark of at least 60% for the third- and fourth-year modules.
- The Department can expect you to be interviewed prior to admission.

Your application is subject to approval by the Department of Animal Sciences.

Programme Content

The master's programme consists of a research component of 100% (180 credits) but you could, in consultation with your supervisor, be requested to follow additional modules, including Biometry 821 (Biometrical Applications).

Research is possible in the following fields:

- increase in the efficiency of animal production and animal products;
- the improvement of product quality in the farming of large and small livestock, and poultry;
- increase in the efficiency and production of alternative animal species; and
- intensive and extensive aquaculture systems, feeding and breeding.

Programme Outcomes

After successful completion of the theoretical modules, you 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 of animal breeding, animal nutrition, animal physiology and animal products to enable problem-solving;
- plan and execute research trials, 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.

Compulsory Module

20826: Animal Science	818(180): Master's thesis

Assessment and Examination

After completion of the research, you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Dr JHC van Zyl

Tel: 021 808 4746

E-mail: brinkvz@sun.ac.za

4.3.3 PhD in Animal Production Systems or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

The programme focuses strongly on research and aims to discover new insights and knowledge in the field of Animal Production Systems. This knowledge increases your general intellectual and professional skills and promotes your adaptability to carry out advanced research in a specific field of study that links up with other fields of study. The programme will equip you at the highest academic level for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

20826: Animal Science	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research, you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Dr JHC van Zyl

Tel: 021 808 4746

E-mail: brinkvz@sun.ac.za

4.3.4 DSc in Animal Production Systems

Programme Code

6001001

Programme Description

For the DSc degree, several advanced original research and/or creative work in Animal Production Systems is required. Additionally original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Animal Production Systems. An oral examination may also be required. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

20826: Animal Science	998(360): DSc research collection

4.4 Department of Conservation Ecology and Entomology

4.4.1 Programmes in Conservation Ecology

4.4.1.1 MSc in Conservation Ecology

Programme Code

5461021

Specific Admission Requirements

- An applicable BScHons degree, BScAgric degree or BScConsEcol degree.
- An average final mark of 60% for the major subject.

Programme Content

The research component (minimum time span six months, 180 credits at NQF level 8) entails independent research on an approved topic in Conservation Ecology that you conduct under a supervisor. As part of the process, you must present a seminar to the Department of Conservation Ecology and Entomology on your proposed thesis. On completion of the research you must write up your results and submit them in the format of a thesis. The thesis must meet the requirements for a master's thesis as prescribed by the Department of Conservation Ecology and Entomology and Stellenbosch University.

Compulsory Module

55638: Conservation Ecology	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof F Roets

Tel: 021 808 2635

E-mail: fr@sun.ac.za

4.4.1.2 PhD with specialisation in Conservation Ecology or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Conservation Ecology, leading to innovation or problem-solving through high-level research in Conservation Ecology and in the industry concerned. This will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

55638: Conservation Ecology	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof F Roets

Tel: 021 808 2635

E-mail: fr@sun.ac.za

4.4.2 Programmes in Entomology

4.4.2.1 MSc or MScAgric in Entomology

Programme Code

5981001 or 2731011

Specific Admission Requirements

- The BScAgric degree or a BScHons in a suitable subject field.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

You determine your topic for the master's degree in consultation with the lecturer concerned. You can select a topic from fields which include morphology and systematics, insect conservation ecology and integrated pest management of insects.

Compulsory Module

34576: Entomology	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof F Roets

Tel: 021 808 2635

E-mail: fr@sun.ac.za

4.4.2.2 PhD in Entomology or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Entomology, leading to innovation or problem-solving through high-level research in Entomology and in the industry concerned. This will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

34576: Entomology	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof F Roets

Tel: 021 808 2635

E-mail: fr@sun.ac.za

4.4.2.3 DSc in Entomology

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Entomology is required. Additionally original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Entomology. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

34576: Entomology	998(360): DSc research collection

4.4.3 Programmes in Nematology

4.4.3.1 MSc or MScAgric in Nematology

Programme Code

5981001 or 2731011

Specific Admission Requirements

- A BScAgric degree or a BScHons degree in a suitable subject field.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

You determine your topic for the master's degree programme in consultation with the lecturer concerned. You can select a topic from fields which include morphology and systematics, biological control and integrated pest management of insects.

Compulsory Module

43850: Nematology	818 / 878 (180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof F Roets

Tel: 021 808 2635

E-mail: fr@sun.ac.za

4.4.3.2 PhD in Nematology or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Nematology, leading to innovation or problem-solving through high-level research in Nematology and in the industry concerned. This will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

43850: Nematology	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof F Roets

Tel: 021 808 2635

E-mail: fr@sun.ac.za

4.4.3.3 DSc in Nematology

Programme Code

6001001

Programme Description

For the DSc degree, a number of advanced original research and/or creative works in Nematology are required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Nematology. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

43850: Nematology	998(360): DSc research collection

4.5 Department of Food Science

4.5.1 MSc in Food Science

Programme Code

2841011

Specific Admission Requirements

- A four-year BSc in Food Science degree, a three-year BSc Food Science degree with a BScHons in Food Science, or a three-year BSc with Chemistry or Biochemistry on final-year level with an honours degree.
- Supplementary Food Science modules, as prescribed by the Department of Food Science, must be taken if you only qualify for the three-year BSc with Chemistry or Biochemistry on final-year level with an honours degree.
- An average final mark of 60% for the final-year modules.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

You choose your research project for the master's programme in consultation with your supervisor.

Compulsory Module

21210: Food Science	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof GO Sigge

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E-mail: gos@sun.ac.za

4.5.2 MSc in Food and Nutrition Security

Programme Code

6591001

Specific Admission Requirements

- A professional bachelor's or honours degree in an applicable Agricultural Science, Health Science or Natural Science field that is on NQF level 8. You must achieve a minimum average mark of 60% over the four years of study.

Duration of Programme

This programme extends over a minimum of two years.

Application Process and Closing date

If you are a prospective South African student, you must apply online at www.maties.com by 30 September of the previous year.

If you are a prospective international student, you must apply online at www.maties.com by 31 August of the previous year.

Please note: Only a certain number of students are selected each year.

Programme Content

This structured programme is presented mainly by means of technology-mediated teaching and learning, in combination with courses presented on campus. This programme comprises twelve theoretical modules and a research assignment (33% of the total credits). If the academic year extends over 45 weeks, it is expected of the student to utilise 20 notional hours per week, over a two-year period, to complete the programme.

First Year

Compulsory Modules

13255: Conceptualising food systems	811(10): Conceptualising food systems
13256: Food safety, hazards & risks	812(10): Food safety, hazards & risks
13257: Human economic development	813(10): Human economic development
13258: Agriculture-nutrition linkages	814(10): Agriculture-nutrition linkages
13259: Food processing & preservation	815(10): Food processing & preservation
13261: Introduction to epidemiology	841(10): Introduction to epidemiology
13262: Macro- & micronutrients & health	842(10): Macro- & micronutrients & health
13263: Functional Foods & Alternative Proteins	843(10): Functional Foods & Alternative Proteins
13264: Food chains and consumers	844(10): Food chains and consumers

Second Year

Compulsory Modules

13265: Assessing food security	821(10): Assessing food security
13266: Food security project analysis	822(10): Food security project analysis
13267: Food & nutrition policies	823(10): Food & nutrition policies
13533: Research assignment (Human Nutrition)	841(60): Research assignment (Human Nutrition)

OR	
13534: Research assignment (Agricultural Economics)	842(60): Research assignment (Agricultural Economics)
OR	
13535: Research assignment (Food Science)	843(60): Research assignment (Food Science)

Assessment and Examination

- The final mark for each theoretical module will consist of a class mark which is compiled through flexible assessment (i.e. various assessments, which could include: STEMLearn/FHMSLearn discussions, assignments, tasks, quizzes, oral presentations. Specific assessment criteria will be detailed in each module's module framework).
- You will only be permitted two attempts at completing the theoretical modules. If you fail to pass a module after these two attempts, you will not be readmitted to the programme.
- You must obtain a minimum of 50% to pass all individual modules.
- The final mark for the research assignment will be calculated as follows:
  - 20% for the protocol
  - 80% for the research assignment; and
- The final mark for the degree programme will be calculated as follows:
  - Course work 67%
  - Research assignment 33%
- You will be allowed to register for the research assignment for a maximum of three years. If you fail to complete the research assignment within this time, your performance will be officially reviewed by the programme committee, and you may be denied the right to reregister for the programme.

Enquiries

Prof GO Sigge

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E-mail: gos@sun.ac.za

4.5.3 PhD in Food Science

Programme Code

5471001

Programme Description

The doctoral programme in Food Production Systems is at least two years, but depending on the field of study could take longer to complete. You choose a relevant research project in consultation with your 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. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

21210: Food Science	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof GO Sigge

Tel: 021 808 3581

E-mail: gos@sun.ac.za

4.5.4 DSc in Food Science

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Food Science is required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Food Science. You may also be required to complete an oral examination. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

21210: Food Science	998(360): DSc research collection

4.6 Department of Forest and Wood Science

4.6.1 Postgraduate Diploma in Forestry and Wood Sciences

Programme Code

6031001

Specific Admission Requirements

- Appropriate three-year BSc degrees, BTech degrees as well as other qualifications that Senate has approved for this purpose.
- A minimum final mark of 60% in all modules or in the major module that is applicable to the postgraduate field of study. The Department can decide to deviate from this requirement.

Closing Date for Applications

Apply by 14 September of the previous year.

Duration of Programme

This programme extends over one year.

Programme Content

The programme consists of an approved curriculum which lays the foundation for specialisation in forestry and wood sciences disciplines. You could be requested, in consultation with your supervisor, to follow additional undergraduate modules to complement the prescribed postgraduate diploma modules. The postgraduate diploma may allow access to the MScFor programme.

Compulsory Module

Choose one of the compulsory modules.

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

plus

Elective Modules

Choose elective modules to the value of 96 credits of which a minimum of 32 credits must be from the field of Wood Product Science and a minimum of 32 credits from the field of Forest Science.

11290: Forest Science	771(32): Applied geo-information sciences
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 and propagation
57584: Wood Product Science	781(32): Wood properties and quality
57584: Wood Product Science	782(32): Primary wood processing
57584: Wood Product Science	783(32): Bio-energy

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests as well as flexible assessment.

Enquiries

Prof B Talbot

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E-mail: bruce@sun.ac.za

4.6.2 Programmes in Forestry and Wood Sciences

4.6.2.1 MSc in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences

Programme Code

6221001

Specific Admission Requirements

- The four-year BScFor degree, the postgraduate diploma in Forestry and Wood Sciences, an applicable honours degree, as well as other qualifications that Senate has approved for this purpose.
- A minimum final mark of 60% in all modules or in the major module that is applicable to the postgraduate field of study. The Department can decide to deviate from this requirement.

Duration of Programme

This programme extends over one year after the four-year BScFor degree.

Programme Content

The master's programme consists of a 100% research component (180 credits) but you could, in consultation with your supervisor, be requested to follow additional modules, including Biometry 821 (Biometrical Applications).

Compulsory Modules

Choose one of the modules below.

11290: Forest Science	818(180): Master's thesis
57584: Wood Product Science	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof B Talbot

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E-mail: bruce@sun.ac.za

4.6.2.2 PhD in Forestry and Wood Sciences or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

This programme leads to the qualification PhD (For) in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. The programme focuses on research in various specialist fields of forestry and ensures that students become specialists in these fields.

You must carry out a relevant and practically oriented research project in Forestry and Natural Resource Sciences, leading to innovation or problem-solving through high-level research in Forestry and Natural Resource Sciences and in the industry concerned. The research project will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Modules

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

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof B Talbot

Tel: 021 808 3293

E-mail: bruce@sun.ac.za

4.6.2.3 DSc in Forestry and Wood Sciences

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences is required. Additionally original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Forestry and Natural Resource Sciences or Wood and Wood Products Sciences. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Modules

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

4.7 Department of Genetics

4.7.1 MScAgric in Genetics

Programme Code

2731011

Specific Admission Requirements

- An applicable BScAgric or BScHons degree.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

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;
- the application of cytogenetic procedures;
- 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.

Compulsory Module

13285: Genetics	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Mr WC Botes

Tel: 021 808 2637

E-mail: wcb@sun.ac.za

4.7.2 PhD in Genetics or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Genetics, leading to innovation or problem-solving through high-level research in Genetics and in the industry concerned. The research project will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

13285: Genetics	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Mr WC Botes

Tel: 021 808 2637

E-mail: wcb@sun.ac.za

4.7.3 DSc in Genetics

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Genetics is required. Additionally original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Genetics. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

13285: Genetics	998(360): DSc research collection

4.8 Department of Horticultural Science

4.8.1 BScHons in Applied Plant Physiology

Programme Code

5971001

Specific Admission Requirements

- An applicable BSc degree with Botany, Biochemistry, Genetics or Plant Biotechnology as major subject in which an average final mark of 60% was obtained.
- Supplementary study may be required.

Closing Date for Applications

Apply by 14 September of the previous year.

Duration of Programme

This programme extends over one year after an applicable three-year BSc degree.

Programme Content

The Honours programme in Applied Plant Physiology is designed to strengthen your knowledge and competencies in the discipline of Horticultural Science, with emphasis on plant physiological, biochemical and molecular mechanisms, which is relevant to production and quality systems within horticultural crops. You will also be equipped in research methodology, whilst your writing and presentation skills will also be developed. These skills will enable you to apply for further postgraduate studies offered in Horticulture (MScAgric).

Compulsory Modules

12487: Applied Plant Physiology	714(16): Ecophysiology of horticultural and agronomical crops
12487: Applied Plant Physiology	734(13): Applied plant physiology and tree

	architecture
12487: Applied Plant Physiology	744(13): 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	773(30): Research project

plus

Elective Modules

Choose one of the groupings below.

39632: Horticultural Science	714(16): Deciduous fruit production
OR	
55565: Agronomy	712(8): Greenhouse production techniques
AND	
55565: Agronomy	732(8): Cultivation of future crops
OR	
13537: Plant genetics and crop improvement	722(8): Plant genetics and crop improvement
AND	
11061: Biometry	721(8): Biometrical applications

plus

Choose two of the five modules below. Neither Agronomy 752 and Horticultural Science 742 nor Agronomy 762 and Horticultural Science 762 can be taken together.

55565: Agronomy	752(8): Weed management
55565: Agronomy	762(8): Vegetable crops for intensive production
39362: Horticultural Science	742(8): Citrus physiology and technology
39632: Horticultural Science	752(8): Ornamental and foliage plant production
39632: Horticultural Science	762(8): Subtropical fruit production

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations in June and November.

Enquiries

Dr E Crouch

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E-mail: elke@sun.ac.za

4.8.2 MScAgric in Horticultural Science

Programme Code

2731001

Specific Admission Requirements

- An applicable BScAgric degree.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

This programme consists of a research and a modular component. The research topic can 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; or
- 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 part of the programme. You must also deepen your subject knowledge on general plant physiology through self-study.

Compulsory Modules

11061: Biometry	821(8): Biometrical applications
39632: Horticultural Science	871(172): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Dr E Crouch

Tel: 021 808 4763

E-mail: elke@sun.ac.za

4.8.3 PhD in Horticultural Science or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Horticultural Science, leading to innovation or problem-solving through high-level research in Horticultural Science and in the industry concerned. The research project will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

39632: Horticultural Science	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Dr E Crouch

Tel: 021 808 4763

E-mail: elke@sun.ac.za

4.8.4 DSc in Horticultural Science

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Horticultural Science is required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Horticultural Science. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

39632: Horticultural Science	998(360): DSc research collection

4.9 Department of Plant Pathology

4.9.1 BScHons in Plant Pathology

Programme Code

5971001

Specific Admission Requirements

- A BSc degree with Microbiology, Genetics, Botany or Biotechnology as major with an average final mark of 60% for the major.
- Supplementary study may be required.

Closing Date for Applications

Apply by 14 September of the previous year.

Duration of Programme

This programme extends over one year.

Programme Content

The programme consists of further specialised study in Plant Pathology. The modules and study tasks add greater depth of learning, building further on a bachelor's programme with Microbiology, Genetics, Botany or Biotechnology as major subject. 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.

Compulsory Modules

32891: Plant Pathology	771(16): Advanced disease management
32891: Plant Pathology	772(16): Advanced plant disease dynamics
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

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations in June and November.

Enquiries

Dr C Lennox

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E-mail: clennox@sun.ac.za

4.9.2 MSc or MScAgric in Plant Pathology

Programme Code

5981001 or 2731011

Specific Admission Requirements

- The BScAgric degree or a BScHons in a suitable subject field.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

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); or
- 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.

Compulsory Module

32891: Plant Pathology	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Dr C Lennox

Tel: 021 808 4796

E-mail: clennox@sun.ac.za

4.9.3 PhD in Plant Pathology or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Plant Pathology, leading to innovation or problem-solving through high-level research in Plant Pathology and in the industry concerned. The research project will equip you at the highest academic level with the knowledge and expertise you

need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

32891: Plant Pathology	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Dr C Lennox

Tel: 021 808 4796

E-mail: clennox@sun.ac.za

4.9.4 DSc in Plant Pathology

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Plant Pathology is required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Plant Pathology. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

32891: Plant Pathology	998(360): DSc research collection

4.10 Department of Soil Science

4.10.1 MScAgric in Soil Science

Programme Code

2731011

Specific Admission Requirements

- An applicable BScAgric degree.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

You select a topic for the research project 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; or
- 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. You will be 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. You must be able to show that you have 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.

Compulsory Module

14176: Soil Science	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof CE Clarke

Tel: 021 808 3659

E-mail: cdowding@sun.ac.za

4.10.2 MSc (Agric)

Programme Code

5981001

Specific Admission Requirements

- A suitable four-year Bachelor's (Agric) degree (NQF level 8), or a three-year bachelor's degree (NQF level 7) and an applicable postgraduate qualification (BScHons) in any of the major subjects that are accompanied by agriculture.
- An average final mark of 60% for all final-year subjects.

Duration of Programme

This programme extends over a minimum of one year but may take longer to complete.

Programme Content

You select a topic for the research project 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; or
- 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. You will be 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. You must be able to show that you have 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.

Compulsory Module

14015: Agriculture	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof CE Clarke

Tel: 021 808 3659

E-mail: cdowding@sun.ac.za

4.10.3 PhD in Soil Science or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

You must carry out a relevant and practically oriented research project in Soil Science, leading to innovation or problem-solving through high-level research in Soil Science and in the industry concerned. The research project will equip you at the highest academic level with the knowledge and expertise you need for entering the research industry or professional field. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

14176: Soil Science	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof CE Clarke

Tel: 021 808 3659

E-mail: cdowding@sun.ac.za

4.10.4 DSc in Soil Science

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Soil Science is required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Soil Science. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

14176: Soil Science	998(360): DSc research collection

4.11 Department of Viticulture and Oenology

4.11.1 Programmes in Oenology

4.11.1.1 MScAgric in Oenology

Programme Code

2731011

Specific Admission Requirements

- An applicable BScAgric degree.
- An average final mark of 60% for the final year modules.

Duration of Programme

This programme extends over two years.

Programme Content

You determine your topic for the master's degree in consultation with your supervisor. A research topic 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.

Compulsory Module

33103: Oenology	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof MA Vivier

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E-mail: mav@sun.ac.za

4.11.1.2 PhD in Oenology or PhD (Agric)

Programme Code

5471001 or 247100

Programme Description

The programmes focus strongly on research in the specialist field of Oenology. You choose a relevant and practically oriented research project which puts you in contact with the industry, leading to problem-solving in the industry concerned, and also prepares you to enter the research or professional market. The programme contributes at a high level to the Faculty of AgriSciences' research profile and delivers professional individuals who can play, either as a team member or individually, a meaningful role in national or international research, teaching and policymaking in specialist fields concerned with sustainable and environmentally friendly grape and wine industries. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

33103: Oenology	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof MA Vivier

Tel: 021 808 3773

E-mail: mav@sun.ac.za

4.11.1.3 DSc in Oenology

Programme Code

6001001

Programme Description

For the DSc degree, a number of advanced original research and/or creative work(s) in Wine Production Systems are required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Wine Production Systems. An oral examination may also be required. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

33103: Oenology	998(360): DSc research collection

4.11.2 Programmes in Viticulture

4.11.2.1 MScAgric in Viticulture

Programme Code

2731011

Specific Admission Requirements

- An applicable BScAgric degree.
- An average final mark of 60% for the final-year modules.

Duration of Programme

This programme extends over two years.

Programme Content

You determine your topic for the master's degree in consultation with your supervisor. A research topic 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.

Compulsory Module

33081: Viticulture	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof MA Vivier

Tel: 021 808 3773

E-mail: mav@sun.ac.za

4.11.2.2 PhD in Viticulture or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

The programmes focus strongly on research in the specialist field of Viticulture. You choose a relevant and practically oriented research project which puts you in contact with the industry, leading to problem-solving in the industry concerned, and also prepares you to enter the research or professional market. The programme contributes at a high level to the Faculty of AgriSciences' research profile and delivers professional individuals 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. See section 2.4 in this chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

33081: Viticulture	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof MA Vivier

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E-mail: mav@sun.ac.za

4.11.2.3 DSc in Viticulture

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work in Wine Production Systems is required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Wine Production Systems. An oral examination may also be required. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

33081: Viticulture	998(360): DSc research collection

4.11.3 Programmes in Wine Biotechnology

4.11.3.1 BScHons in Wine Biotechnology

Programme Code

5971001

Specific Admission Requirements

- A suitable degree (e.g. BSc, BScAgric or BEng) with any applicable discipline as major.
- An average final mark of 60% for all final-year major subject modules.

Closing Date for Applications

See the website for relevant application information and deadlines.

Duration of Programme

This programme extends over one year.

Programme Content

The honours programme 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.

The programme comprises formal lectures, as well as seminars, self-study and experimental work in Wine Biotechnology. 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; and
- grapevine biology, biotechnology and improvement.

You must carry out self-study on the South African wine industry as well as independent research in grapevine and wine biotechnology.

Compulsory Modules

50997: Wine Biotechnology	771(30): Research methodology for grapevine and wine biotechnology
50997: Wine Biotechnology	772(20): Techniques in grape and wine sciences
50997: Wine Biotechnology	773(20): Wine-related microbes
50997: Wine Biotechnology	774(20): Grapevine biology and biotechnology
50997: Wine Biotechnology	775(10): Seminar
50997: Wine Biotechnology	776(20): Chemistry and biochemistry of grapes and wine

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations throughout the year.

Enquiries

Prof MA Vivier

Tel: 021 808 3773

E-mail: mav@sun.ac.za

4.11.3.2 MScAgric or MSc in Wine Biotechnology

Programme Code

2731011 or 5981001

Specific Admission Requirements

- An applicable BScAgric, BEng or BScHons degree.
- An average final mark of 60% for the major subject.

Duration of Programme

This programme extends over two years.

Programme Content

You determine your topic for the master's degree in consultation with your supervisor. A research topic can be selected from one of the following themes:

- the selection and genetic improvement of wine yeasts and bacteria for the improvement of wine fermentation and processing, also using alternative techniques such as directed evolution, and for the improvement of the quality and sensory properties of wine and other grape-based beverages;
- interaction of wine yeasts and lactic acid bacteria related to nutrient usage and the impact on wine aroma;
- assessing the impact of grape and winemaking practices on the microbiome;
- grape and wine sensory evaluation techniques and consumer studies; and
- understanding the interaction of grapevines with their biotic and abiotic environments by studying molecular and metabolite profiles of the plant.

Compulsory Module

50997: Wine Biotechnology	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof MA Vivier

Tel: 021 808 3773

E-mail: mav@sun.ac.za

4.11.3.3 PhD in Wine Biotechnology or PhD (Agric)

Programme Code

5471001 or 274100

Programme Description

The programmes focus strongly on research in the specialist field of Grape or Wine Biotechnology. You choose a relevant fundamental or practically oriented research project which puts you in contact with the industry, leading to problem-solving in the industry concerned, and also prepares you to enter the research or professional market. The programme contributes at a high level to the Faculty of AgriSciences' research profile and delivers professional individuals 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. See section 2.4 in this

chapter for general information on the PhD degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

50997: Wine Biotechnology	978(360): Doctoral dissertation

Assessment and Examination

After completion of the research you must submit a dissertation to the satisfaction of the examiners and present a seminar. You will be expected to defend your dissertation during this seminar.

Enquiries

Prof MA Vivier

Tel: 021 808 3773

E-mail: mav@sun.ac.za

4.11.3.4 DSc in Wine Biotechnology

Programme Code

6001001

Programme Description

For the DSc degree a number of advanced original research and/or creative work(s) in Wine Production Systems are required. Additionally, original and previously published work(s) of a high standard are required that show that you have made a real and exceptional contribution to the enrichment of the knowledge base in Wine Production Systems. An oral examination may also be required. See section 2.5 in this chapter for general information on the DSc degree in the Faculty of AgriSciences.

Programme Content

Compulsory Module

50997: Wine Biotechnology	998(360): DSc research collection

4.11.4 MSc (Agric)

Programme Code

5981001

Specific Admission Requirements

- A suitable four-year Bachelor's (Agric) degree (NQF level 8), or a three-year bachelor's degree (NQF level 7) and an applicable postgraduate qualification (BScHons) in any of the major subjects that are accompanied by agriculture.
- An average final mark of 60% for all final-year subjects.

Duration of Programme

This programme extends over two years.

Programme Content

You determine your topic for the master's degree in consultation with your supervisor.

Compulsory Module

14015: AgriSciences	818(180): Master's thesis

Assessment and Examination

After completion of the research you must submit a thesis to the satisfaction of the examiners and present a

seminar. You will be expected to defend your thesis during this seminar.

Enquiries

Prof MA Vivier
Tel: 021 808 3773
E-mail: mav@sun.ac.za

5. Multidisciplinary postgraduate programmes

5.1 Programme in Sustainable Agriculture

5.1.1 MSc (Sustainable Agriculture)

Programme Code

5981001

Specific Admission Requirements

- You must have a suitable four-year bachelor's (Agric) degree (NQF level 8), or a three-year bachelor's degree (NQF level 7) and an applicable postgraduate qualification (e.g. BScHons or a postgraduate diploma) in any of the major subjects that are applicable to agriculture.
- You must have achieved an average final mark of 60% or higher.
- You must be proficient in English.
- You must submit a written motivation for admission to the programme.

Programme Content

The purpose of this programme is to train you as a researcher in understanding and working within sustainable agriculture. To this end, we adopt a systems approach to agriculture. 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 starts with the module Introduction to Systems Thinking. Next, the programme teaches concepts in sectoral sustainable agriculture such as 'sustainable animal production', 'sustainable plant production' and 'livelihood perspectives'. Modules like Systems Analysis and Simulation, QUALUS (Quantitative Land Use Analysis) and Biometry will improve your quantitative and analytical skills, which you need to generate and integrate knowledge of sustainable agriculture. A work-integrated learning opportunity that links you to organisations in the industry will give you a real-life perspective and ensure that you are ready for the job market.

Compulsory Modules

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
11061: Biometry	821(8): Biometrical applications

Assessment and Examination

Modules are assessed by means of practical and written assignments, tests and written examinations in June and November.

After you have completed your research, you must submit a thesis that the examiners approve. Then you must present a seminar where you will have to defend your thesis.

Enquiries

Dr EE Phiri

Tel: 021 808 4558

E-mail: sust_agri@sun.ac.za

5.2 Centre for Bioinformatics and Computational Biology

5.2.1 MSc in Bioinformatics and Computational Biology

Programme Code

14166 – 879(180)

This programme is offered as a multidisciplinary programme within the Faculties of AgriSciences, Medicine and Health Sciences, and Science. You enrol in the faculty where your research focus and supervisor(s) are situated and will graduate with the degree from that faculty.

Specific Admission Requirements

- One of the following qualifications:
  - A BScHons degree in Bioinformatics and Computational Biology, Biochemistry, Genetics, or Molecular Biology;
  - An applicable BScHons degree in a biological field;
  - A BScHons degree in Computer Science, Informatics, Mathematics, Applied Mathematics or Statistics;
  - An applicable BScHons degree in a Mathematics-related field; or
  - Any other academic degree qualification and appropriate experience (assessed using the regular RPL procedures) approved by the Senate
- Depending on your previous training and experience, the Postgraduate Committee of the Division of Molecular Biology and Human Genetics may prescribe additional studies.

Programme Content

Independent research on an approved topic as determined by the supervisor(s) and leading to a thesis is required. This programme consists of a 100% thesis.

Compulsory Module

Thesis: Bioinformatics and Computational Biology	818(180)

Assessment and Examination

After completion of the research you must submit a thesis for examination to the satisfaction of the appointed examiners and do an oral examination.

Enquiries

Programme leader: Prof H Patterton

Tel: 021 808 2774

Email: hpatterton@sun.ac.za

5.2.2 PhD in Bioinformatics and Computational Biology

Programme Code

14166 – 978(360)

Programme Description

The programme is offered as a multidisciplinary programme within the Faculties of AgriSciences, Medicine

and Health Sciences, and Science. You enrol in the faculty where your research focus and supervisor(s) are situated, and will graduate with the degree from that faculty.

A publication-ready dissertation containing the results of your independent research is required. See also section 2.3 in the chapter on "Postgraduate Programmes" in the Faculty of Science's Yearbook part for general information on this PhD degree.

5.2.3 Structured MSc in Bioinformatics of Infectious Diseases and Pathogen Genomics

This is a new programme that has been submitted for approval to the Department of Higher Education and Training (DHET) and for accreditation by the Council on Higher Education (CHE). The programme will, however, only be implemented once it has been registered with the South African Qualifications Authority (SAQA). We hope to implement the programme by 2026. To include your details on the contact list for further information, or to get more information on the programme itself, please contact Ms S Dyers at sdyers@sun.ac.za.

This programme is offered as a multidisciplinary programme within the Faculties of AgriSciences, Medicine and Health Sciences, and Science. You enrol in the faculty where your research focus and supervisor(s) are situated and will graduate with the degree from that faculty.

Specific Admission Requirements

- One of the following qualifications:
  - a Bachelor of Science Honours degree (NQF level 8) in Bioinformatics, Data Science, Statistics, Mathematics, Computer Science, Biochemistry, Genetics, Molecular Biology, or a related field, or
  - a professional 480-credit bachelor's degree (NFQ level 8) in Bioinformatics, Data Science, Statistics, Mathematics, Computer Science, Biochemistry, Genetics, Molecular Biology, or a related field, or
  - another academic degree qualification and appropriate experience (assessed using the regular RPL procedures) that have been approved by the Faculty Board of the Science, Medicine and Health Sciences or AgriSciences faculties.
- A minimum of 65% in the preceding qualification is required to be considered for the MSc degree. Candidates are selected on academic merit and only a limited number of candidates are admitted to the programme.

Duration of programme

The programme extends over two years on a full-time basis.

Programme Content

This programme consists of compulsory and elective modules presented over a 9-month period. This is followed by independent research on an approved topic as determined by the supervisor(s) and leading to a thesis.

Compulsory Modules

Bioinformatics	Xxx (35)
Algorithms and Machine Learning in Bioinformatics	xxx (10)
Python in Bioinformatics	xxx (10)
R in Bioinformatics	xxx (10)
Thesis	xxx (90)

Elective Modules

Please note: An elective module will only be offered if a minimum of five students have enrolled for the module.

Choose one of the following modules.

Infectious Diseases	Xxx (25)
Pathogen Genomics	Xxx (25)

Assessment and Examination

- The compulsory and elective modules are assessed in a flexible manner by a combination of tutorials, assignments, practical and tests. You must pass each module with at least 50% to obtain

the degree.

- You must complete a thesis that is assessed according to the University's guidelines through a process of internal and external examination. You must pass the thesis with at least 50% to obtain the degree.
- After examination of the thesis, you must present the research results as a seminar to the satisfaction of the examination committee.
- The final mark for the degree is calculated as the weighted average of all the modules.

Enquiries

Programme leader: Prof H Patterton

Tel: 021 808 2774

E-mail: hpatterton@sun.ac.za

Subjects, modules and module contents

1. Definitions and explanations of important terms

It is important that you take note of the definitions of a few terms in order to understand and use this chapter fully. The example below shows how these terms will appear in the information that is offered later in this chapter.

Example:

15504 Agricultural Economics

234 (16) South African agriculture (6L)

1.1 Explanation

15504 Agricultural Economics

Each subject is identified by a **five-digit subject number**. The subject number "15504" refers to the subject Agricultural Economics.

15504 Agricultural Economics

The **subject name** is presented directly after the five-digit subject number before the various modules of the subject are offered. Normally the subject name is followed by the module code and the credit value of the specific module, for example in this case: Agricultural Economics 234 (16).

234 (16) South African agriculture (6L)

The **module code** consists of a three-digit number that is unique to the specific module. The abovementioned module code "234" has the following meaning:

The first digit "2" refers to the year of study in which the module is presented, for example:

- Year 1: **1**14
- Year 2: **2**14
- Year 3: **3**14

The second digit "3" refers to the semester that the module will be presented in and also serves as a number to distinguish between various modules offered within the same specific year of study. The University uses different numbers to indicate the particular semester of a module, either the first or the second semester or modules that are presented in both semesters (which are year modules). The numbers that indicate semesters are as follows:

- **1**, **2** or **3**– modules are presented in the first semester.
  Semester 1: 214, 324, 334
- **4**, **5** or **6** – modules are presented in the second semester.
  Semester 2: 342, 354, 364
- **7**, **8** or **9** – modules are presented in both semesters, which are year modules.
  Year module (both semesters): 278, 288, 391

The third digit "4" of the module code "234" serves as a distinguishing digit between various modules of the same subject in a particular year of study.

Credit value – 234 (16) South African agriculture (6L)

The number in brackets immediately following the module code indicates the **credit value** of the particular module.

Module subject – 234 (16) South African agriculture (6L)

This indicates the subject that will be dealt with in this specific module.

Teaching load – 234 (16) South African agriculture (6L)

The teaching load of a module is given immediately after the module subject. It gives you both the teaching load and the type of teaching per week that you can expect in this particular module. For the module 234 (16) South African agriculture (6L) you can expect six lectures each week for the duration of the module. The following abbreviations are used for the teaching load:

- **L** – Lecture lasting 50 minutes, for example 1L
- **P** – Practical period lasting 50 minutes, for example 1P, 2P, 3P
- **S** – Seminar lasting 50 minutes, for example 1S
- **T** – Tutorial lasting 50 minutes, for example 1T, 2T

2. Prerequisite pass, prerequisite and corequisite modules

After the description of the content of the module, the following prerequisite pass, prerequisite and corequisite modules, where applicable, are given for that module:

Prerequisite pass module

A prerequisite pass module is a module that you must pass before you can take the module(s) for which it is a prerequisite pass module.

Prerequisite module

A prerequisite module is a module in which you must obtain a final mark of at least 40, before you can take the module for which it is a prerequisite module. If you registered for a prerequisite module while it was examined by the "examination" assessment system, your class mark for it must be 40 for you to meet the prerequisite.

If you have once complied with a prerequisite rule, your compliance will remain valid for the period given in the applicable assessment rules, even if you repeat the prerequisite module and do not meet the minimum level when repeating the module.

Please note: You must pass all the modules you used as prerequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

Corequisite module

A corequisite module is a module that you must register for in an earlier semester than the module for which it is a corequisite, or in the same semester.

Please note: You must pass all the modules you used as corequisites in the programme before the relevant degree, certificate or diploma can be awarded to you.

2.1 Condition for the granting of a qualification or degree

The Faculty will only award a qualification if you have passed all the relevant prerequisite and corequisite modules of the specific degree programme.

3. Subjects, modules and module contents

Subjects with their accompanying modules, credits, module subjects, teaching loads, language specifications and module contents are presented below in alphabetical order.

15504 Agricultural Economics

234 (16) South African agriculture (6L)

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)

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.

Prerequisite module: Economics 114

Home department: Agricultural Economics

262 (8) The economics of agricultural resources (3L)

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)

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.

Prerequisite module: Agricultural Economics 242

Home department: Agricultural Economics

334 (16) Agricultural and food marketing (3L, 3P)

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)

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)

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.

Prerequisite module: Agricultural Economics 242

Home department: Agricultural Economics

414 (16) Techniques for national and international market analysis (4L)

The determinants of demand and supply as well as elasticities and impact indicators in national and international markets. Introduction to econometric techniques.

Prerequisite modules:

- *Biometry 212, 242 OR*
- *Mathematics (Bio) 124 OR*
- *Statistics and Data Science 188*

Home department: Agricultural Economics

434 (16) Farm investment and finance management (3L)

Farm investment and finance management focus on considerations of balancing investment requirements and credit. Agricultural finance processes and the role and cost of credit in farm management. Broadening critical thinking to value-adding decisions. Apply acquired knowledge to the preparation and evaluation of credit application.

Prerequisite module: Agricultural Economics 314

Home department: Agricultural Economics

444 (16) Environmental policy (3L)

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.

Prerequisite modules: Economics 114, 144

Home department: Agricultural Economics

454 (16) Agricultural policy analysis (3L)

The theoretical base of economic policy in agriculture; analysis of the 'farm problem' in historical and contemporary context; the management of market failures in agriculture: South and Southern Africa; international trade policy.

Home department: Agricultural Economics

478 (32) Agricultural economics research project (1L)

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.

Home department: Agricultural Economics

479 (24) Risk and business adjustment management (2L, 1T)

The application of agricultural economic knowledge in the food business environment with specific focus on risk and business adjustment. Extend your interpretation of gained agricultural economic knowledge into the domains of economics, business, management and finance. Sources of risk, evaluation of risk and the design of risk management options is done on the enterprise, strategic and food system levels.

Home department: Agricultural Economics

750 (20) Institutional Economics

Introduction of a range of problems, decision-making situations and institutional settings relevant to the study of agricultural and resource economics. Through the lens of theory, students will assess and propose solutions to real-world challenges faced by the agricultural sector.

Home department: Agricultural Economics

770 (20) Food and fibre value chain management

Agricultural value chains provide an introduction and theoretical underpinning to the practical and multi-disciplinary analysis of value chains, supported by recent case studies. The module introduces students to the growing importance of value chains to appreciate how two powerful forces – producers and consumers – drive agricultural value-adding activities in a competitive environment.

Home department: Agricultural Economics

771 (20) Farm management

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.

Home department: Agricultural Economics

772 (20) Topical issues in agricultural policy

The mechanisms of policy implementation; the policy analysis matrix; in-depth study of agricultural policy issues in South Africa; the management of policy processes.

Home department: Agricultural Economics

773 (20) Wine marketing

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.

Home department: Agricultural Economics

774 (20) General equilibrium models for policy analysis

Introduction to input-output tables, social accounting matrices (SAMs) and techniques related to multiplier and computable general equilibrium models.

Home department: Agricultural Economics

775 (20) Agricultural production and resource management

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.

Home department: Agricultural Economics

776 (20) International trade and marketing

International trade theory and trade policy, international marketing and marketing strategies for the export market in general and for South Africa.

Home department: Agricultural Economics

780 (20) Rural development

Historical overview of rural-development conceptual frameworks; the contribution of agriculture to rural development; two-sector models; modern growth models; integrated rural development; project analysis, practical experience with rural-development projects.

Home department: Agricultural Economics

781 (30) Research assignment: Agricultural economics

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.

Home department: Agricultural Economics

782 (16) National and international market analysis

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 models.

Prerequisite modules:

- *Biometry 212, 242 OR*
- *Mathematics (Bio) 124 OR*
- *Statistics and Data Science 188*

Home department: Agricultural Economics

784 (16) Environmental policy

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.

Prerequisite modules: Economics 114, 144

Home department: Agricultural Economics

785 (16) Agricultural policy in the South African context

The theoretical base of economic policy in agriculture; analysis of the 'farm problem' in historical and contemporary context; the management of market failures in agriculture: South and Southern Africa; international trade policy.

Home department: Agricultural Economics

786 (16) Farm investment and finance management

Farm investment and finance management focus on considerations of balancing investment requirements and credit. Agricultural finance processes and the role and cost of credit in farm management. Broadening critical thinking to value-adding decisions. Apply acquired knowledge to the preparation and evaluation of credit application.

Prerequisite module: Agricultural Economics 314

Home department: Agricultural Economics

850 (15) Institutional Economics

Introduction of a range of problems, decision-making situations and institutional settings relevant to the study of agricultural and resource economics. Through the lens of theory, students will assess and propose solutions to real-world challenges faced by the agricultural sector.

Home department: Agricultural Economics

880 (15) Analysis of food and fibre value chains

Agricultural value chains provide an introduction and theoretical underpinning to the practical and multi-disciplinary analysis of value chains, supported by recent case studies. The module introduces students to the growing importance of value chains to appreciate how two powerful forces – producers and consumers – drive agricultural value-adding activities in a competitive environment.

Home department: Agricultural Economics

884 (15) Rural development

Overview of rural-development frameworks; the contribution of agriculture to rural development; rural-analysis development project.

Home department: Agricultural Economics

885 (15) Applied SAM based modelling

Introduction to input-output tables, social accounting matrices (SAMs), multiplier and computable general equilibrium models and their application.

Home department: Agricultural Economics

891 (15) Strategic farm management

Systems philosophy and the systems approach to strategic planning and decision-making on sector level; environmental scanning, planning and management of the strategic management process; analysis and planning of the farm system; long-term investment decision-making, planning and control of financial goals.

Home department: Agricultural Economics

892 (15) Agricultural policy analysis

The theoretical structure of agricultural policy analysis; in-depth study of agricultural policy issues in a global context; the management of policy processes.

Home department: Agricultural Economics

893 (15) Strategic marketing of wine

Environmental scanning strategy determination in wine marketing.

Home department: Agricultural Economics

894 (15) Topical issues in agricultural resource use

Assignments on themes like the development of an inventory of bottom quality and quantity, the inter-dependency of the demand for food, fibre and bio-energy, 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

895 (15) Agricultural production economics and decision analysis

Sustainable production systems; modelling, simulation and programming techniques; orientation to problem-solving; decision analysis; problems, challenges and issues regarding agricultural production; case studies.

Home department: Agricultural Economics

896 (15) International trade and marketing strategies

International economics: international trade theory and policy, and marketing strategies.

Home department: Agricultural Economics

13258 Agriculture-nutrition Linkages

814 (10) Agriculture-nutrition linkages

This theme focuses on the challenges of reducing food insecurity in South Africa, arguing that these are different today from what they were in the past, as they are across Africa, requiring innovative responses and solutions that fundamentally reconsider the underpinnings of food insecurity and how to respond.

Home division: Human Nutrition

55565 Agronomy

212 (8) Agronomical crop production (1.5L, 1.5P)

Economic importance of crops; relationship between soil, climate and production capacity; cultivation practices such as tillage, crop rotation and weed control.

Prerequisite modules:

- *Crop Production 152 OR*
- *Biology 154*

Home department: Agronomy

312 (8) Greenhouse production techniques (1.5L, 1.5P)

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)

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)

Development and ecology of South African veld types; morphology and physiology of pasture plants and their reaction to defoliation; pasture management principles of grazing management in veld and planted pastures; determination of veld condition methods to evaluate the condition of veld and planted pastures.

Home department: Agronomy

332 (8) Cultivation of future crops (1.5L, 1.5P)

Identification, morphology and growth requirements of new potentially important food, fibre, medicinal and industrial crops; morphology and growth requirements of selected crops; management practices for sustainable maximal production of these crops.

Home department: Agronomy

342 (8) Weed management (1.5L, 1.5P)

Characteristics and identification of weeds; weed control strategies; biological and physical weed control; introduction to chemical weed control; integrated weed management programmes.

Home department: Agronomy

362 (8) Vegetable crops for intensive production systems (1.5L, 1.5P)

Identification of the most important vegetable crops that are cultivated in intensive production systems; morphology and physiology of these crops; production techniques in intensive plant production systems for these crops.

Home department: Agronomy

424 (16) Physiological and ecological principles of natural pasture management (3L, 3P)

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.

Prerequisite modules:

- *Agronomy 322 OR*
- *Conservation Ecology 314 OR*
- *Crop Production 214*

Home department: Agronomy

444 (16) Advanced Weed Management for Annual and Perennial Crops (3L, 3P)

This is an elective module that allow students to specialise in weed management. The module covers both theory and practice for an in-depth knowledge of weed science. The content builds on topics introduced in Weed Management 342, advanced knowledge of chemical herbicides, integrated weed management and practical weed management in annual and perennial crops.

Corequisite module: Agronomy 342

Home department: Agronomy

454 (16) Production physiology and technology for annual agronomical crops (3L, 3P)

Conservation Agriculture practices (crop rotations, crop residue management, crop diversity) related to cool-weather crops, integration of livestock in cropping systems; physiological processes involved in yield increase in cool-weather crops; utilisation and quality requirements of crops.

Prerequisite module: Agronomy 322

Home department: Agronomy

712 (8) Greenhouse production systems (1.5L, 1.5P)

Managing different soilless (hydroponic) plant production units in terms of the growing system, growth mediums, irrigation and fertigation scheduling and climate control options.

Home department: Agronomy

732 (8) Cultivation of future crops (1.5L, 1.5P)

Investigating a range of alternative crops for their potential as valuable future crops in terms of source of food, fibre, medicine and for industrial use. Considering the most sustainable production practices for these crops under different growing conditions.

Home department: Agronomy

752 (8) Weed management (1.5L, 1.5P)

Evaluation of the characteristics of a range of weeds as well as approaches to control these weeds. Formulating appropriate weed management practises and developing Integrated Weed Management programmes.

Home department: Agronomy

762 (8) Vegetable crops for intensive production systems (1.5L, 1.5P)

Assessing production practices of the most important vegetable crops cultivated in intensive production systems. Relating the morphology and physiology of these crops, to their production techniques and examining alternative, more sustainable practises.

Home department: Agronomy

13335 Agronomy Science Project

772 (30) Agronomy science project (1L)

Identification, planning, execution, evaluation and reporting of a selected appropriate research project.

Method of assessment: Final report is assessed

Home department: Agronomy

13505 Animal Anatomy and Physiology

214 (16) Animal anatomy and physiology (3L, 3P)

Introduction to animal anatomy and physiology. Discussion of the anatomy of the various organ systems, as well as function and endocrine regulation thereof to ensure homeostasis and optimal production and reproduction. Thermoregulation and homeostasis are also discussed in detail. Comparisons are made between mammals, birds and fish.

Prerequisite modules: Biology 124, 154

Home department: Animal Sciences

13716 Animal Breeding and Genetics I

424 (16) Animal Breeding and Genetics (3L, 3P)

This module focuses on applying principles and underlying theories of mendelian genetics, genetics of populations, quantitative and molecular genetics to practical animal breeding situations. It will also include the principles of the major mating systems and how they are utilised in animal production. Throughout the module, the main emphasis is on traits of economic importance in the livestock industry including production, reproduction and product traits.

Prerequisite module: Genetics 354

Home department: Animal Sciences

13717 Animal Breeding and Genetics II

452 (8) Animal breeding and genetics (2L, 1.5P)

This module covers the species-specific breeding systems, including breeding plans and how they are influenced by additive and non-additive components of genetic variance. It also introduces the student to the animal breeding industry in South Africa. International and national genetic evaluation schemes of all livestock are studied. Issues of animal breeding professional practice like ethics, legislation and laws that govern the industry in South Africa are also covered.

Prerequisite modules:

- *Genetics 354*
- *Animal Breeding and Genetics I 424*

Home department: Animal Sciences

13715 Animal Health

342 (8) Animal health (1.5L, 1.5P)

An introduction to the various agents and initiators of disease in animals and how they respond at the organism, tissue, cellular and molecular levels. Preventative measures to manage the incidence of diseases.

Prerequisite module: Animal Anatomy and Physiology 214

Home department: Animal Sciences

54801 Animal Management Science

434 (16) Intensive management systems (3L, 3P)

Management of intensively produced monogastric animals including pigs, poultry and aquaculture species, including aspects regarding production facilities and management practices. Production facilities include housing of pigs and poultry, and aquaculture units. Management practices include management of all production stages of pigs (reproduction, weaner and growers), poultry (layers, breeders, hatcheries and broilers) and aquaculture species (fin fish breeding, hatcheries and grow out).

Practicals: Calculation of housing requirements for a piggery. Determination of ~~of~~ egg quality, break-out analysis and layer and breeder hen handling and assessment. Farm visits are done on an *ad hoc* basis as biosecurity allows.

Prerequisite pass module: Introduction to Animal Nutrition 244

Corequisite modules:

- *Animal Nutrition Science 344*
- *Animal Health 342*
- *Animal Physiology 324, 344*

Home department: Animal Sciences

464 (16) Animal management science (3L, 3P)

Cattle and sheep management practices; production systems; reproduction and mating systems; mating and lambing/calving seasons; identification of animals; fattening and marketing of animals; animal-waste management; flock/herd health; principles of wool production.

Practicals: Assessment and handling of cattle and sheep, as well as management practices. Identification of animal diseases and designing of flock/herd health programmes. Students compile a complete flock/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.

Prerequisite pass module: Introduction to Animal Nutrition 244

Prerequisite modules:

- *Animal Nutrition Science 324*
- *Animal Health 342*
- *Animal Physiology 324, 344*

Home department: Animal Sciences

56898 Animal Nutrition Science

324 (12) Introduction to ruminant nutrition (3L, 3P)

Digestive processes and digestibility of feeds and nutrients; metabolism and utilisation of end products of digestion; protein and energy systems of ruminants; ARC and NRC nutrient standards; feed evaluation. Execution of a digestibility and balance trial with sheep (or other animals), including laboratory analyses.

Prerequisite modules:

- *Animal Anatomy and Physiology 214*
- *Biochemistry 214, 244*
- *Introduction to Animal Nutrition 244*

Home department: Animal Sciences

344 (12) Introduction to monogastric nutrition (3L, 3P)

Characteristics and composition of feeds and raw materials. Factors determining nutrient requirements and intake of animals. Raw material characteristics, nutrient composition, anti-nutrients and toxins. Processing of raw materials and finished feeds. Introductory diet formulation for poultry pigs, and finfish using computer software, with consideration of factors associated with inclusion levels and raw material physical characteristics.

Prerequisite pass module: Introduction to Animal Nutrition 244

Prerequisite modules:

- *Animal Anatomy and Physiology 214*
- *Biochemistry 214, 244*

Home department: Animal Sciences

414 (12) Advanced ruminant nutrition (3L, 3P)

Species-specific nutrition of ruminant animals. Advanced computer-aided feed formulation, production modelling and live cycle assessment.

Prerequisite pass modules:

- *Animal Anatomy and Physiology 214*
- *Introduction to Animal Nutrition 244*

Prerequisite module: Animal Nutrition Science 324

Home department: Animal Sciences

444 (12) Advanced monogastric nutrition (3L, 3P)

Species-specific nutrition of monogastric animals, including nutrition of all production phases of pigs, poultry (breeders, layers and broilers), aquaculture (finfish), companion animals and horses. Practicals included advanced computer-aided feed formulation and production modelling.

Prerequisite pass modules:

- *Animal Anatomy and Physiology 214*
- *Introduction to Animal Nutrition 244*

Prerequisite module: Animal Nutrition Science 344

Home department: Animal Sciences

11851 Animal Physiology

324 (16) Animal physiology (3L, 3P)

A closer look at the role of the immune system in ensuring animal production and the use of pharmaceuticals in animal production systems. The importance of optimal animal reproduction is also covered, with an introduction to the use of assisted reproductive technologies to ensure viable and cost-efficient animal production, under extensive and intensive conditions.

Prerequisite module: Animal Anatomy and Physiology 214

Home department: Animal Sciences

344 (16) Animal physiology (3L, 3P)

A closer look at the interaction between the endocrine, cardiovascular, immune, urinary and digestive systems to ensure the maintenance of homeostasis in domesticated animals (mammals, birds, and fish) and wildlife to ensure optimal production in livestock and wildlife species.

Prerequisite modules:

- *Animal Anatomy and Physiology 214*
- *Animal Physiology 324*

Home department: Animal Sciences

11878 Animal Production

214 (16) Management technology: Production animals (3L, 3P)

Introduction to nutrients and their functions, classification and processing of raw materials for livestock feed.

Sheep and goats: Supplementary nutrition of grazing sheep and feedlot finishing. Sheep management. Goat management.

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

Dairy cattle: Nutrition and husbandry of non-lactating and lactating cows and dairy calves. Housing facilities and herd health.

Poultry: Basic principles in poultry production. Broiler management.

Pigs: Management of pigs in different production stages.

The cost and return calculations of each of the above-mentioned operations are discussed.

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

Corequisite modules:

- *Animal Production Physiology 112 OR*
- *Biology 154*

Home department: Animal Sciences

44733 Animal Production Physiology

112 (8) Animal production physiology (1.5L, 1.5P)

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 gastrointestinal tract and a basic introduction to principles of animal nutrition.

Home department: Animal Sciences

51004 Animal Product Science

334 (16) Meat science (3L, 3P)

Meat production and meat consumption in perspective; factors that influence carcass composition; slaughter of meat animals, butchering of carcasses; pre-slaughter and post-slaughter effects on meat quality; storage and processing of meat products.

Prerequisite modules:

- *Animal Anatomy and Physiology 214*
- *Biochemistry 244*
- *Introduction to Animal Nutrition 244*
- *Animal Physiology 324*

Home department: Animal Sciences

20826 Animal Science

144 (20) Animal Science (3L, 3P)

An introduction to Animal Science and careers in Animal Science. An overview of the livestock industry in South Africa and the world. A general introduction to livestock breeds and animal production systems; large stock, small stock, poultry and pigs. An introduction to animal behaviour and welfare care and handling of sheep, cattle, pigs, poultry, and horses.

Home department: Animal Sciences

474 (32) Animal Science (1L)

Students will be trained in the science of conducting research, which includes conducting a literature review, designing and executing a scientific experimental design, analysis and interpretation of data, and compilation into a research report and oral presentation of the scientific findings as a seminar. The purpose of this module is to develop skills that include a critical way of thinking about and interpretation of scientific findings, application of theoretical and biometrical concepts, and the reporting of findings in a scientific report. Exposure to industry where students partake in a compulsory tour to relevant livestock industries. Practical work (one month) as prescribed in the "compulsory practical work" section of this part of the Yearbook. Of this, two weeks can be spent in a farm environment and the remaining two weeks in a relevant commercial industrial environment. A wool classing and Dohne Merino course, as prescribed under the "compulsory practical work" section of this part of the Yearbook, forms part of this module.

Prerequisite pass modules:

- *Animal Anatomy and Physiology 214*
- *Introduction to Animal Nutrition 244*

Prerequisite modules:

- *Animal Nutrition Science 324, 344*
- *Animal Health 342*
- *Animal Physiology 324, 344*

Home department: Animal Sciences

52078 Applied Chemistry

334 (16) Food and Beverage Chemistry (3L, 3P)

Methods of analysis in the food and beverage industry (infra-red, UV-vis and atomic spectroscopy, calibration-curve error analysis, nuclear magnetic resonance molecular structure analysis and high-performance liquid chromatography); the chemistry of sugars (including the Maillard reaction); the molecular basis for colour in food; chemical aspects of food preservation.

This module may only be taken by students registered for the BSc (Food Sc) programme.

Prerequisite pass modules: Chemistry 214, 264

Home department: Chemistry and Polymer Science

20710 Applied Mathematics

114 (16) Probability Theory and Statistics (3L, 3T)

Combinatorial analysis; the basic counting principles; permutations and combinations. Random phenomena; sample spaces and events; the probability axioms; the probability of an event; random selection; probability rules; conditional probability; the rule of Bayes; stochastic independence. Discrete and continuous stochastic variables; expected value and variance of a stochastic variable; important discrete distributions: binomial, Poisson, geometric, hypergeometric, negative binomial; important continuous distributions, uniform, normal

Home department: Mathematical Sciences, Division Applied Mathematics

144 (16) Modelling in Mechanics (3L, 3T)

Development of the skilled use of vector, differential and integral calculus in the modelling of dynamics of simple physical systems, including the analysis of force fields, motion and modelling assumptions.

Prerequisite module: Mathematics 114

Corequisite module: Mathematics 144

Home department: Mathematical Sciences

20753 Applied Mathematics B

124 (15) Statics (4L, 2T)

Vectors; forces; sum of forces at a point; direction cosines and direction angles; components and component vectors; scalar products; vector products; moment of a force; force systems on rigid bodies; equivalent force systems; couples; line of action of the resultant; equilibrium of a rigid body; friction; centre of mass; centroid; volumes; definite integration; moment of inertia of areas.

Home department: Mathematical Sciences

12487 Applied Plant Physiology

414 (16) Ecophysiology of horticultural and agronomical crops (3L, 3P)

Advanced principles of stomatal conductance, transpiration, and photosynthesis. Micro-meteorological influences on gas exchange. Effects of excess energy – temperature and light. The use of chlorophyll fluorescence as stress indicator. Upscaling of gas exchange, carbon and water 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 from proximal and remote platforms.

Prerequisite modules:

- *Horticultural Science 314 OR*
- *Agronomy 322 OR*
- *Grapevine Sciences 314*

Home department: Horticultural Science

464 (16) Nutrition of horticultural and agronomical crops (3L, 3P)

Factors affecting nutrient availability and uptake from the rhizosphere. Root anatomy, mineral application, uptake and partitioning. The role of root symbioses in nutrient acquisition. Phloem transport and carbohydrate partitioning. Management of vegetative and reproductive balances. Seasonal crop-based nutritional requirements and application strategies.

Practicals: A nutrient deficiency project, as well as a series of lectures by industry specialists on topics relating to sustainability in fertiliser management.

Prerequisite modules:

- *Soil Science 244 AND*
- *Horticultural Science 314 OR*
- *Agronomy 342*

Home department: Horticultural Science

714 (16) Ecophysiology of horticultural and agronomical crops

Advanced principles of stomatal conductance, transpiration, and photosynthesis. Micro-meteorological influences on gas exchange. Effects of excess energy – temperature and light. The use of chlorophyll fluorescence as stress indicator. Upscaling of gas exchange, carbon and water balance of crops. Water

relations of cells, tissues, and whole plants. Stress physiology and advantageous aspects of stress. Climate change and agriculture. Theory and application of ecophysiological measurement techniques from proximal and remote platforms.

Home department: Horticultural Science

734 (13) Applied plant physiology and tree architecture

Lectures: Underlying physiology of growth, development and production practices of horticultural crops. Correlative phenomena and the role of plant hormones supported by an overview of relevant cell, tissue and organ anatomy as well as basic genetic principles. Overview of environmental perception and acclimation/ adaptation. Dormancy as morphogenetic and survival mechanism. Physiology of growth cessation, hardening, induction and progression of dormancy, rest breaking and branching. Tree architecture and training systems, principles and techniques of tree manipulation and the role of rootstocks. Integration of the above taking production practices into account.

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.

Home department: Horticultural Science

744 (13) Postharvest physiology and technology of horticultural and agronomical crops

Postharvest physiology of fresh-plant products: structure and composition of the product, role of respiration and ethylene metabolism, fresh-plant product 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 fruit, stone fruit and table grapes), as well as some tropical and subtropical crops and vegetables.

Practicals: A physiological-disorder defect identification project, a series of lectures by industry specialists on topics such as postharvest problems, logistics and handling of fresh product and ripening, ethylene inhibitors commercially, profitability of certain deciduous fruit types, market trends, and alternative crops like fynbos, visits to the Cape Town market in Epping, a pack house and cold stores, as well as a fresh-cut facility.

Corequisite module: Biochemistry 244

Home department: Horticultural Science

764 (16) Nutrition of horticultural and agronomical crops

Factors affecting nutrient availability and uptake from the rhizosphere. Root anatomy, mineral application, uptake and partitioning. The role of root symbioses in nutrient acquisition. Phloem transport and carbohydrate partitioning. Management of vegetative and reproductive balances. Seasonal crop-based nutritional requirements and application strategies**.**

Practicals: A nutrient deficiency project, as well as a series of lectures by industry specialists on topics relating to sustainability in fertilizer management.

Home department: Horticultural Science

773 (30) Research project

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.

Home department: Horticultural Science

46213 Aquaculture

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

713 (16) Introduction to Aquaponics Production Systems

Aquaponics food production technology is complex and requires a broad spectrum of knowledge to understand and manage the processes involved. A good understanding of the following study fields is necessary: aquaculture, horticulture, chemistry, biology, food safety, and engineering. The content of this module will cover an overview of aquaponics, plant production in aquaponics, fish production in aquaponics, nutrition and feeding of aquatic organisms, water quality management, aquaponics system design, commissioning an aquaponics system, aquaponics system management, and aquaponics product marketing & economics.

Home department: Animal Sciences

741 (16) Aquaculture production and management systems II

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.

Home department: Animal Sciences

742 (16) Aquaculture ecology

Aquaculture ecology.

Home department: Animal Sciences

743 (16) Aquaculture nutrition

Feeding behaviour of aquaculture species. Nutrition management practices of aquaculture species. Nutrition and food quality of aquaculture species.

Home department: Animal Sciences

745 (16) Advanced Aquaponics Technologies

Aquaponics food production technology is complex and requires a broad spectrum of knowledge in order to understand and manage the processes involved. A good understanding of the following study fields is necessary: aquaculture, horticulture, chemistry, biology, food safety, and engineering. The content of this module will cover fish health management, plant diseases and pest management, food safety, urban & vertical aquaponics, scientific research methods, entrepreneur skills, business development, product development & marketing, social development potential of aquaponics, regulations & legislation, aquaponics for space.

Home department: Animal Sciences

772 (30) Aquaculture research practice

Preparation and planning of research projects in relation to species, facilities, equipment and apparatus; technique and handling methods; collection, processing and interpretation of data; presentation and information transfer.

Home department: Animal Sciences

12910 Aquaculture Management Science

724 (16) Aquaculture review, assessment and project development I

Aquaculture species; species selection and biology; aquaculture management practices and production systems; site selection.

Practical: 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.

Home department: Animal Sciences

754 (16) Aquaculture review, assessment and project development II

Aquaculture risk assessment; aquaculture best management practices; production planning; financial planning.

Practical: 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.

Home department: Animal Sciences

13265 Assessing Food Security

821 (10) Assessing food security

The module covers food and nutrition assessment methods, different levels as well as indicators, analysis, monitoring and evaluation.

Home division: Human Nutrition

11053 Biochemistry

Please note: Students intending to take Biochemistry as a subject are required to take modules such as Biology, Physics and Mathematics during their first year. Chemistry 124 plus Chemistry 144 are taken as the first-year equivalent of Biochemistry.

214 (16) Biomolecules: Structure-function relationships (3L, 3P)

Introduction to the living cell, bio-elements, and the importance of water as the solvent for biochemical reactions and its role in living systems. Introduction to biomolecules (nucleic acids, proteins, carbohydrates, and lipids): their structures, functions and characteristics. An introduction to protein ligand binding, enzyme catalysis and enzyme kinetics.

The practical component covers basic laboratory skills, e.g. how to weigh, how to prepare a solution, dilutions, the use of a micro pipette, the use of a pH meter and a spectrophotometer. Students will investigate the principles of buffering and how to determine an unknown concentration using a standard curve.

Prerequisite pass modules:

- *Chemistry 124 or 164, 144*
- *Biology 124*

Home department: Biochemistry

244 (16) Intermediary metabolism (3L, 3P)

Bioenergetics of metabolism, the metabolism of biomolecules (carbohydrates, lipids and some nitrogen containing compounds). Glycolysis, citric acid cycle and glyoxylate cycle. Oxidative phosphorylation. Photosynthesis. Regulation and integration of metabolism: exploring the implications of metabolic abnormalities in different biological systems.

The practical component includes enzymatic assays, enzyme kinetics, the role of effectors on enzyme activity and the basic principles of chromatography.

Prerequisite module: Biochemistry 214

Home department: Biochemistry

315 (16) Biophysical and structural protein biochemistry (3L, 3T)

Biophysical analysis: quantitative, qualitative and structural analysis of biological molecules, with focus on amino acids, peptides and proteins, utilising techniques such as spectrophotometry, fluorescence, mass spectrometry, gel electrophoresis and chromatography.

Advanced protein biochemistry: Protein purification techniques and analysis of protein purity, composition and structure. Protein structure/function relationships are studied in the context of a number of specialised complex protein systems and enzymatic reaction mechanisms.

Prerequisite pass modules:

- *Biochemistry 214, 244*
- *Mathematics (Bio) 124 OR*
- *Mathematics 114*

Home department: Biochemistry

345 (16) Specialised biochemical topics (3L, 3T)

Selected topics chosen from the following (two of the following three topics are selected for presentation every year):

Antibiotics: The biochemistry of selected antibiotics and antimicrobial agents.

Intracellular signal transduction pathways integrated with eucaryotic gene expression: ligand-activated receptor signalling; receptor binding theory; cell surface receptors; nuclear receptors; protein-protein interactions; signalling networks and cross talk; regulation of gene expression; chromatin remodelling; promoters and enhancers; transcription factors.

Immunology: Innate and specific acquired immunity; antibody structure and function; defence mechanisms against pathogenic organisms; vaccinations; allergies; immune disorders; differential gene expression in lymphocyte development and immune diagnostic techniques.

Prerequisite modules: Biochemistry 315

Home department: Biochemistry

365 (16) Practical protein expression, purification and analysis techniques (3L, 3P)

Molecular biology, recombinant protein expression and protein purification techniques. Analysis of DNA and 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, immobilised-metal affinity chromatography, desalting, 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. By registering for this module, students confirm that they are available during both these periods.

Prerequisite modules:

- *Biochemistry 315*

Home department: Biochemistry

53953 Biodiversity and Ecology

212 (16) Statistics and other tools for biologists (3L, 3P)

This module is a thorough introduction to the key numerical skills and processes underpinning the good practice of biological sciences. It covers experimental design, 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 R statistical computing free software. Hands-on statistical exercises cover a range of descriptive statistics, parametric and non-parametric analyses, basic data manipulation, plots, linear regression and analysis of variance. Applied scientific investigatory principles to biology are explored using experimental planning (controls, replication, randomisation), ethics, scientific and popular publication processes, and the use of scientific literature.

Corequisite modules:

- *Science in Context 178 OR*
- *Computer Skills 171*

Home department: Botany and Zoology

214 (16) Principles of ecology (3L, 3P)

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.

Prerequisite pass module: Biology 124 or 144 and a final mark of at least 40% in the other Biology module

Corequisite module: Biodiversity and Ecology 212 or an equivalent statistical module

Home department: Botany and Zoology

224 (16) Diversity and function of invertebrates (3L, 3P)

The focus of this module is invertebrate diversity. Major adaptations in morphology (form) and recent molecular changes in taxonomy, as well as physiological adaptations within the major phyla will be explored. Topics will include recent developments in phylogenetic classifications within the major groups; physiological challenges, such as those related to respiration, osmoregulation, feeding, locomotion, defence, sensory perception and reproduction, which invertebrates face in their respective environments (marine, freshwater and terrestrial); and what strategies are used to cope with or compensate for these challenges. The practical component of the module will entail laboratory work.

Prerequisite pass modules: Biology 144 or 154 and a final mark of at least 40% in the other Biology module

Home department: Botany and Zoology

254 (16) Vertebrate life (3L, 3P)

The module deals with various aspects of vertebrates – where they originated, present diversity, how they evolved, what they do and how they work. Topics covered 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 seminars and practical sessions with data collected in the laboratory or in the field excursion.

Prerequisite pass module: Biology 144 or 154 and a final mark of at least 40% in the other Biology module

Home department: Botany and Zoology

264 (16) Diversity of plant form and function (3L, 3P)

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.

Prerequisite pass modules: Biology 144 or 154 and a final mark of at least 40% in the other Biology module

Home department: Botany and Zoology

315 (16) Ecology field course (3L, 3P)

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 during the last two weeks of 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.

This module is a restricted module and largely limited to students registered in the Biodiversity and Ecology programme. Participants may be selected from other programmes based on past performance and available places.

Prerequisite pass modules: Biodiversity and Ecology 212 or 214 and a final mark of at least 40% in the other Biodiversity and Ecology module

Home department: Botany and Zoology

324 (16) Angiosperm diversity and evolution (3L, 3P)

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.

The practical series focuses on Fynbos taxa and plant identification up to the family level.

Prerequisite pass modules:

- *any two of the following three modules: Biology 124, 144, 154*

Home department: Botany and Zoology

311 (16) Climate and Global Change Challenges (3L, 3P)

The study of global change with a biological perspective brings together historical and current evidence for such changes and summarises its main drivers. Topics include global climate change, anthropogenic drivers such as pollution, invasion biology, land use and ecosystem change. Data at different spatial and temporal scales and at different levels of biological organisation are covered (from species to communities and ecosystems, and from micro- to macroscales), highlighting the technologies and numerical techniques used to study these processes. Examples will have a strong African focus, including case studies from the Western Cape province from both faunal and floral perspectives. Important areas of teaching include the relevance of understanding global climate change for African, in particular South African, ecosystems. There is a strong emphasis on appropriate communication regarding all the above topics, both among scientists and between scientists and other stakeholders, including the general public.

Home department: Botany and Zoology

341 (16) Climate and Global Change Solutions (3L, 3P)

This module builds on Biodiversity and Ecology 311 (Climate and Global Change Challenges). It will expose students to the concepts of adaptation and mitigation of global and climate change, providing them with a variety of tools to develop solutions to the challenges of global change. Topics include the concepts of

resilience and resistance from both a biological and a human perspective, spatial planning for biodiversity (with a focus on how conservation outcomes may change with changing climates and species responses), conservation genetics as a tool to support spatial planning and species conservation (including adaptive responses to environmental stressors), carbon storage and trading and their links to ecological restoration (with a focus on blue carbon ecosystems), managing invasive species at national as well as international level, restoration ecology, and policy and legislation to support conservation and management outcomes.

Biodiversity and Ecology 311 is not a prerequisite for Biodiversity and Ecology 341 (especially for international students). However, it is highly recommended that students do take Biodiversity and Ecology 311, because an understanding of the fundamentals of the drivers of climate change and their impact on biodiversity and well-being (which are covered in Biodiversity and Ecology 311) will prepare students for the content of Biodiversity and Ecology 341 and provide a stronger footing from which to start. Biodiversity and Ecology 341 can be taken independently, if necessary, but this will require additional, independent work by students for them to be able to follow the content of the module.

Home department: Botany and Zoology

342 (16) Integrative Marine Science (3L, 3P)

This module is presented as five sections that progress from understanding the physical, chemical, geological and biological nature of marine systems to the utilisation, management and protection of marine products systems. Exploration of the physical marine environment focusses specifically on ocean climate and circulation, tides and waves, and coastal and estuarine processes. This is followed by the chemical section, which examines the properties of seawater, focussing on salinity and dissolved gases. The geological section considers plate tectonics, marine provinces and marine sediments. The biological section explores biological life in oceans and adaptations of marine organisms to the different marine environments; productivity and how this feeds into energy and food webs; and benthic, pelagic, island, estuarine and mangrove systems. The final section explores the historical and contemporary reliance of humans on the ocean; consequences of harvesting marine products; the development of marine protected areas and how this often leads to conflict with people who rely on the ocean for their livelihoods or recreation. Throughout the module we will explore skills related to understanding and measuring different processes.

Home department: Botany and Zoology

11490 Biodiversity and Ecosystem Services

874 (6) Biodiversity and ecosystem services

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 and 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.

Learning outcomes

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

- 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.

Home department: Conservation Ecology and Entomology

25046 Biology

124 (16) Cell biology (3L, 3P)

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)

Classification of organisms. Diversity of micro-organisms, plants and animals. Ecological principles and global changes.

Corequisite module: Biology 124

Responsible departments: Botany and Zoology and Microbiology

Home department: Botany and Zoology

146 (16) Principles of Biology (3L, 3P)

For students in the BSc (extended curriculum programmes).

Introduction of biological concepts: 'What is life?', biological evolution, biodiversity and the Tree of Life. The chemical basis of life. Biological molecules. Enzymes. Biological membranes: Structure and function. Cell structure and function: Pro- and eukaryotes, as well as animal and plant cells. Mendelian genetics and inheritance. Introduction to animal phylogeny. Vertebrate life.

Home department: Botany and Zoology

154 (16) Functional Biology (3L, 3P)

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.

Corequisite module: Biology 124

Responsible departments: Botany and Zoology and Genetics

Home department: Botany and Zoology

11061 Biometry

212 (8) Introductory Biometry (2L, 1T or 1P)

Role of statistics in research; methods of tabulation and graphical representation of data; descriptive measures of locality, variation and association; the elementary principles of estimation, randomization sampling methods, unbiasedness and sampling distributions; simple- and multiple linear regression; introduction to hypothesis testing; contingency tables and chi-square tests; tests for normality. All data will be analysed using applicable software.

Prerequisite modules:

- *Mathematics (Bio) 124 OR*
- *Mathematics 114*

Home department: Genetics

242 (8) Applications in Biometry (2L, 1T or 1P)

Treatment and experimental design; efficiency of estimation; analysis of variance: F-test for homogeneity of variance, one- and two-sample hypothesis tests for means, multiple comparisons procedures; confidence intervals; non-parametric tests. All data will be analysed using applicable software.

Prerequisite module: Biometry 212

Home department: Genetics

721 (8) and 821 (8) Biometrical applications and data analysis in R

Data processing and graphical procedures with R. Simple descriptive statistics; t-tests for single populations, independent samples 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. Power analysis. 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; covariance analysis; categorical data analyses (Chi-squared tests); logistic regression. This module is presented in two blocks of five half days each in the first semester.

Prerequisite modules:

- *Biometry 212 and 242 or 211*
- *Students with different undergraduate Statistics modules must obtain at least 50% for an admission examination*

Home department: Genetics

54410 Biotechnology

315 (16) Advanced Biotechnology (3L, 3P)

This module focuses to topical and contemporary aspects of microbial, plant and animal biotechnology. It covers advanced recombinant DNA methodologies and how they can be purposed to genetic interventions which ultimately improve human well-being. Some of the themes covered during the module are (i) metagenomic libraries and their uses, (ii) the creation of plant-based GMOs and their applications, and (iii) the creation of animal-based GMOs and their applications.

Prerequisite module: Biotechnology 245

Home department: Genetics

48550 Business Management

113 (12) Business management (3L, 1P)

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)

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.

Home department: Business Management

11479 Chemistry

124 (16) Fundamental principles of chemistry I (3L, 3P)

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)

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.

Corequisite module: Chemistry 124

Home department: Chemistry and Polymer Science

164 (16) Fundamental principles of chemistry (3L, 3P)

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.

If you failed Chemistry 124 in a particular year, you may register for this module in the same academic year only if you achieved a final mark of at least 40% and a practical mark of at least 60%.

Mode of delivery: This hybrid-learning module is offered through online themes using SUNLearn as platform, as well as four face-to-face tutorial sessions.

Home department: Chemistry and Polymer Science

176 (32) Introduction to chemistry (3L, 3P)

For students in the BSc (extended curriculum programmes). This module deals with the following themes: Classification of matter; atoms, molecules and ions; stoichiometry; reactions in aqueous solutions; atomic structure; chemical bonding and molecular structure; the periodic table; weak acids and weak bases; electrochemistry; introduction to basic organic chemistry and an introduction to thermodynamics. Examples that illustrate the importance and relevance of science as an everyday phenomenon will be highlighted.

Home department: Chemistry and Polymer Science

214 (16) Organic chemistry (3L,3P)

Reaction mechanisms, including nucleophilic addition and substitution, elimination, electrophilic addition, electrophilic aromatic substitution, organometallic reactions, stereochemistry.

Prerequisite pass modules: Chemistry 124 or 164, 144

Home department: Chemistry and Polymer Science

234 (16) Inorganic chemistry (3L, 3P)

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.

Prerequisite pass modules: Chemistry 124 or 164

Home department: Chemistry and Polymer Science

254 (16) Physical chemistry (3L, 3P)

Chemical thermodynamics; colligative properties; phase diagrams; reaction kinetics; probability and introduction to statistical thermodynamics.

Prerequisite pass modules: Chemistry 124 or 164

Prerequisite module: Mathematics 114

Corequisite module: Mathematics 144

Home department: Chemistry and Polymer Science

264 (16) Chemical analysis I (3L, 3P)

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.

Prerequisite pass modules: Chemistry 124 or 164 and 144

Prerequisite modules:

- *Mathematics 114 or 144 OR*
- *Mathematics (Bio) 124 OR*
- *Engineering Mathematics 115 or 145*

Home department: Chemistry and Polymer Science

314 (16) Chemical analysis II (3L, 3P)

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 ^{1}H and ^{13}C nuclear magnetic resonance spectroscopy (NMR); for molecular structure determination; introduction to analytical mass spectrometry; instrumental chromatographic methods.

Prerequisite pass module: Chemistry 264

Home department: Chemistry and Polymer Science

324 (16) Physical chemistry (3L, 3P)

Quantum mechanical description of atoms and molecules; vibrational and rotational spectra; advanced statistical thermodynamics; introduction to symmetry.

Prerequisite pass modules: Mathematics 114, 144

Prerequisite module: Chemistry 254

Home department: Chemistry and Polymer Science

344 (16) Organic chemistry (3L, 3P)

Reaction mechanisms, including those pertaining to enolate chemistry, chemo-, stereo- and diastereo-selectivity, controlling geometry of double bonds, pericyclic reactions; stereochemistry; syntheses.

Prerequisite pass module: Chemistry 214

Home department: Chemistry and Polymer Science

364 (16) Inorganic chemistry (3L, 3P)

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).

Prerequisite pass module: Chemistry 234

Prerequisite module: Chemistry 264

Home department: Chemistry and Polymer Science

30317 Computer Programming

143 (12) Computer programming (3L, 2P)

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%)]

Method of assessment: Examination

Home Department: Electrical and Electronic Engineering

18139 Computer Science

113 (16) Computer Science for Actuarial Studies (3L, 3P)

Introduction to computer programming from a financial perspective. Basic financial problems are rephrased in terms of analytical problem-solving. Standard imperative programming constructs including types of variables, assignments, if-then-else-and loops, and recursive approaches are covered as needed in financial programming. Static data structures (in particular arrays) and declarative programming models such as spreadsheets are also covered.

Corequisite modules:

- *Actuarial Science 112*
- *Mathematics 114*

Home department: Mathematical Sciences

144 (16) Introductory Computer Science (3L, 3P)

Further formulation and solution of problems by means of computer programming; introductory data structures and algorithms in an object-oriented set-up; key concepts in object orientation: inheritance and polymorphism; design patterns as abstractions for the creation of reusable object-oriented designs; searching and sorting algorithms; complexity theory for the analysis of algorithms; fundamental methods in the design of algorithms; dynamic data structures; regular expressions and finite automata.

Prerequisite modules: Computer Science 113 or 114

Home department: Mathematical Sciences

214 (16) Data Structures and Algorithms (3L, 3T)

The classical data structures and algorithms in an object-oriented set-up. Advanced techniques for the analysis of algorithms.

Prerequisite pass module: Computer Science 144

Prerequisite module: Mathematics 114

Home department: Mathematical Sciences

244 (16) Computer Architecture (3L, 3P)

Basic computer architecture. Programming in machine language and assembly language. Assemblers, binders and loaders. Basic concepts of operating systems; memory management, process management and file systems.

Prerequisite module: Computer Science 214

Home department: Mathematical Sciences

315 (16) Machine Learning (3L, 3T)

Dimension reduction techniques; machine-learning techniques based on maximum likelihood, maximum-posterior and expectation-maximization estimates; modelling using logistic regression, Gaussian mixtures and hidden Markov models.

Prerequisite modules:

- *Computer Science 144 OR*
- *Computer Science E 214*
- *Mathematical Statistics 245, 246 OR*
- *Systems and Signals 344*
- *Mathematics 214 OR*
- *Applied Mathematics 214 OR*
- *Engineering Mathematics 214*

Home department: Mathematical Sciences

343 (16) Databases and Web-centric Programming (3L, 3P)

Introduction to relational databases. Mapping relational model onto object model. Implementing a database application in the context of the web. Web services.

Server-side scalability. Virtualisation. Cloud Computing.

Prerequisite module: Computer Science 214

For programmes in Engineering:

Prerequisite modules:

- *Computer Science E 214*
- *Computer Systems 245*

Home department: Mathematical Sciences

441 (16) Machine Learning

This module is an introduction to selected topics in machine learning.

Prerequisite pass modules:

- *Computer Science 144*
- *Mathematical Statistics 245, 246*

Home department: Mathematical Sciences

50040 Computer Skills

171 (4) Computer skills (1L)

Study load: 26 lectures in total, presented as 2L per week every second week.

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.

Home department: Mathematical Sciences

176 (8) Computer skills (1L, 4T)

This module is taken by students in the BSc (extended curriculum programmes). Utilisation of computers in computer users' areas on campus. Introduction to an operating system, internet, email, word processing, spreadsheet and presentation software.

Home department: Mathematical Sciences

272 (5) Computer skills (2L)

Study load: 35 lectures in total.

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

Prerequisite module: Computer Skills 171 or Science in Context 178

Home department: Mathematical Sciences

13255 Conceptualising Food Systems

811 (10) Conceptualising food systems

Thorough scientific based knowledge and research techniques in the field of the food and nutrition security are reviewed in this module. This will require experience and an understanding of the situation in which the problem is embedded in the food system.

Home division: Food Science / Agricultural Economics/Human Nutrition

55638 Conservation Ecology

212 (8) Conserving nature (2L, 1P)

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.

Home department: Conservation Ecology and Entomology

244 (16) Conservation censusing (3L, 3P)

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; develop experience in indices of species richness and diversity; introduction to community composition and differences. Exposure to taxonomic identification of insect orders and small mammal species.

Prerequisite pass module: Conservation Ecology 212

Home department: Conservation Ecology and Entomology

314 (16) Biome ecology (3L, 3P)

Introduction to biomes and ecosystem services; key drivers; biomes in social-ecological systems context; biome-level management issues; ecology of tropical and afromontane forests, woodlands, savannahs, treeless vegetation types; wetlands; patterns of diversity and endemism.

Home department: Conservation Ecology and Entomology

344 (16) Conservation in Social-Ecological Systems (3L, 3P)

The relationship between society and the natural environment; history, values and philosophy of conservation; environmental and research ethics; government, societal and business influences on conservation; environmental legislation; environmental impact assessment (EIA); challenges in community-based natural resource management; human environmental stressors; the meaning of "the environment" and "nature" to people of various cultural and social backgrounds; conservation management for ecotourism and recreation; social-ecological systems and resilience theory.

Prerequisite pass module: Conservation Ecology 314

Home department: Conservation Ecology and Entomology

414 (16) Contemporary conservation (3L, 3P)

Contemporary conservation issues 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.

Home department: Conservation Ecology and Entomology

424 (16) Wildlife management (3L, 3P)

Decision-making in the face of uncertainty. Sustainable harvesting in both terrestrial and marine environments, and wildlife management. The wildlife management (WM) section incorporates the principles of WM, habitat and game assessment, grazing management, sustainable utilisation, game capture and translocation, wildlife diseases, nutritional ecology and contraception methods, human-wildlife conflict/coexistence issues, and planning and executing conservation-based research. Case studies in conservation research are also discussed.

Home department: Conservation Ecology and Entomology

478 (40) Conservation research project (1L)

In this module, students work together with an academic supervisor to develop and carry out a conservation research project over the course of their final year of study. The research focus of this conservation ecology research project is agreed upon by the student, supervisor and programme coordinator. The project requires a strong conservation focus, but may cover either the biological, ecological or social realms of the focus.

Students will develop a project proposal that gives a comprehensive summary of relevant literature, defines the research question, and describes research methods. Research is then carried out, generally in the field, although in some cases this may be a lab- or desktop-based study. Data are then collated and analysed. Findings are communicated through a popular communication, such as writing for Farmer's Weekly or National Geographic – to teach students to also address audiences outside of academia, increasing research impact – and a final project report, written in scientific journal format.

Prerequisite modules: Conservation Ecology 314, 344

Corequisite module: Conservation Ecology 414

Home department: Conservation Ecology and Entomology

444 (16) Conservation in Agriculture and Forestry Landscapes (3L, 3P)

Biodiversity, whether it is terrestrial or aquatic, is fundamental to ensuring healthy environments. Agriculture and forestry can contribute to biodiversity conservation, creating resilient landscapes through biodiversity conservation, which is the integration of applied ecological, economic, and social concepts to design and manage agriculture and forestry systems for biodiversity conservation across multiple scales. This module is about demonstrating how contemporary techniques for agricultural and forestry landscapes are contributing to regional and landscape conservation. The module aims to showcase the futureproofing of agriculture and forestry through living and dynamic landscapes. Incorporating the latest policies associated with sustainable resource management, we will show that it is possible to create agricultural ecosystems that also conserve biodiversity. Integrated into this module will be the philosophy behind conservation, area-wide integrated pest management and restoration in agriculture and forestry. Real-world case studies will demonstrate examples of production, but the core of this module is developing conservation in these utilised landscapes. By using case studies, we highlight action and policies that will ensure the future of biodiversity-friendly agriculture in Africa. We aim to prepare students to understand and address practical conservation in agriculture in real-world situations.

Home department: Conservation Ecology

14052 Crop Production

151 (8) Development of competency profile for crop scientists (1.5L, 1.5P)

Principles and practice of guided self-reflection. Time management, stress management, Getting Things Done 'The art of stress-free productivity' (GTD), work preparedness, CV building, job interviews, modern farming and job prospects, small group sessions with current industry participants.

No examination. The class mark will serve as the final mark.

Home department: Horticultural Science

152 (8) Introduction to applied plant science (1.5L, 1.5P)

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)

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.

Corequisite module: Biology 124

Prerequisite modules:

- *Biology 144 or 154 OR*
- *Crop Production 152*

Home department: Horticultural Science

478 (16) Advanced Crop Production (1L, 2P)

Practically orientated crop production related field, laboratory, meta-analysis or literature investigations using relevant and current experimental approaches and methods of analysis, while addressing topical issues in crop production systems related to food security and environmental challenges. Specialization in one of the following disciplines: Agricultural Economics; Agronomy; Entomology & Nematology; Genetics; Grapevine Sciences; Horticultural Sciences; Plant Pathology or Soil Science.

Home department: Horticultural Science

53961 Crop Protection

152 (8) Introduction to plant protection and improvement (1.5L, 1.5P)

Introduction to the disciplines of plant breeding, plant pathology, entomology, nematology and weed science. Case studies of plant pests, diseases and weeds that have shaped the history of the world and influenced food security. The basic principles of plant improvement for pest and disease management.

Home department: Plant Pathology

244 (16) Introductory plant pathology and entomology (3L, 3P)

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.

Home department: Conservation Ecology and Entomology

13327 Crops for Extensive Production Systems

711 (18) Crops for extensive production systems (3L, 3P)

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.

Home department: Agronomy

14026 Data Science

141 (16) Data Science (4L; 2P)

Fundamental data science concepts; data-analytic thinking; types of data; the data cycle; CRISP data mining process; describing a dataset numerically; describing a dataset graphically; organising data; file formats; data manipulation in R software; introduction to predictive modelling; overfitting; data leakage; model evaluation; other data science tasks and techniques; data ethics; communicating results.

Home department: Statistics and Actuarial Science

241 (16) Data Science (4L, 2P)

Introduction to Python; Python commands and file systems; programming structures; data sources; data collection; optimisation; resampling and the bootstrap; naïve Bayes classification; application of linear models; data ethics.

Prerequisite pass modules:

- *Data Science 141*
- *Mathematical Statistics 214 OR*
- *Probability Theory and Statistics 114 or 144 with at least 60%*

Prerequisite module: Mathematical Statistics 214

Home department: Statistics and Actuarial Science

316 (16) Data Science (4L, 2P)

In this module approaches to supervised and unsupervised machine learning are discussed.

Supervised learning uses labelled datasets and can be separated into two types of problems, namely classification and regression. Classification problems can be solved by a multivariate technique, namely discriminant analysis, that separates two or more groups of observations based on variables measured on each sample unit. The naïve Bayes classifier is another effective classification algorithm for discriminating between two or more groups. To measure the classification accuracy of these techniques, cross validation and bootstrap resampling procedures are also discussed. In regression problems the relationship between dependent and independent variables is investigated. Popular regression algorithms are regularized regression, principal component regression and partial least-squares regression. For classification and regression problems, tree-based methods, such as random forests and boosting, can also be applied as modelling techniques.

Unsupervised learning uses unlabelled datasets and is associated with tasks in clustering and dimensionality reduction. Clustering is done according to a similarity measure for grouping data objects together. Modern clustering techniques such as k-means, Gaussian mixture models and spectral clustering are discussed. Dimensionality reduction is the statistical technique of reducing the number of random variables in a problem by obtaining a set of principal variables. Specifically, principal component analysis and independent component analysis are discussed.

Prerequisite pass module: Data Science 241

Corequisite module: Mathematical Statistics 312

Home department: Statistics and Actuarial Science

346 (16) Data Science (4L, 2P)

In this module big data and deep learning are discussed.

Big data refers to data that is so large, fast or complex that it is difficult or impossible to process using traditional methods. The challenges of big data analysis include capturing, storing, searching, sharing, transferring, visualising, querying and updating of data sources.

Cloud computing services are also used to manage big data. Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user.

Natural language processing, a subfield of linguistics, computer science and artificial intelligence, is also applied to big data. Natural language processing is concerned with the interactions between computers and human language, in particular how to program computers to process and analyse large amounts of natural language data so that the computer can automatically perform repetitive tasks.

Neural networks are a subset of machine learning and are at the heart of deep learning algorithms. Neural networks rely on training data to learn and improve the accuracy of the network over time. Once the network is fine-tuned for accuracy, using backpropagation, it is utilised as a powerful tool to classify and cluster data at a high velocity.

Prerequisite modules:

- *Data Science 316 or Data Science 344*
- *Mathematical Statistics 312*

Home department: Statistics and Actuarial Science

14911 Data Science and Computational Thinking

314 (8) Data Science with Python (3L, 3P)

The purpose of this module is to develop skills and capabilities in data science and computational thinking. The module will emphasize developing and implementation of inferential thinking. This module is accessible

to students who have completed a first-level module in mathematics but with no programming skills. The module will teach through extensive use of examples and practical data analysis. The outcome is for students to become comfortable in analysing large datasets and to be able to expand such analysis using Python programming.

Prerequisite pass module: Mathematics (Bio) 124 OR Mathematics 114

Home department: School for Data Science and Computational Thinking

344 (8) Applied Data Science (3L, 3P)

This module provides an understanding of the relevance of data science and teaches fundamental data analytic skills through application in agricultural and biological sciences. Students will gain an understanding of how data science can contribute to advancements of these fields. Through practical examples and exercises, students will learn the sequential steps involved in conducting data-driven analyses following good data practices and how to use data science methods to solve real-world problems in these fields.

By the end of the module, students will have developed a deeper understanding of the role of data science in agriculture and biological sciences, apply the steps of the data science lifecycle, collect and prepare data for analysis, conduct exploratory data analysis, visualize data to communicate findings, apply statistical methods to make inferences, make decisions or come to conclusions based on data analysis, and communicate the results of data analysis.

Prerequisite pass module: Data Science 314

Home department: School for Data Science and Computational Thinking

14735 Data Science Research in Statistical Genetics

471 (40) Data Science Research Assignment in Statistical Genetics

The research assignment provides students with a comprehensive learning experience that integrates knowledge from previous courses. Students will integrate knowledge and experiences gained from all previous modules and apply these to a data-rich research topic. Students will have the opportunity to synthesise what they have learned and apply that knowledge to new, complex situations. Students should engage in the entire process of solving a real-world data science problem, from collecting and processing actual data, applying suitable and appropriate analytic methods to the problem, and communicating the results in a clear and comprehensible way.

Prerequisite pass modules:

- *Biotechnology 315*
- *Genetics 314, 344*
- *Mathematical Statistics 312*
- *Data Science 346*

Home department: Genetics

12084 Economics

114 (12) Economics (3L, 1T)

Problems economists address: inequality, poverty, economic growth, sustainability, scarcity, choice.

Economic decision-making: incentives, relative prices, economic rent, labour, production, opportunity cost.

Economic relationships and interactions: game theory, equity, efficiency.

Markets: demand and supply, price-taking and competitive markets, elasticity, labour market.

Market dynamics: rent-seeking, market failure, externalities and government policies.

Home department: Economics

144 (12) Economics (3L, 1T)

The module introduces students to economic application and policy, with a strong focus on South Africa, by exploring contemporary economic issues: inflation, unemployment, economic growth, external stability and a fair distribution of income.

The aggregate economy in the short-run and long-run: measuring the aggregate economy, the multiplier model, unemployment and fiscal policy, inflation and monetary policy, the money market and the South

African Reserve Bank (SARB), technological change and income inequality.

Globalisation: international trade, migration and investment.

Corequisite module: Economics 114

Home department: Economics

214 (16) Economics (3L, 1T)

Macroeconomics: business cycle measurement, consumer and firm behaviour, closed one-period macroeconomic models, consumption and savings decisions in a two-period model.

Microeconomics: goods and factor markets, demand theory, production and cost theory, market structures and the theory of the firm, welfare theory.

Prerequisite pass modules: Economics 114, 144

Home department: Economics

244 (16) Economics (3L, 1T)

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.

Prerequisite pass modules: Economics 114, 144

Corequisite module: Economics 214

Home department: Economics

318 (24) Economics (4L, 1T)

Introduction to econometrics: statistical concepts, the classical linear model of regression, multicollinearity, autocorrelation, heteroscedasticity, dummy variables, estimation of regression models.

Macroeconomics: mathematical techniques, economic growth, business cycle, monetary and fiscal policy.

Introduction to game theory: mathematical techniques, different types of games, equilibrium concepts.

Prerequisite pass module: Economics 214

Prerequisite module: Economics 244

Home department: Economics

348 (24) Economics (4L, 1T)

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.

Prerequisite pass module: Economics 214

Prerequisite module: Economics 244

Corequisite module: Economics 318

Home department: Economics

388 (24) Economics (2L, 2T)

Introduction to data science for economists: data scientific techniques applied to data in economics or finance. Topics include programming, visualisation and elementary machine learning methods.

Labour economics and labour econometrics: labour market, demand and supply, demographic tendencies, trade unions, the South African labour market.

Prerequisite pass module: Economics 214

Prerequisite module: Economics 244

Corequisite module: Economics 318

Home department: Economics

13345 Economics of Sustainable Agriculture (Including Farm Management)

876 (8) Economics of sustainable agriculture (including farm management)

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.

Learning outcomes

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

- 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)

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 the relationships between T, P and V; introduction to basic engineering applications.

Corequisite module: Engineering Mathematics 115

Home department: Chemical Engineering

46825 Engineering Drawings

123 (15) Orthographic drawings (1L, 3P, 3T)

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.

Home department: Mechanical and Mechatronic Engineering

143 (15) Orthographic Drawings (Supplementary module) (Hybrid Format)

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.

Corequisite module: Engineering Drawings 123 (must be completed in the same academic year as Engineering Drawings 143. This implies that if you fail Engineering Drawings 143, you must take Engineering Drawings 123 again.)

Departmental approval: Registration depends on your overall academic record and the available capacity.

Home Department: Mechanical and Mechatronic Engineering

38571 Engineering Mathematics

115 (15) Introductory differential and integral calculus (5L, 2T)

To take this module, you must have achieved a mark of at least 6 (or 70%) for Mathematics on your NSC or your IEB school-leaving certificate or must have successfully completed the first year of a suitable extended curriculum programme.

Mathematical induction and the binomial theorem; functions; limits and continuity; derivatives and rules of differentiation; applications of differentiation; the definite and indefinite integral; integration of simple functions.

Home department: Mathematical Sciences

145 (15) Further differential and integral calculus (5L, 2T)

Complex numbers; transcendental functions; integration techniques; improper integrals; conic sections; polar coordinates; partial derivatives; introduction to matrices and determinants.

Prerequisite module: Engineering Mathematics 115

Home department: Mathematical Sciences

214 (15) Differential equations and linear algebra (4L, 2T)

Ordinary differential equations of first order; linear differential equations of higher orders; Laplace transforms and applications. Matrices: linear independence, rank, eigenvalues.

Prerequisite pass module: Mathematics 114 or Engineering Mathematics 115 or Mathematics 144 or Engineering Mathematics 145

Prerequisite module: Mathematics 144 or Engineering Mathematics 145

Home department: Mathematical Sciences

59498 Engineering Statistics

314 (15) Engineering statistics (3L, 2.5T)

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 testing; simple linear and non-linear regression and correlation analyses; introduction to multiple linear regression; introduction to analysis of variance and experimental design.

Prerequisite pass modules: Engineering Mathematics 115, 145

Home department: Statistics and Actuarial Science

34576 Entomology

314 (16) Insect pest management (3L, 3P)

Origin and types of insect pests; analysis of an insect pest problem in agriculture; methods of control: Biological control, lures, juvenile hormones, resistant plants, agrotechnical methods, legislative measures and chemical control; properties and testing of pesticides; integrated pest management. Biology and control of key South African pests.

Home department: Conservation Ecology and Entomology

418 (32) Insect diversity (6L, 6P)

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.

Home department: Conservation Ecology and Entomology

464 (16) Insect conservation ecology (3L, 3P)

Topics in this module include 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, insect response to global change and social issues in insect diversity conservation. These topics are presented in the field of insect conservation, with a special

interest in conservation agriculture, but all these principles are applicable across the entire conservation field.

Home department: Conservation Ecology and Entomology

58335 Entrepreneurship and Innovation Management

214 (16) Introduction to entrepreneurship (4L)

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.

Corequisite module: Business Management 113

Home department: Business Management

244 (16) Small business management (4L)

The scope and nature of small business development in South Africa; the important role of SMMEs in the South African economy; management of entrepreneurial opportunities; small business marketing management, purchasing, manufacturing and financial management; alternative routes to entrepreneurship; financing of opportunities in the market environment; management of growth of the small business; legal requirements which small businesses must adhere to; E-commerce and the entrepreneur; compilation of the business plan with the emphasis on the layout; different elements of the plan, balance sheet, income statement and cash flow statement; broad-based black economic empowerment and opportunities for SMMEs.

Prerequisite module: Entrepreneurship and Innovation Management 214

Corequisite module: Business Management 113

Home department: Business Management

318 (24) Creativity and innovation management (4L)

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.

Prerequisite modules: Entrepreneurship and Innovation Management 214 or 244

Home department: Business Management

26883 Financial Accounting

179 (26) Financial Accounting (4L, 1T)

This module focusses on the theoretical principles of International Financial Reporting Standards and accounting systems as well as the preparation and presentation of financial statements for different enterprises. This module is equivalent to Financial Accounting 188 (it covers all the same material, but some lectures and tutorials are taught separately). The focus on the separately taught lectures and tutorials will be supplementary conceptual development specifically for students that are part of the Faculty's BCom (Management Sciences) extended curriculum programme.

Home department: School of Accountancy

188 (24) Financial accounting (4L)

Theoretical principles of International Financial Reporting Standards; accounting systems; preparation and presentation of financial statements for different enterprises.

Note: Students who did not pass Accounting in their Grade 12 year must attend five lectures per week.

Home department: School of Accountancy

288 (32) Financial Accounting (4L, 1T)

Continuation of International Financial Reporting Standards; introduction to group statements and treatment of intergroup transactions.

Prerequisite pass module: Financial Accounting 178 or 188 or 179

Home department: School of Accountancy

51047 Financial Management

214 (16) Introduction to financial management (3L, 1P)

Compiling the statement of financial position, the statement of profit or loss and the statement of cash flows; 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.

Corequisite modules:

- *Business Management 113*
- *Business Management 142 OR*
- *Mathematics 114 OR*
- *Mathematics (Bio) 124*

Home department: Business Management

244 (16) Corporate financial management (3L, 1P)

The evaluation and interpretation of corporate financial performance by means of detailed ratio analyses and sustainability considerations; share and bond valuation; discussion of the influence of dividend policy on corporate valuations; the influence of financing policy on a firm's value; the effort of behavioural biases and heuristics on investment decisions.

Corequisite module: Financial Management 214

Home department: Business Management

314 (12) Financial planning and control (2L)

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.

Corequisite modules:

- *Financial Management 214*
- *Financial Management 244 OR*
- *Investment Management 254*

Home department: Business Management

332 (12) Capital investments (2L)

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.

Corequisite modules:

- *Financial Management 214*
- *Financial Management 244 OR*
- *Investment Management 254*

Home department: Business Management

352 (12) Financial management research (2L)

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.

Corequisite modules:

- *Financial Management 214*
- *Financial Management 244 OR*
- *Investment Management 254*

Home department: Business Management

354 (12) Mergers and acquisitions (2L)

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.

Corequisite modules:

- *Financial Management 214*
- *Financial Management 244 OR*
- *Investment Management 254*

Home department: Business Management

13264 Food Chains and Consumers

844 (10) Food chains and consumers

This theme focuses on providing insight into the agri-food business system, related governance systems and strategies and the role of value chains and how the food chain performance can be improved. Economics, management and marketing terminology and principles will be considered. This module also focuses on the factors impacting the human behaviour and the decision-making process regarding food choice.

Home division: Agricultural Economics

13857 Food Process Engineering

414 (15) Food process engineering fundamentals (3L, 1P, 2T)

Engineering approach to problem-solving; thermodynamic properties of water and an ideal gas; conservation of mass, momentum and energy; thermodynamic processes in closed and open systems; generation, usage and reticulation of steam; pump and pipe systems; steady-state conduction, convection and radiation; air-water vapour mixtures and air conditioning processes.

Prerequisite pass modules:

- *Mathematics (Bio) 124*
- *Food Science 244*

Home department: Mechanical and Mechatronic Engineering

444 (15) Food processing engineering applications (3L, 2T)

Behaviour, pumping 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.

Method of assessment: Examination

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

Prerequisite module: Food Process Engineering 414

Home department: Mechanical and Mechatronic Engineering

13267 Food and Nutrition Policies

823 (10) Food and nutrition policies

This theme focuses on providing insight into the contemporary focus areas in food and nutrition policies in South Africa. It makes students familiar with the principles and the diversity of the South African food and nutrition policies.

Home division: Human Nutrition

13259 Food Processing and Preservation

815 (10) Food processing and preservation

This theme focuses on providing insight into the most important unit operations applied in the food industry and the impact of these unit operations on the quality of food products and the most important novel food processing technologies applied in the food industry and on postharvest handling, energy efficiency water use and water treatment.

Home department: Food Science

13256 Food Safety, Hazards & Risks

812 (10) Food safety, hazards & risks

This theme focuses on providing insight into microbiological, chemical and physical aspects of food safety, the lines of defence and responsibilities in prevention and the quality assurance systems and legislation in place to reduce risks in relation to food.

Home department: Food Science

21210 Food Science

144 (16) Introduction to food science (3L, 3P)

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. May include factory visits.

Home department: Food Science

214 (16) Commercial food processing and preservation I (3L, 3P)

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. May include factory visits.

Home department: Food Science

244 (16) Commercial food processing and preservation II (3L, 3P)

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. May include factory visits.

Prerequisite module: Food Science 214

Home department: Food Science

314 (16) Animal food products (3L, 3P)

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. May include factory visits.

Prerequisite pass module: Food Science 244

Home department: Food Science

324 (16) Nutrition for the food scientist (3L, 3P)

Nutrients and implications for food product development, processing and preservation. Carbohydrates, proteins, fats, vitamins and minerals pertaining to human nutrition. Critical analysis of commercial food products concerning nutritional aspects, legislation and labelling.

Prerequisite pass module: Food Science 244

Home department: Food Science

333 (16) Quality management systems (3L, 3P)

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.

No examination. The class mark serves as final mark.

Home department: Food Science

344 (16) Cereal Science (3L, 3P)

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.

Prerequisite pass module: Food Science 244

Home department: Food Science

353 (16) Food and Beverage Biochemistry (3L, 1P)

The objective of this module is to provide students with a fundamental understanding of the biochemistry of food products as well as the analytical techniques required for analysis of foodstuffs. The course material is therefore focussed on proteins and their role and function in food systems as well as the use of enzyme technology in the manufacturing of food products.

This includes studying the biochemistry of enzymes in food production and spoilage as well as the characteristics, application and analysis of proteins and enzymes in the food industry.

Prerequisite pass modules: Biochemistry 214, 244

Prerequisite module: Applied Chemistry 334

Home department: Food Science

354 (16) Sensory analysis and process control (3L, 3P)

Introduction to sensory science; consumer sensory analysis, statistical analysis of data; correlation of data obtained through physical measurement and sensory analysis.

Prerequisite pass module: Food Science 244

Prerequisite module: Biometry 242

Home department: Food Science

414 (16) Food packaging (3L, 3P)

Packaging strategy to safely and cost-effectively deliver food products to the consumer; packaging design and development; new trends and innovations; food bio-deterioration and packaging requirements for different preservation techniques; functions of packaging; packaging sectors (metal, glass, plastics, paper/paperboard); quality and shelf life of packaged products; interaction between food product and packaging (migration, scalping, taints); selection of suitable pack types packaging materials and pack types for specific food products; modified atmosphere, active and intelligent packaging.

Prerequisite pass module: Food Science 244

Home department: Food Science

478 (48) Trial design and product development (3L, 6P)

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.

Prerequisite pass modules: Food Science 324, 333, 344, 354

Co-requisite module: Food Science 488

Home department: Food Science

488 (32) Food chemistry and analysis (3L, 3P)

Advanced analysis of foods. Chemistry of proteins, carbohydrates, fats, enzymes, water, food additives and complex food systems.

Prerequisite pass module: Chemistry 264

Prerequisite modules:

- *Food Science 344*
- *Biochemistry 244*

Home department: Food Science

13266 Food Security Project Analysis

822 (10) Food security project analysis

This theme focuses on providing insight into the planning and implementation of nutrition focused interventions and the monitoring and evaluation of the performance, relevance and effects of these interventions.

Home department: Agricultural Economics

11290 Forest Science

171 (24) Introduction (2L, 2P)

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 June or September is to be completed satisfactorily as part of this module.

Home department: Forest and Wood Science

212 (8) Natural forest ecosystems (2L, 2P)

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.

Home department: Forest and Wood Science

254 (16) Forest mensuration and inventory (3L, 3P)

Measurement of diameter and height, and determination of volume, form and density of trees, stands of timber and forest products. Measurement and estimation of wood properties and product quality in standing trees; quantitative description of forest structure, sampling techniques and their application in forest inventory. Use of remote sensing for forest measurement and assessment.

Prerequisite modules:

- *Mathematics (Bio) 124 OR*
- *Engineering Mathematics 115*

Home department: Forest and Wood Science

334 (16) Forest growth and yield science (3L, 3P)

Theory of tree growth, site evaluation; development of site index equations; growing stock and stand density; developing volume and taper equations; prediction of current yield; tree and forest growth models; prediction of future yield, modelling wood property variation.

Home department: Forest and Wood Science

355 (16) Forest finance, economics, policy and marketing (3L, 3P)

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.

Home department: Forest and Wood Science

356 (16) Silviculture I (3L, 3P)

Environmental factors that influence tree and stand growth; species-site-market matching; site preparation; plantation establishment and regeneration; vegetation management (including coppice management, pruning and thinning); integrated pest and disease management.

Home department: Forest and Wood Science

364 (16) Timber harvesting (3L, 3P)

Introduction to timber-harvesting; timber-harvesting nomenclature/terminology, equipment and systems; time study, time components, production, productivity and machine and harvesting systems costing; evaluation and system selection; operational and tactical harvest planning; ergonomics and forest work-science, health and safety in forest operations; impact of harvesting on the environment; harvesting of biomass.

One week of practical work (power-saw course) in September of the second year to be completed satisfactorily as part of this module.

Corequisite module: Forest Science 254

Home department: Forest and Wood Science

414 (8) Silviculture II (2L, 2P)

The eco-physiological basis for forest production; carbon cycling and carbon sequestration; effects of silvicultural practices and environmental factors on stand growth and environmental sustainability; nutritional management and nutrient cycles; integrated fire management.

Home department: Forest and Wood Science

424 (16) Forest management and planning (3L, 3P)

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.

Prerequisite module: Forest Science 254

Home department: Forest and Wood Science

434 (16) Forest roads and transport (3L, 3P)

Introduction to road construction materials and materials testing and pavement design. Road transport terminology/ nomenclature and applicable legislation; Introduction to access development; forest road network planning and management; influencing factors and road placement techniques. Road construction; road maintenance and drainage; impacts of roads on the environment. Introduction to secondary timber transport. Introduction to logistics.

Corequisite module: Forest Science 364

Home department: Forest and Wood Science

435 (8) Silviculture III (2L, 2P)

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.

Corequisite module: Genetics 214

Home department: Forest and Wood Science

442 (1) Experiential work (1P)

Three weeks of practical work during the four years of study. Two-week study tour during the winter recess of the fourth year.

Home department: Forest and Wood Science

468 (32) Research or management project (3L, 3P)

A study of a management unit in the forest and wood industry.

The data collected at the management unit are analysed, processed and used for the compilation of a comprehensive management plan on the basis of which the module will be assessed

Or

Independent execution of a theoretical and/or practical investigation in any forest science or wood science related field, and the submission of a comprehensive research report.

No examination. The class mark serves as final mark.

Home department: Forest and Wood Science

724 (32) Tree propagation

Plant propagation of forestry species, principles and practices of tree propagation and nursery management; principles of sexual and asexual tree propagation; seed management principles.

Home department: Forest and Wood Science

771 (32) Applied geo-information sciences

The use of position estimation (GNSS), LiDAR, remote sensing and geographic information systems (GIS) in the context of natural resource research and management (agriculture, forestry, conservation); spatial awareness, the nature of spatial data, data models, co-ordinate systems and map projections; sources of spatial data; position logging, data capturing using LiDAR, camera and drone or satellite sensors; data processes: capture, ordering, storage and manipulation; specific emphasis on extracting information and the analysis of spatial patterns in the context of natural resources; visual output for research publication.

Home department: Forest and Wood Science

772 (32) Silviculture

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.

Home department: Forest and Wood Science

773 (32) Timber harvesting and transport logistics

Timber-harvesting techniques and nomenclature/terminology, harvesting methods and systems selection; tactical and operational harvest planning; forest biomass; work/time study; machine and system costing and ergonomics; forest road and timber transport management and logistics.

Home department: Forest and Wood Science

774 (32) Forest inventory and yield prediction

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.

Home department: Forest and Wood Science

775 (32) Forest management

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.

Home department: Forest and Wood Science

776 (32) Tree improvement and propagation

Genetic tree improvement and propagation of forestry species; principles and practices of tree improvement and propagation; management of research programmes; genetic traits and continuous variation within forestry species; selective processes and testing.

Home department: Forest and Wood Science

780 (24) Forest science project

Research in the context of the forestry value chain; research design and methods; data capture and analysis; formulation of results and conclusions.

Home department: Forest and Wood Science

13263 Functional Foods and Alternative Proteins

843 (10) Functional foods and alternative proteins

This theme focuses on providing insight into health-promoting foods, the use of genetically modified crops and their relevance to food and nutrition security as well as the concept of nutritional genomics and their impact on preventing nutrition disorders.

Home division: Food Science

10478 Genetic Data Analysis

413 (8) Genetic data analysis

The Genetic Data Analysis module is aimed at the application of population and quantitative genetics theory in the analysis and interpretation of molecular genetic data. Specific emphasis is placed on acquiring practical skills for the composition of genetic datasets, conducting appropriate statistical analyses for answering particular research questions, and the interpretation of results within a biologically relevant context. Examples are taken from a number of fields, including agricultural, conservation and medical genetics, and used as a training model on a continuous basis.

Home department: Genetics

10481 Genetics

411 (16) Genetics: Molecular Techniques

The advancement in the field of molecular genetic techniques has revolutionised genetics and many of its applications. This module provides a theoretical platform (lectures, discussions, etc.) with concurrent hands-on practical sessions, which include DNA and RNA characterisation and manipulation.

Home department: Genetics

13285 Genetics

214 (16) Introductory genetics (3L, 3P)

The fundamental concepts that underlie the inheritance of biological traits are studied with reference to the genotype-phenotype paradigm, and the molecular basis of genetic diversity. Cellular mechanisms and components, including the cell cycle; mitosis and meiosis; chromosomes, and genes are related to the principles of heredity: Mendelian genetics and extensions; linkage and recombination; linkage analysis and chromosome mapping; sexual reproduction and sex determining chromosomes; and chromosomal aberrations. The implications of such processes are further discussed at the organismal and population levels of biology with an introduction to population and quantitative genetics: population diversity; genotype and allele frequencies; the Hardy-Weinberg law and deviations; and complex and multifactorial traits.

Prerequisite pass module: Biology 124

Prerequisite modules:

- *Biology 144 or 154 OR*
- *Animal Science 144 OR*
- *Crop Protection 152 AND*
- *Mathematics (Bio) 124 OR*
- *Mathematics 114 or 144 OR*
- *Probability Theory and Statistics 144*

Home department: Genetics

244 (16) Introductory molecular biology (3L, 3P)

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.

Prerequisite module: Genetics 214

Home department: Genetics

314 (16) Genomes and genome analysis (3L, 3P)

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.

Prerequisite pass module: Genetics 244

Home department: Genetics

324 (16) Molecular population genetics (3L, 3P)

The genetic structure and dynamics of populations are investigated, especially with the use of molecular markers; including, frequencies of alleles and genotypes; heterozygosity, linkage disequilibrium; random mating and the Hardy-Weinberg principle. Factors that determine genetic variation: mutation, migration, selection and population size; subdivided- and genetic relationships between populations are also discussed. Emphasis is placed on applications in molecular population genetics; phylogenetics and population genomics.

Prerequisite pass module: Genetics 214

Corequisite module: Genetics 244

Home department: Genetics

344 (16) Advanced topics in molecular genetics (3L, 3P)

Various advanced topics are addressed in this module and may include the following: diagnostic applications in human genetics; DNA fingerprinting and forensic science; applications from genome projects; personalised medicine and pharmaco-genetics; neurogenetics; epigenomics; genetic modification; gene therapy; genome editing; synthetic biology; viruses and the exploitation of their genomes.

Prerequisite pass module: Genetics 244

Home department: Genetics

354 (16) Quantitative genetics (3L, 3P)

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.

Prerequisite modules:

- *Genetics 324*
- *Biometry 212, 242 OR*
- *Psychology 243 and 253 OR*
- *Mathematical Statistics 214 OR*
- *Biodiversity and Ecology 212*

Home department: Genetics

414 (16) Plant breeding techniques (3L, 3P)

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.

Prerequisite pass module: Genetics 344

Home department: Genetics

64165 Geo-Environmental Science

124 (16) Introduction to human-environmental systems (3L, 3P)

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.

Home department: Geography and Environmental Studies

154 (16) Introduction to earth systems science (3L, 3P)

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.

Home department: Earth Sciences

12923 Geographical Information Technology

214 (16) Geographical Information Systems (3L, 3P)

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.

Prerequisite module:

- *Mathematics 114 OR*
- *Mathematics (Bio) 124*

Home department: Geography and Environmental Studies

241 (16) Spatial data management (3L, 3P)

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.

Prerequisite module: Geographical Information Technology 141 or 214

Home department: Geography and Environmental Studies

312 (16) Spatial analysis (3L, 3P)

Query operations and query languages; Geometric measures; Spatial analytical operations; Surface analysis; Geostatistics; Network analysis; Analysis design; Fuzzy sets.

Prerequisite module: Geographical Information Technology 214 or 241

Home department: Geography and Environmental Studies

13872 Grapevine Sciences

214 (12) Grapevine plant materials and their growth and metabolism (2L, 3P)

Grapevine resources for wine and table grape production (rootstock and scion cultivars and varieties); ampelography; seasonal cycles; vine growth and metabolism.

Home department: Viticulture and Oenology

244 (16) Resource allocation and physiology of grapevines (3L, 3P)

Resource allocation and physiology of grapevines, the latter including vegetative, reproductive, ripening and stress physiology.

Prerequisite module: Grapevine Sciences 214

Home department: Viticulture and Oenology

312 (8) Table and raisin grape production (2L, 3P)

The global industries. Climate and other requirements for table and raisin grape production. Cultivars, rootstocks, nursery vine quality. Vegetative and reproductive development. Trellis systems and vine development. Production practices linked to the seasonal cycle of the grapevine (pruning, dormancy management, canopy management, crop control, bunch preparation). External and internal fruit quality. Maturity indexing, harvest and post-harvest practices. Compiling production, harvest and post-harvest plans for two table grape cultivars (one labour intensive and one not labour intensive) OR for two raisin grape cultivars. Case study of a commercial unit's implementation of a production plan, as well as the harvest and post-harvest processes of these two cultivars.

Home department: Viticulture and Oenology

314 (12) Grapevine improvement/propagation, establishment and cultivation practices (2L, 3P)

The improvement and propagation of grapevine material, grapevine development and the maintenance of grapevines through pruning. Detailed knowledge of nursery practices, grapevine planting and training, and pruning systems and their application in different scenarios will be shared.

Prerequisite modules: Grapevine Sciences 214, 244

Home department: Viticulture and Oenology

344 (12) Trellising systems and canopy management: pests, disease and abnormalities (2L, 3P)

The basis for choosing the appropriate training/trellising system and the appropriate canopy management programme. The identification of pests, diseases and abnormalities (including nutrient deficiency/toxicity) is covered, along with appropriate interventions.

Corequisite module: Grapevine Sciences 314

Home department: Viticulture and Oenology

444 (16) Advanced viticulture (3L, 3T, 3P)

This module provides a theoretical and practical basis for identifying and managing variability within vineyards, with a focus on maximising yield and quality while minimising environmental impacts by optimizing the use of natural resources (soil and water) and chemical applications (fertilizers, and pesticides and herbicides). The implementation of this concept is accomplished by the analysis of local variation in factors that influence grapevine yield and quality (soil, topography, microclimate, vine health, vegetative growth, etc.) using remote sensing techniques (proximal sensors, aerial platforms and satellites) in combination with geographic information system (GIS) and basic geostatistics principles for generating spatial variability maps of the vineyards.

Prerequisite module: Grapevine Sciences 344

Home department: Viticulture and Oenology

452 (8) Grape farming systems and business models (2L, 3P)

Table and raisin grape production systems to produce table grapes/raisins for desired quality and market requirement outcomes. Market access 2-day accredited short course (including GLOBALGAP or similar quality traceability system), compiling production, harvest and post-harvest plans for a commercial unit. Case study of a commercial unit's implementation of a production plan, as well as the harvest and post-harvest processes.

Prerequisite modules: Grapevine Sciences 314, 344

Corequisite module: Grapevine Sciences 444

Home department: Viticulture and Oenology

13710 Grapevine and Wine Sciences

142 (8) Introduction to grapevine and wine sciences (1.5L, 1.5P)

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.

Home department: Viticulture and Oenology

212 (8) Introduction to grapevine and wine microbiology (1.5L, 1.5P)

History of wine microbiology, description of micro-organisms associated with the grapevine and wine environments and practical ways to isolate, identify and manage their growth, basic biochemical pathways pertaining to wine fermentation.

Home department: Viticulture and Oenology

278 (8) Practical Project (1): Integrated grapevine and wine sciences (2L, 2P)

Application of viticultural and oenological knowledge contained in first- and second-year modules in which critical academic skills are demonstrated. Presentation of a photographic/electronic portfolio, a literature review, a vineyard plan and a wine tasting. Basic principles of entrepreneurship and related skills and formulating an industry-related individual idea/innovation.

Home department: Viticulture and Oenology

378 (16) Practical Project (2): Integrated grapevine and wine sciences (2L, 2P)

Application of viticultural and oenological knowledge contained in second- and third-year modules in which critical academic skills are demonstrated. Presentation of scientific reports, portfolios, process flow charts, compliant wine labels, a basic wine costing and marketing plan and a wine tasting. Entrepreneurial principles (industry-related idea filtering in a "company" team/group, lean canvas and basic product/service prototype development).

Prerequisite module: Grapevine and Wine Sciences 278

Home department: Viticulture and Oenology

444 (8) International terroir and wines (2L, 3P)

This module introduces the student to the terroir concept in grapevine and wine science, and explores viticultural management practices and wine style decision-making under 'normal' and rapidly -changing climatic conditions. It introduces the main characteristics (typicality) of international and local wines associated with specific terroirs.

Prerequisite module: Grapevine Sciences 344

Home department: Viticulture and Oenology

454 (8) The Future of Wine (2L, 3P)

The module will provide an overview of the drivers of change in the wine industry, including influential people and the relevance of innovation, emerging technologies and entrepreneurship in the context of a changing world. This module will also accommodate the completion and final evaluation of the entrepreneurship capstone project.

Home department: Viticulture and Oenology

478 (60) Industry Internship (3T, 3P)

This module utilises a work-integrated learning strategy to enhance practical viticultural and winemaking experience in the industry under the guidance of academic and industry mentors. Experience in all aspects of cellar and vineyard management. Identification of a relevant industry-related problem or topic in the workplace and executing an experiment or literature review and/or analysis from a scientific viewpoint. Working in teams and individually to manage vines, monitor ripening, produce wine, conduct experiments where applicable, write a project report and present results and write a reflection on experiences.

Prerequisite pass modules:

- *Grapevine Sciences 214, 244, 314*
- *Wine Sciences 214, 244, 314*
- *Grapevine and Wine Sciences 278*

Prerequisite modules:

- *Grapevine Sciences 344*
- *Wine Sciences 344*
- *Grapevine and Wine Sciences 378*

Home department: Viticulture and Oenology

39632 Horticultural Science

222 (8) Fruit production (1.5L, 1.5P)

Overview of the deciduous fruit industry with emphasis on technology of fruit production, including rootstocks, vegetative growth, bearing habits, delayed foliation, flowering, pollination and fertilization, fruit set, fruit thinning, maturity standards, principles of pruning and training.

No examination. The class mark will serve as final mark.

Prerequisite modules:

- *Crop Production 152 OR*
- *Biology 154*

Home department: Horticultural Science

314 (16) Deciduous fruit production (3L, 3P)

Biology and technology of deciduous fruit production (pome fruit and stone fruit). Deciduous fruit industry, bearing habits, rootstocks, vegetative development, shoot growth, growth reactions to bending and pruning of shoots. Carbohydrate and nitrogen reserves. Eco-, para- and endo-dormancy. Reproductive development, flower formation, fruit set, crop load management, fruit growth, fruit ripening.

Prerequisite module: Crop Production 214

Home department: Horticultural Science

342 (8) Citrus production (1.5L, 1.5P)

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.

Prerequisite module: Crop Production 214

Home department: Horticultural Science

352 (8) Ornamental, foliage and aromatic plant production systems (1.5L, 1.5P)

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.

Prerequisite module: Crop Production 214

Home department: Horticultural Science

362 (8) Subtropical fruit production (1.5L, 1.5P)

Biology and technology of subtropical fruit production. Bearing habits, rootstocks, nursery tree quality, vegetative development, shoot and root growth. Reproductive development, fruit growth, external and internal fruit quality. The focus is on avocado and macadamia, with reference to other subtropical crops.

Prerequisite module: Crop Production 214

Home department: Horticultural Science

434 (16) Applied plant physiology and tree architecture (3L, 3P)

Lectures: Underlying physiology of growth, development and production practices of horticultural crops. Correlative phenomena and the role of plant hormones supported by an overview of relevant cell, tissue and organ anatomy as well as basic genetic principles. Overview of environmental perception and acclimation/adaptation. Dormancy as morphogenetic and survival mechanism. Physiology of growth cessation, hardening, induction and progression of dormancy, rest breaking and branching. Tree architecture and training systems, principles and techniques of tree manipulation and the role of rootstocks. Integration of the above with knowledge on production practices gained in preceding modules.

Practicals: Inter alia lectures by industry specialists on relevant pre-harvest topics as well as visits to fruit production areas to illustrate and support the module content.

Prerequisite module: Horticultural Science 314

Home department: Horticultural Science

444 (16) Postharvest physiology and technology (3L, 3P)

Postharvest physiology of fresh plant products: structure and composition of the product, role of respiration and ethylene metabolism, fresh plant-product 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 physiological-disorder defect identification project, a series of lectures by industry specialists on topics such as postharvest problems, logistics and handling of fresh product and ripening, ethylene inhibitors commercially, visits to the Cape Town market in Epping, pack houses and cold stores, as well as a fresh-cut facility.

Corequisite module: Biochemistry 244

Home department: Horticultural Science

714 (16) Deciduous fruit production (3L, 3P)

Seasonal vegetative and reproductive developmental biology of deciduous fruit (pome and stone fruit): shoot, flower formation, fruit set, fruit growth and ripening of fruit. Production technologies to ensure a sustainable production of high-quality fruit: bearing habits, rootstocks, bending and pruning of shoots, mechanical and chemical regulation of crop load. Endogenous tree dynamics: Eco-, para- and endo-dormancy, carbohydrate and nitrogen reserves.

Home department: Horticultural Science

742 (8) Citrus physiology and technology (1.5L, 1.5P)

The physiology, biology and technology aspects involved with the aim of optimizing citrus production. Manipulations of the citrus physiology with choices of genetic material and plant growth regulators to obtain higher yield and improved fruit quality.

Home department: Horticultural Science

752 (8) Ornamental and foliage plant production systems (1.5L, 1.5P)

Biology and technology of the production of cut flowers and foliage plants, such as roses, chrysanthemums, tulips (geophytes), also including orchard-based fynbos production and geophytes. Production prerequisites for selected flower types and fynbos. Control of flower initiation, scheduling of flowering time and harvesting, colour development and implementation of optimum postharvest practices.

Home department: Horticultural Science

762 (8) Subtropical fruit production (1.5L, 1.5P)

Biology and technology of subtropical fruit production. Bearing habits, rootstocks, nursery tree quality, vegetative development, shoot and root growth. Reproductive development, fruit growth, external and internal fruit quality. Postharvest of subtropical fruit. Relevant seminar topics will encourage research. The focus is on avocado and macadamia, with reference to other subtropical crops.

Home department: Horticultural Science

13257 Human Economic Development

813 (10) Human economic development

This theme focuses on providing insight into the concept, theories and measures of economic development. It serves to further examine the extreme contrast not only between developed and developing countries, but also the different livelihood situations between population groups/families within the countries.

Home department: Agricultural Economics

44792 Industrial Ergonomics

414 (15) Industrial ergonomics (3L, 2T)

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

Home department: Industrial Engineering

47422 Industrial Programming

244 (15) Industrial programming (2L, 3T)

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.

Prerequisite module: Engineering Mathematics 145

Home department: Industrial Engineering

44776 Industrial Psychology (Special)

354 (12) Industrial psychology (Special) (3L)

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

13334 Intensive Crop Production Systems

771 (18) Intensive crop production systems (3L, 3P)

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.

Home department: Agronomy

14213 Intercultural Communication (Eng)

113 (8) Introduction to Intercultural Communication for Engineers (2L, 3T)

Dimensions of culture, such as individualism and collectivism, power distance, uncertainty avoidance, and masculinity and femininity. The "Describe-Analyse-Evaluate" framework. Barriers to effective intercultural communication, such as stereotyping and prejudice. Writing assignments related to intercultural communication in the engineering context, with introduction to coherence, style and referencing. Introduction to the engineering studies. Reading skills development. Basic skills in use of Microsoft Word and Excel.

Home department: Engineering (Admin)

13713 Introduction to Animal Nutrition

244 (16) Introduction to animal nutrition (3L, 3P)

Digestive systems and digestion in various domestic and wild animals. Raw material identification and application in basic feed formulation. Energy, protein, vitamin and mineral nutrition of domestic animals.

Corequisite module: Animal Anatomy and Physiology 214 [not applicable to BAgric (Agri-business Management) students]

Home department: Animal Sciences

12298 Introduction to Economics

141 (12) Introduction to economics (4L, 2T)

The focus of this module is to provide a comprehensive introduction to microeconomics in general, set against a contemporary South African background. Students will learn how to apply microeconomic principles to a wide variety of real-world situations in both their personal and professional life. Deeper understanding and working knowledge of the following basic fundamental microeconomic concepts will be provided: what economics is about; the three central economic questions; how different economies answer these questions; how the economy functions as a whole; what drives the economy.

Home Department: Economic and Management Sciences (General)

13261 Introduction to Epidemiology

841 (10) Introduction to epidemiology

The content module will cover basic principles of nutritional epidemiology and types of nutritional surveys, the association between poverty and health and the social determinants of health.

Home division: Human Nutrition

14289 Introduction to Statistical Learning

441 (12) Introduction to Statistical Learning (2L)

Objectives and content: Statistical learning is a collective noun for a variety of techniques that can be used to identify, describe, and model patterns and trends in data sets. Some of these techniques are well established in traditional statistics, for example regression analysis and discriminant analysis, while others have become feasible because of the ready availability of computing power. Examples of the latter are support vector machines, neural networks and recommender systems, all of which are discussed in the module. The module strikes a balance between a study of these and other specific methods on the one hand and the underlying fundamentals on the other. Regularisation, optimisation and the curse-of-dimensionality and ways of combatting it, are important concepts that are emphasised throughout the module.

Prerequisite pass modules:

- *Mathematical Statistics 312*
- *Data Science 246 or Data Science 314*

Home department: Statistics and Actuarial Science

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:

- 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

13350 Introduction to Transport and Logistics Systems

144 (12) Introduction to transport and logistics systems (3L, 1P)

Introduction to the unique purpose of the transport system; the components of the system; the economic significance of the transport system; the organisation and regulation of transport; concepts of demand and supply; and transport from a management perspective.

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.

Home department: Logistics

55344 Investment Management

254 (16) Introduction to investment theory (3L, 1P)

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.

Prerequisite modules:

- *Business Management 142*
- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 or 144*

Corequisite module: Business Management 113

Home department: Business Management

314 (12) Equity analysis (2L)

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.

Prerequisite pass modules:

- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 or 144*

Prerequisite module: Investment Management 254

Home department: Business Management

324 (12) Fixed-income securities (2L)

Features and overview of fixed income securities and sectors; yield measures and spreads; valuations; interest rate risks and returns; credit analysis; term structure and interest rate dynamics; and other selected securities.

Prerequisite pass modules:

- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 or 144*

Prerequisite module: Investment Management 254

Home department: Business Management

344 (12) Derivative Instruments (2L)

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.

Prerequisite pass modules:

- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 or 144*

Prerequisite module: Investment Management 254

Home department: Business Management

349 (12) Property and Alternative Investments (2L)

This module focuses on preparing students to make investment decisions regarding property and other alternative investments (private equity, hedge funds, commodities, etc.). In this regard, the focus falls on themes such as markets and trends; financial and investment analysis in respect of the acquisition, ownership and sale; market valuation approaches; types of investment and financing instruments.

This module also focuses on the ethical management of investment portfolios encompassed by the Code of Ethics and Standards of Professional Conduct of the CFA Institute, which includes themes such as the liability

of investment practitioners towards the profession, employers, clients, possible clients and the broad public; reporting of historical investment returns; responsible risk-taking; risk control.

Prerequisite pass modules:

- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 or 144*

Prerequisite modules:

- *Investment Management 254*
- *Financial Management 214 or*
- *Financial Accounting 178 or 188*

Home department: Business Management

14219 Logistics and Supply Chain Management

214 (16) Logistics and Supply Chain Management (3L, 1P)

Introduction to Logistics and Supply Chain Management: Supply chain overview, the role of logistics in the firm, the elements of logistics, integrated logistics management, organisation for effective logistics, international logistics, new trends.

Demand Management: Balancing supply and demand, demand forecasting, sales and operations planning, collaborative planning, forecasting and replenishment.

Order Management and Customer Service: Order management, customer service and relationship management.

Supply chain technology and information flows: Role of information and data in the supply chain, the implementation and use of software and technology in the supply chain.

Logistics Research: literature review, how to find and read academic sources.

Prerequisite module: Business Management 113

Home department: Logistics

244 (16) Logistics and Supply Chain Management (3L, 1P)

Supply Management / Procurement: Impact on the firm's bottom line, progression from tactical to strategic role, cross-functional impact and process; procurement cycle, public sector procurement.

Portfolio of relationships: Tactical, collaborative, strategic alliance, logistics relationships, 3PL industry overview.

Sourcing materials and services: Managing procurement, strategic sourcing, global sourcing, outsourcing, total cost of ownership (TCO), negotiation.

Producing goods and services: Role of production operations in the supply chain, operations strategy and planning, decisions in production, production technology, packaging in the supply chain.

Inventory in the supply chain: Role of inventory in the economy and organisations, inventory costs, inventory management approaches, inventory classification.

Logistics research: Identifying and defining the logistics research problem.

Prerequisite pass modules: Business Management 113

Prerequisite modules:

- *Logistics and Supply Chain Management 214 OR*
- *Introduction to Transport and Logistics Systems 144*

Home department: Logistics

314 (12) Logistics and Supply Chain Management (2L)

Transport: Role of transportation; challenges faced in transportation; modes of transportation; transportation planning and strategy; execution and control; transportation technology; vehicle costing and fleet management.

Distribution: Role of distribution; distribution planning and strategy; distribution execution; distribution technology.

Supply chain sustainability: logistics and the environment, supply chain sustainability framework.

Reverse logistics: reverse logistics systems, reverse flows, closed loop supply chains, customer returns, environmental challenges and technology application to improve reverse flows.

Prerequisite pass module: Business Management 113

Please note: You may not take any third-year Logistics and Supply Chain Management modules in combination with Financial Accounting 389.

Home department: Logistics

324 (12) Logistics and Supply Chain Management (2L)

Supply chain network analysis and design: Network design as a part of supply chain planning; logistics/ supply chain network design; modelling approaches.

Logistics performance measurement and financial analysis: Performance measurement; logistics/supply chain performance metrics; benchmarking the supply chain; impact of logistics on financial performance.

Supply chain strategy: strategic supply chain resource requirements, supply chain strategy implementation, change management, stakeholder management, integrated metrics.

Supply chain risk: managing risk in supply chains and business continuity planning.

Prerequisite modules:

- *Logistics and Supply Chain Management 214 OR*
- *Logistics and Supply Chain Management 244 OR*
- *Introduction to Transport and Logistics Systems 114*

Please note: You may not take any third-year Logistics and Supply Chain Management modules in combination with Financial Accounting 389.

Home department: Logistics

344 (12) Logistics and Supply Chain Management (2L, 1P)

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.

Logistics research: getting data (qualitative and quantitative), data preparation, formulation of hypotheses and basic statistical tests, with applications in the fields of logistics and supply chain management.

Pr*erequisite pass module:*

- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 OR*
- *Probability Theory and Statistics 144*

Please note: You may not take any third-year Logistics and Supply Chain Management modules in combination with Financial Accounting 389.

Home department: Logistics

354 (12) Logistics and Supply Chain Management (2L)

*Logistics researc*h: 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.

Prerequisite modules: Logistics and Supply Chain Management 314, 324

Please note: You may not take any third-year Logistics and Supply Chain Management modules in combination with Financial Accounting 389.

Home department: Logistics

13262 Macro- & Micronutrients & Health

842 (10) Macro- & micronutrients & health

This theme focuses on providing insight into the problem of malnutrition, and evidence-based approaches to address the problem.

Home division: Human Nutrition

10812 Management Accounting

288 (24) Management Accounting (3L)

Introduction to strategy. Time value of money; risk and return; valuation of preference shares and bonds; working capital management; financing decision and cost of capital. Fundamental concepts of cost and management accounting; cost assignment and behaviour; job costing; standard costing; process costing; joint and by-products; budgeting and control.

Prerequisite pass module: Financial Accounting 188 or 179, or

Prerequisite module: Financial Accounting 178

Home department: School of Accountancy

23795 Marketing Management

214 (16) Marketing management (3L, 1P)

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.

Corequisite modules:

- *Business Management 113*
- *Financial Management 214 OR*
- *Financial Accounting 278 or 288 OR*
- *Biometry 212*

Home department: Business Management

244 (16) Integrated and Digital Marketing Communication (3L, 1P)

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.

Prerequisite module: Marketing Management 214

Home department: Business Management

314 (12) Omnichannel Retail Marketing (2L)

Omnichannel approach to retail strategy and the retailing mix; location decisions; merchandise decisions; price decisions; communication decisions; consumer services and information; technology and systems; franchise agreements.

Prerequisite module: Marketing Management 214

Home department: Business Management

324 (12) Services management (2L)

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.

Prerequisite module: Marketing Management 214

Home department: Business Management

344 (12) Marketing research (2L)

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.

Prerequisite modules:

- *Marketing Management 214, 244*
- *Probability Theory and Statistics 144 OR*
- *Statistics and Data Science 188*

Home department: Business Management

354 (12) Strategic marketing (2L)

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.

Prerequisite modules: Marketing Management 214, 244

Home department: Business Management

21539 Mathematics

114 (16) Calculus (5L, 2T)

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.

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.

Home department: Mathematical Sciences

144 (16) Calculus and linear algebra (5L, 2T)

Complex numbers; transcendental functions; techniques of integration; improper integrals; conic sections; polar co-ordinates; partial derivatives; introduction to matrices and determinants.

Prerequisite module: Mathematics 114

Home department: Mathematical Sciences

186 (32) Introductory mathematics (3L, 3T)

For BSc (extended curriculum programme) and BEng (extended curriculum programme) students.

Any student who wishes to take this module must have achieved a mark of at least 5 (or 60%) for Mathematics in the NSC or the IEB's school-leaving certificate.

An introduction to calculus, linear algebra and mathematical reasoning: Different presentations of functions in terms of formulas, graphs, tables and stories; inverse of a function; exponential and logarithmic functions; trigonometric functions and their inverse functions; modelling with functions. Gradual progression from

average to instantaneous rate of change; limits; basic integration. Systems of equations; analytic geometry; mathematical induction; binomial theorem.

Home department: Mathematical Sciences

214 (16) Advanced Calculus and Linear Algebra (4L, 2T)

Advanced Calculus: Functions of more than one real variable, multiple integrals, line integrals, surface integrals, the divergence theorem.

Linear algebra: Vectors in n dimensions: linear transformations of real vector spaces and their matrices; geometric transformations: rotation, reflection, dilation, projection; composition of transformations. General real vector spaces: subspaces, linear independence, basis, dimension; rank and nullity of a matrix. General inner-product matrices; orthogonality, orthonormal bases, projections, the Gram-Schmidt process; QR factorisation of a matrix; least squares approximations; orthogonal matrices.

Prerequisite pass modules: Mathematics 114, 144

Home department: Mathematical Sciences

21547 Mathematics (Bio)

124 (16) Mathematics for the biological sciences (4L, 2T)

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.

Home department: Mathematical Sciences

176 (32) Introductory mathematics for the biological sciences (3L, 3P)

For students in the BSc (extended curriculum programmes).

Any student who wishes to take this module must have achieved a mark of at least 4 (or 50%) for Mathematics in the NSC or the IEB's school-leaving certificate.

Different presentations of functions in terms of formulas, graphs, tables and stories; inverse of a function; exponential and logarithmic functions; trigonometric functions and their inverse functions; modelling with functions; gradual progression from average to instantaneous rate of change; limits. Simple two-dimensional Euclidean geometry, as applied to polygons and circles; co-ordinate geometry; linear programming: optimising a function in two variables subject to linear constraints; introduction to data handling and probability.

Home department: Mathematical Sciences

11580 Mathematics for EMS

171 (18) Mathematics for EMS (3L, 2T)

The focus of this module is to provide a foundation and promote deeper understanding and working knowledge of the following basic fundamental Mathematics concepts: pre-calculus review; straight lines, linear functions and linear programming with an emphasis on shadow prices and sensitivity analysis; financial mathematics that extensively covers simple interest, compound interest involving time-lines, interest-discount rate conversions and annuities; sets and counting techniques; probability; functions, limits and the derivative; differentiation; applications of the derivative with an emphasis on the optimisation of cost, revenue and profit functions; antiderivatives (integrals) of power functions only in relation to areas under curves.

Home department: Economic and Management Sciences (General)

22853 Mathematical Statistics

214 (16) Distribution Theory and Introduction to Statistical Inference (4L, 2P)

Continuous stochastic variables; expected value and variance of a continuous stochastic variable; important continuous distributions; uniform, normal, exponential, gamma, beta. Moments and moment-generating functions for discrete and continuous distributions. Bivariate probability distributions; marginal and conditional distributions; the multinomial and bivariate normal distribution; determining the distribution of functions of variables. The central limit theorem (without proof). Samples and sampling distributions: the standard parametric cases. Interval estimation and hypothesis testing: applying these principles in the standard cases of parametric inference. Data representation and description, calculating and interpreting sample measures.

Prerequisite pass modules:

- *Probability Theory and Statistics 114 or Probability Theory and Statistics 144*
- *Mathematics 114 and Mathematics 144, with an average final mark of at least 60% for the two together, or Mathematics 214 with a final mark of at least 55% (If you have passed Engineering Mathematics 115 and Engineering Mathematics 145 with an average mark of at least 60% for the two together, or Engineering Mathematics 214 with a final mark of at least 55% you are exempt from this.)*

Home department: Statistics and Actuarial Science

245 (8) Statistical Inference (2L, 1P)

Introduction to statistical inference. Principles of point estimation: efficiency, minimum variance unbiased estimators, consistency. Method of moments estimators. Maximum likelihood estimators. The Neyman-Pearson lemma: proof and applications. Likelihood ratio tests. Parametric estimation theory and hypothesis testing. Bayesian inferential statistics.

Prerequisite pass module: Mathematical Statistics 214

Home department: Statistics and Actuarial Science

246 (8) Linear Models in Statistics (2L, 1P)

Advanced matrix algebra. Stochastic vectors and matrices. The multivariate normal distribution. Maximum likelihood estimation of parameters in the multivariate normal distribution. Distributions of quadratic forms. The simple linear regression model. The method of least squares. Inference in the simple linear regression model. Introduction to R software.

Prerequisite pass module: Mathematical Statistics 214

Home department: Statistics and Actuarial Science

312 (16) Statistical Inference and Probability Theory (3L, 1P)

Advanced distribution theory, sequences of random variables, limit theory for sequences, generating functions, sampling distributions and approximations. Sufficiency. Different approaches to inference. Goodness-of-fit methods. Bayes inference: Decision theory and Bayes risk using loss functions, Bayesian belief networks and Bayesian classification. Markov Chain Monte Carlo simulation techniques: Gibbs sampling and Metropolis-Hasting algorithms.

Prerequisite pass module: Mathematical Statistics 245

Prerequisite modules:

- *Mathematical Statistics 246 with a final mark of at least 40%*
- *Mathematics 214 or Engineering Mathematics 214*

Home department: Statistics and Actuarial Science

16284 Microbiology

214 (16) Introductory microbiology (3L, 3P)

History, microscopy, classification, structure and function (bacteria and archaea), nutritional requirements and growth factors, nutrient uptake, energy generation, culture media, growth curves, continuous culture, physical and chemical control, environmental factors, biofilm formation, quorum sensing and antimicrobial therapy.

Prerequisite pass modules:

- *Biology 124 or 144*
- *Chemistry 124 or 164 and 144*

Home department: Microbiology

244 (16) Microbial diversity (3L, 3P)

Kingdoms of life, and modern microbial taxonomy and introductory microbial genomics. Prokaryotes, archaeal cell structure and function, non-proteobacterial Gram-negative bacteria, Proteobacterial classes, Firmicutes and Actinobacteria. Fungal groups, cell structure and function. Structure of viruses and virus taxonomy and multiplication strategies. Microbiology of water and soil environments, different metabolic types of micro-organisms, the role of different microbial taxa 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.

Prerequisite pass modules:

- *Biology 124 or 144*
- *Chemistry 124 or 164 and 144*

Home department: Microbiology

43850 Nematology

344 (16) Introduction to Nematology (1L, 3P)

An introduction to the scientific field of nematology, which include plant parasitic and insect parasitic nematodes. The emphasis is on the morphological characteristics of diagnostic value, as it forms the basis of the taxonomic classification system used for nematodes. The general reproduction and biology of nematodes are discussed. Control of plant parasitic nematodes and the control of insects with the use of entomopathogenic nematodes are covered. The focus is on the biology, identification and control of plant parasitic genera of economic importance to agriculture. The lectures are combined with practical sessions in which extraction techniques, symptomatology and live specimens of nematodes are studied using stereo and light microscopy.

The following modules may not be taken concurrently with this one: Plant Pathology 314, 344

Home department: Conservation Ecology and Entomology

59528 Operations Research (Eng)

345 (15) Operations research (Deterministic Models) (3L, 3T)

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.

Prerequisite module: Engineering Mathematics 214

Home department: Industrial Engineering

415 (15) Operations research (Stochastic Models) (3L, 3T)

Analysis of problems leading to a selection of 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; local-search- and population-based metaheuristics.

Prerequisite modules:

- *Engineering Statistics 314 OR*
- *Probability Theory and Statistics 114*

Home department: Industrial Engineering

13005 Physics (Bio)

134 (16) Introductory physics for biological sciences A (3L, 3P)

Selected topics, relevant to the biological sciences, from introductory mechanics, hydro-statics and optics.

Corequisite modules:

- *Mathematics (Bio) 124 OR*
- *Mathematics 114*

Home department: Physics

154 (16) Introductory physics for biological sciences B (3L, 3P)

Selected topics, relevant to the biological sciences, from introductory electricity, magnetism, thermodynamics, gas laws, atomic physics, radioactivity, oscillations and waves.

Prerequisite module: Physics (Bio) 134

Home department: Physics

12998 Physics

176 (32) Preparatory physics (3L, 3P)

Students follow this module in the BSc extended curriculum programmes in AgriSciences and Science and for the BEng. The module focuses on the nature of physics with the following themes as content: Mechanics, electromagnetism, modern physics.

Home department: Physics

13328 Physiological and Ecological Principles of Natural Pasture Management

712 (18) Physiological and ecological principles of natural pasture management (3L, 3P)

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.

Home department: Agronomy

13537 Plant Genetics and Crop Improvement

422 (8) Plant genetics and crop improvement (3L, 3P)

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.

Prerequisite modules: Genetics 324, 354

Home department: Genetics

32891 Plant Pathology

314 (16) Plant disease management (3L, 3P)

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.

Home department: Plant Pathology

344 (16) Plant disease dynamics (3L, 3P)

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

414 (16) Taxonomy and biology of plant pathogens (3L, 3P)

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.

Prerequisite pass modules: Plant Pathology 314, 344

Home department: Plant Pathology

444 (16) Plant-microbe interactions (3L, 3P)

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.

Prerequisite pass modules: Plant Pathology 314, 344

Home department: Plant Pathology

474 (16) Advanced plant pathology (2L, 0.5T)

Topical issues in plant pathology, including new approaches for the management of plant diseases. Emphasis is placed on postharvest and soilborne diseases, and the use of pesticide spray technology for

improving plant disease control of foliar and fruit disease in an environmentally safe manner. Aspects related to the sustainable production of plant-based foods, including phytosanitary issues, pesticide residues and microbial contaminants of plant-based food crops. Visits to key agricultural industries in order to obtain a practical understanding of the role of plant pathology in agriculture. Attendance of postgraduate research seminars.

Home department: Plant Pathology

771 (16) Advanced disease management

The importance of epidemiology in control and management of plant diseases through the integration of cultivation practices, physical, biological and chemical strategies (seed technology, minimum manipulation, plant quarantine, sanitation practices and resistance). The mode of action of fungicides and the management of fungicide resistance in fungal populations. Biological control. Development and production of biocontrol systems for soil-borne, plant and fruit pathogens.

Home department: Plant Pathology

772 (16) Advanced plant disease dynamics

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

Home department: Plant Pathology

773 (10) Research methodology

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

Home department: Plant Pathology

774 (60) Project management and presentation

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.

Home department: Plant Pathology

775 (18) Advanced topics in plant pathology

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.

Home department: Plant Pathology

13342 Plant Production and Plant Protection

872 (8) Plant production and plant protection

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

56820 Probability Theory and Statistics

114 (16) Probability Theory and Statistics (3L, 3T)

Combinatorial analysis; the basic counting principles; permutations and combinations. Random phenomena; sample spaces and events; the probability axioms; the probability of an event; random selection; probability rules; conditional probability; the rule of Bayes; stochastic independence. Discrete and continuous stochastic variables; expected value and variance of stochastic variables; important discrete distributions: binomial, Poisson, geometric, hypergeometric, negative binomial; important continuous distributions, uniform, normal.

Please note: This module is identical to Probability Theory and Statistics 144(16), which is offered in the second semester by the Department of Statistics and Actuarial Science for BCom students.

Home department: Mathematical Sciences, Division Applied Mathematics

23256 Production Management

212 (8) Production and operational management (2L, 2T)

Introduction to operations management; strategy and sustainability; process analysis and manufacturing processes; lean supply chains; sales and operations planning; materials requirements planning (dependent inventory).

Home department: Industrial Engineering

314 (15) Operations Facilities and Management (3L; 1P; 2T)

Process analysis and improvement by combining Lean and Theory of Constraints approaches; facility design with regard to facility location, facility layout and production line design; demand forecasting and capacity planning; integrated production planning from an aggregate to operational level; inventory planning and control; scheduling, execution and control of production.

Prerequisite module: Production Management 212

Corequisite module: Engineering Statistics 314

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)

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.

Home department: Agronomy

46167 Quality Assurance

344 (15) Quality assurance (2L, 3T)

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.

Prerequisite module: Engineering Statistics 314

Home department: Industrial Engineering

59471 Quality Management

444 (15) Quality management (3L, 3T)

Definition of reliability and maintainability; reliability management; methods and techniques for reliability modelling, data analysis, prediction and maintainability assurance; quality management; methods and techniques for quality management; quality improvement; quality planning; quality control; leadership for quality management; cost of (poor) quality.

Prerequisite module: Engineering Statistics 314

Home department: Industrial Engineering

13347 Quantitative Analysis of Land Use Systems

881 (8) Quantitative analysis of land use systems (QUALUS)

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.

Learning outcomes

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

- 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.

Home department: Agricultural Economics

13533 13534 13535 Research Assignment

841, 842, 843 (60) Research assignment

Includes the planning and implementation of a research project. The research assignment will be submitted in the format of a scientific report/publication.

Home division: Food Science/Agricultural Economics/Human Nutrition

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:

- 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

64866 Scientific Communication Skills

116 (12) Scientific communication skills (3L, 3T)

For students in the BSc extended curriculum programmes. This module focuses on the development of speaking, listening and reading skills in the academic environment in general and specifically in the natural sciences. Aspects such as engaging with and understanding relevant academic and natural science texts, understanding text components, the use of fluent, correct and proper language and the interpretation of graphic data will be addressed.

Home department: SU Language Centre

146 (6) Scientific communication skills (3L)

For BSc students in the BSc extended curriculum programmes. This module focuses on the development of writing skills in the academic environment in general and specifically in the natural sciences. Aspects such as engaging with and understanding relevant academic and natural science texts, understanding text components, presenting data in an edited and coherent text, the use of correct and proper language, the employment of accurate language, correct referencing techniques and using graphics to clarify data will be addressed.

Home department: SU Language Centre

19003 Sociology

333 (12) Environmental sociology (2L, 0.5T)

An introduction to the field of environmental sociology; sociological approaches to contemporary environmental issues and problems, particularly as they pertain to South Africa and the Global South.

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:

- 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)

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.

Home department: Soil Science

142 (8) Applications of soil science (1.5L, 1.5P)

Principles of plant nutrition and fertilisation; ground water and irrigation; salinity and drainage; soil management.

Prerequisite module: Soil Science 114

Home department: Soil Science

214 (16) Introduction to soil science (3L, 3P)

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.

Prerequisite module: Chemistry 144

Home department: Soil Science

222 (16) Soil biology and ecology (3L, 3P)

Soil biodiversity contributes to soil health through important soil processes such as nutrient cycling, carbon cycling, improvement of soil structure through soil aggregation, protection of plants against stress and pathogens, among others. Therefore, soil biodiversity is directly or indirectly linked to most sustainable development goals such as food production, water quality, climate action and air quality. Soil biota can also be used as indicators of soil and environment quality which is insightful in management of food production systems and conservation of environments. Therefore, this module is designed to: i) explain the different organisms that live in the soil in terms their size, distribution, and taxonomy ii) discuss the methods used to study, analyse, and interpret data of soil organisms and iii) explain how different organisms interact in nutrients and energy acquisition and transfer in different trophic levels. Students will apply the knowledge and skills gained to analyse, interpret, and link soil biota data to environmental functions and services, and iv) explain the threats to soil biodiversity.

Prerequisite module: Biology 124

Home department: Soil Science

244 (16) Plant nutrition and fertilisation (3L, 3P)

Composition and nutrition of plants; individual plant nutrient elements; equilibria in the soil; organic and mineral fertilisers: their characteristics and uses; determination of fertiliser requirements and fertiliser application in practice; interaction with rhizosphere and pedosphere organisms; management of fertilizers to protect the environment.

Prerequisite modules:

- *Chemistry 124, 144*
- *Soil Science 214*

Home department: Soil Science

314 (16) Genesis, morphology, classification and uses of soil (3L, 3P)

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 limitations in relation to plant production; Soil genesis and its relation to soil morphology.

Prerequisite modules:

- *Chemistry 124, 144*
- *Soil Science 214*

Home department: Soil Science

344 (16) Soil and water management (3L, 3P)

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; principles of drainage; soil surface management; erosion and control thereof and soil surface management.

Prerequisite modules:

- *Mathematics (Bio) 124 or Mathematics 114, 144*
- *Soil Science 214, 244, 314*

Home department: Soil Science

414 (16) Advanced soil physics (3L, 3P)

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. Biophysical soil quality. Laboratory and practical fieldwork.

Prerequisite pass modules:

- *Chemistry 214*
- *Soil Science 214, 244, 314, 344*

Home department: Soil Science

424 (16) Advanced soil chemistry (3L, 3P)

Structure and reactivity of soil mineral colloids and organic matter; surface interfacial reactions between soil colloids and chemical species such as heavy metals or organic molecules; chemical equilibria in soils: mineral dissolution and precipitation, exchange, adsorption, redox and acid-base reactions; chemistry of acid, alkaline, and water-logged soils, soil biogeochemical processes. Laboratory and practical fieldwork.

Prerequisite pass modules:

- *Chemistry 214*
- *Soil Science 214, 244, 314, 344*

Home department: Soil Science

444 (16) Advanced pedology (3L, 3P)

International soil classification systems, soil geomorphology and landscape evolution in South Africa, modern soil mapping technologies, soil morphology interpretation and soil quality.

Prerequisite pass modules:

- *Chemistry 214*
- *Soil Science 214, 244, 314, 344*

Home department: Soil Science

19658 Statistics

214 (16) Applied statistics (3L, 2T)

Descriptive statistics: Various data types; frequency distributions; contingency tables; graphical representation of data types; measures of location and spread; box- and whisker plot.

Discrete stochastic variables and probability distributions: Expected value, variance and standard deviation of a discrete stochastic variable; correlation between discrete stochastic variables; joint, marginal and conditional distributions; distribution of the sum of variables; binomial and Poisson distributions.

Continuous stochastic variables and probability distributions: Expected value, variance and standard deviation of a continuous stochastic variable.

Distributions: Uniform, normal, exponential, gamma, t, F, chi square and beta.

Sampling distributions: The central limit theorem; sampling distributions of one mean; one proportion and one variance; sampling distributions of the difference between two means and the difference between two proportions; sampling distributions of the ratio of two variances.

Inferential statistics: Interval estimation and hypothesis testing for one mean, one proportion and one 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 it.

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

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

Prerequisite pass modules:

- *Statistics and Data Science 188 OR*
- *Probability Theory and Statistics 114 OR*
- *Probability Theory and Statistics 144*

Corequisite module: Statistics 224 (If you have passed Mathematics 114 or Mathematics 144 or Engineering Mathematics 115 or Engineering Mathematics 145 you, are exempt from this.)

Home department: Statistics and Actuarial Science

244 (16) Statistical inference (3L, 2T)

Sampling techniques: Simple random sampling; stratified sampling; systematic sampling; cluster sampling; probability proportional to size sampling.

Properties of estimators: Unbiasedness; efficiency; consistency; sufficiency; robustness.

Estimation methods: Maximum likelihood and optimisation of linear models.

Simple linear regression analysis: 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.

Multiple linear regression analysis: 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.

Linear models for classification: Methods of estimation; inference on the model parameters; evaluation of model performance; prediction intervals and confidence intervals.

Analysis of variance: One- and two-factor ANOVA; multiple comparisons testing.

Non-parametric techniques for analysis of variance: Wilcoxon's rank sum test; the sign test; Wilcoxon's signed-rank test; Kruskal-Wallis test; Friedman's test.

Note: Application of statistical *techniques* using Microsoft® Excel and R is emphasised throughout.

Prerequisite pass module: Statistics 214

Prerequisite module: Statistics 224

Home department: Statistics and Actuarial Science

59587 Strategic Management

344 (12) Strategic management (1.5L, 0.5P)

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.

Corequisite module: Business Management 113 (not applicable for students in Forest Science)

Home department Business Management

19712 Strength of Materials

143 (12) Introduction: Mechanics of deformable bodies (3L, 2T)

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.

Corequisite modules:

- *Engineering Mathematics 115*
- *Applied Mathematics B 124*

Home department: Civil Engineering

14912 Sustainability Transitions

478 (16) Introduction to Sustainability Transitions

This module provides an introduction to the urgent and rising interest in supporting transitions to just and sustainable futures, with an emphasis on perspectives from the Global South. This module introduces students to the key trends and drivers underlying the sustainability polycrisis. Building on this foundation, the module emphasises the complex, interconnected nature of social, ecological and economic sustainability challenges, and the need for deep, systemic transformations. Attention is paid to unpacking the main paradigms and frameworks for understanding systemic transformations to sustainability and the role of futures-methods tools for exploring pathways to more sustainable futures. These strategies are highlighted with a focus on case studies of transitions and transformations in different sectors. Throughout the module, students will engage in learning activities where they will learn about and apply different systemic futures tools to explore the consequences of scaling up some promising, but not-yet-mainstream sustainability initiatives, to critically engage with some of the complexities and opportunities of navigating to a sustainable and just future. The module explicitly aims to cultivate a deepened sense of agency amongst students to engage in supporting sustainability transitions through a better understanding of the complex processes underlying transformative change and inspiring examples across diverse contexts.

Home department: Centre for Sustainability Transitions

13343 Sustainable Animal Production

873 (8) Sustainable animal production (including global change, LCA)

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:

- 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 by 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

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 module 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

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.

Learning outcomes

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

- 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.

Home department: Animal Sciences

38784 Theory of Interest

152 (6) Theory of interest (2L, 1T)

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

Home department: Statistics and Actuarial Science

21008 Transport Economics

214 (16) Introduction to Transport economics (3L)

Role and functions of transport. Transportation, logistics and technology. The demand for transportation. Laws of variable proportions and scale. Cost economies and traceability. Modal supply characteristics. Transportation, investment and generalised cost. Location and land settlement. Transport and government policy.

Prerequisite modules: Economics 114, 144

Home department: Logistics

64007 University Practice in the Natural Sciences

176 (8) University practice in the natural sciences (3L)

Study load: 78 lectures in total, presented as 5L per week in the first semester and 1L per week in the second semester.

For students in the BSc (extended curriculum programmes). It is followed up during the second semester in the different subject-specific modules of Mathematics 176, Physics 176, Chemistry 176 and Biology 146. Basic terminology and concepts are addressed. Study and life skills receive attention. The natural sciences and specifically the subjects taken by the students serve as a context.

13329 Weed Management

741 (18) Weed management (3L, 3P)

Characteristics and identification of weeds; weed biology and ecology; weed control strategies; biological and physical weed control; chemical weed control; integrated weed management programmes.

Home department: Agronomy

50997 Wine Biotechnology

771 (30) 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.

Home department: Viticulture and Oenology

772 (20) Techniques in grape and wine sciences

General laboratory safety and etiquette, biological calculations; project planning and reporting; general microbiology techniques (growth kinetics and fermentation); general molecular biology techniques (nucleic acid extraction and manipulation, polymerase chain reaction FF(PCR), agarose gel electrophoresis, cloning of DNA fragments, transformation techniques, DNA sequencing, protein isolation and analysis, introduction to bioinformatics); chemical analyses (liquid and gas chromatography, spectroscopy, enzymatic assays); general statistical analyses. Small-scale winemaking and analyses of wine, including sensory evaluation.

Home department: Viticulture and Oenology

773 (20) Wine-related microbes

An introduction to the microorganisms occurring on the grapes, in grape juice and throughout the wine-making process, as well as their role (beneficial or detrimental) during this process. Biotechnology of wine yeasts and bacteria, including genetic aspects and targets for improvement.

Home department: Viticulture and Oenology

774 (20) Grapevine biology and biotechnology

A concise introduction to the vegetative and reproductive structures of the grapevine and their development in interaction with the environment, as well as important viticultural concepts. A critical evaluation of a selection of latest research results, challenges and opportunities in the field of grapevine molecular biology and biotechnology.

Home department: Viticulture and Oenology

775 (10) Seminar

Write a literature review on a relevant subject and do an oral presentation on the subject.

Home department: Viticulture and Oenology

776 (20) Chemistry and biochemistry of grapes and wine

Plant growth regulators, major compounds in grapes, both volatile and non-volatile, grape ripening and compound accumulation in grape berries during the season. Major and minor chemical compounds in musts and wines, both volatile and non-volatile. Role of enzymes, tannins and additives in winemaking. Concepts and processes related to colour stability, macromolecular composition and sensory (taste and aroma) of different types of wines. The role and processes involved in wine ageing, oxidation processes. Analytical methods (chromatography, spectroscopy, spectrometry) and data analysis tools to evaluate grape and wine chemical and biochemical composition.

Home department: Viticulture and Oenology

13890 Wine Sciences

214 (16) Introduction to wine industry (3L, 3P)

The South African wine industry, consumers and products in context. Wine-of-Origin system, legislation and regulations, including labelling. Workplace health and safety in a winemaking context. Principles of sustainable wine production.

Home department: Viticulture and Oenology

244 (16) Wine styles and sensory evaluation (3L, 3P)

Wine evaluation systems, working in a formal tasting environment, effective communication to wine consumers in tasting rooms (service-learning). Wine components, wine scoring, descriptive analysis and the appropriateness of different sensory tests. Consumer preferences and issues. Traditional and non-traditional wine markets. Wine styles: importance in winemaking, and the process of wine production for various styles, including legislation around permissible additives. Brandy, sparkling, sherry and other production systems.

Prerequisite module: Wine Sciences 214

Home department: Viticulture and Oenology

314 (16) Grape processing and wine production (3L, 3P)

Principles and practices of winemaking will be discussed and implemented producing different wine styles. Harvesting of the grapes; grape processing; use of different winemaking technologies; addition of processing agents; management of alcoholic and malolactic fermentations (MLF); MLF and its impact on wine quality; handling of problem fermentations.

Prerequisite modules:

- *Grapevine and Wine Sciences 212*
- *Wine Sciences 244*

Home department: Viticulture and Oenology

344 (16) Wine stabilization, clarification, bottling and faults (3L, 3P)

Principles and techniques for wine clarification, stabilisation and bottling will be discussed. Wine faults: prevention, origins and treatments. Wine tasting and analyses.

Prerequisite module: Wine Sciences 314

Home department: Viticulture and Oenology

446 (24) Biochemistry of wine flavours (3L, 3T, 3P)

Integrated and comprehensive study of fermentation-derived aroma compound production. The role of phenolics, polysaccharides, ageing, oxidation and wood-derived compounds in wine.

Prerequisite modules: Wine Sciences 314, 344

Home department: Viticulture and Oenology

57584 Wood Product Science

224 (16) Dendrology and Wood anatomy (3L, 3P)

Introduction to plant taxonomy and commercially important tree genera; introduction to tree growth; macroscopic and microscopic anatomy and identification of types of woods; descriptions of cell wall ultrastructure, wood variability; wood quality.

Home department: Forest and Wood Science

234 (16) Mechanics of wood products (3L, 3P)

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.

Prerequisite module: Strength of Materials 143

Home department: Forest and Wood Science

244 (16) Wood chemistry (2L, 4P)

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.

Practicals are offered over several consecutive days as block practicals together with wood physics.

Corequisite modules:

- *Engineering Chemistry 123 OR*
- *Chemistry 144*

Home department: Forest and Wood Science

255 (4) Introduction to woodwork and workshop practice (1P)

One week of practical work during the June or September holidays of the second year. Orientation to wood workshop practices, health and safety in the workshop, general workshop operations, machine operation and maintenance, use of hand tools, finishing of wooden products.

Home department: Forest and Wood Science

264 (16) Wood physics and drying (2L, 4P)

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.

Practicals are offered over several consecutive days as block practicals together with wood physics.

Home department: Forest and Wood Science

346 (4) Introduction to CNC machine programming and use (1P)

One week of practical work during the June or September holidays of the third year. Orientation to the use of CNC machines, health and safety aspects related to the use of such machines, maintenance of machines, CNC design, programming and manufacturing.

Home department: Forest and Wood Science

335 (16) Wood adhesives and composite products (3L, 3P)

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.

Home department: Forest and Wood Science

414 (16) Wood products manufacturing I (3L, 3P)

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.

Home department: Forest and Wood Science

426 (4) Introduction to wood finishing practices (1P)

One week of practical work during the January holidays of the fourth year. Orientation to the use of modern finishing equipment, health and safety aspects related to the use of such equipment, maintenance of equipment, and manufacturing practices.

Home department: Forest and Wood Science

434 (16) Wood degradation and preservation (3L, 3P)

Degradation due to fungi, insects and weathering; Composition and properties of various surface finishes, including preservatives, surface preparation and coating application. Surface characterisation and performance testing, environmental aspects.

Home department: Forest and Wood Science

444 (12) Bio-energy (2L, 2P)

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.

Home department: Forest and Wood Science

781 (32) Wood properties and quality

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. Testing and analysis to evaluate wood quality.

Home department: Forest and Wood Science

782 (32) Primary wood processing

The primary sawmill processing of logs into solid wood products. Theory and practices of wood drying. Manufacture and properties of composite products, including the adhesion process. Processing variables, economy and system optimisation.

Home department: Forest and Wood Science

783 (32) Bio-energy

Conversion of wood into energy, processing methods, determination of calorific values and other properties, comparison of different biofuels, harvesting and storage problems, different conversion methods, processing problems, environmental aspects, emissions. Consolidation of theoretical knowledge in a realistic case study based on South African biofuels.

Home department: Forest and Wood Science

784 (24) Wood products science project

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.

Home department: Forest and Wood Science

13348 Work-integrated Learning

882 (20) Work-integrated learning

Teams of students with different disciplinary and preferably cultural backgrounds 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.

The ultimate goal is for teams to reach an interdisciplinary synthesis of the information they have compiled and translate this into advice on future actions for their client.

Learning outcomes

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

- 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 verbally and in writing.

Home department: Animal Sciences

Research and service bodies

In this chapter the research and service bodies that reside in the Faculty of AgriSciences are presented.

1. The South African Grape and Wine Research Institute (SAGWRI) at Stellenbosch University

History

The South African Grape and Wine Sciences Research Institute (SAGWRI) was established at Stellenbosch University at the end of 2019 as a Type 2 research institute (according to the classification of centres, institutes and schools (CIS) at the University). The Institute's founding department is the Department of Viticulture and Oenology in the Faculty of AgriSciences and operates as a cross-faculty research institute that provides postgraduate training and research. From 2020 onwards, the SAGWRI will incorporate all research activities and training programmes of the former Institute for Wine Biotechnology (IWBT), the Department of Viticulture and Oenology, and also host the DST/NRF SARChI for Integrated Wine Science.

Objectives

The Institute supports a focused and fully integrated research and innovation approach to the grapevine and wine sciences. The Institute will advance postgraduate studies and research in grape and wine sciences at Stellenbosch University and establish its position as a leading national, African and international scientific unit.

The structure of the new Institute is designed to support a trans approach (trans-university and trans-disciplinary) by structurally supporting close associations between all grape and wine-interested departments and researchers through the establishment of associate memberships for individual academics with grape and wine-related projects. The Institute has close ties with the South African table and wine grape industries, as well as associated industry partners.

Postgraduate students and postdoctoral fellows conduct research at the SAGWRI in several core disciplines that include viticulture, oenology, biotechnology, analytical chemistry of grape and wine matrices, spectroscopy, sensory and consumer sciences and data science. Several research themes are covered and include:

- Grapevine Biology, Biotechnology and Improvement
- Grapevine x Environment x Management Interactions
- Digital Viticulture
- Wine Production and Analytics
- Biology and Biotechnology of Wine Microorganisms
- Microbial Resources, Ecology and Evolution
- Applied Teaching and Learning Research

Contact details

For more information, visit http://sagwri.sun.ac.za/ or contact Prof MA Vivier at mav@sun.ac.za or 021 808 3773.

2. Institute for Plant Biotechnology (IPB)

History

The Institute for Plant Biotechnology (IPB) was founded at Stellenbosch University in 1998, in collaboration with the South African Sugarcane Research Institute. The IPB originally operated as part of the Department of Botany, but after strategic restructuring at the University it moved to the Department of Genetics in the Faculty of AgriSciences, where it currently functions as an independent unit.

The IPB was established under the leadership of Dr Frikkie Botha. In 2004 Prof Jens Kossmann took over and was appointed director, a position that he currently still occupies. Under Prof Kossmann the IPB functions as a multicultural and interdisciplinary team of researchers and postgraduate students who focus on research opportunities in plant biotechnology. Fundamental research forms the core of the IPB's activities, but every project has some long-term application.

Objectives

The IPB specialises in the characterising and manipulation of primary carbon metabolism in plants. The ultimate goal is to manipulate the relevant metabolic pathways to either improve yield and/or quality, or to

produce novel, high-value products in plants. Some projects are aimed at the genetic manipulation of carbon partitioning within plant organs, such as sugarcane culms, grape berries and potato tubers.

The Institute's approach is to first get a better understanding of the control of carbohydrate metabolism in these important sink tissues and then to genetically manipulate apparent key enzymes to investigate the effect of these modifications on metabolic flux. In addition to the work on the partitioning of endogenous compounds, the Institute also focus on the improvement of these compounds and the introduction of completely new ones. As part of several international collaborative projects, the IPB has, for example, developed transgenic plants that produce novel, high-value products, i.e. neutraceuticals and pharmaceuticals or biopolymers for industrial application. The IPB also tries to understand plant growth in relation to abiotic stress factors with the aim of breeding or engineering plants that are more productive with less input.

Contact details

The Institute is situated on the main campus of Stellenbosch University, in the heart of the Winelands region in the Western Cape province of South Africa.

For more information, visit http://www.sun.ac.za/english/faculty/agri/plant-biotech or contact Prof J Kossmann at kossmann@sun.ac.za or 021 808 3834.

3. 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 is utilised for commercial production in order to manage these farms as far as possible towards self-sufficiency.

3.1 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. A 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.

Contact details

For more information, contact the Experimental Farm Manager, Mr Willem van Kerwel, at 021 808 4870.

3.2 Mariendahl

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

Contact details

For more information, contact the Experimental Farm Manager, Mr John Morris, at 021 884 4460.

Alphabetical subject list